SUSTAINABLE DEVELOPMENT UNIT ■ LATIN AMERICA AND THE CARIBBEAN

Disaster Risk Management in Latin America and the Caribbean Region:

GFDRR Country Notes

THE WORLD BANK

GFDRR
Global Facility for Disaster Reduction and Recovery

SUSTAINABLE DEVELOPMENT UNIT ■ LATIN AMERICA AND THE CARIBBEAN

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GFDRR Country Notes

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GFDRR
GLOBAL FACILITY FOR DISASTER REDUCTION AND RECOVERY

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ABBREVIATIONS

AECI	Spanish International Cooperation Agency
AGIES	Guatemalan Association of Seismic Engineers
AME	Asociación de Municipios del Ecuador (Ecuador Association of Municipalities)
AMHON	Honduran Association of Municipalities
ANAM	National Environment Authority
BCIE	Central American Development Bank
BECOL	Belize Electricity Company Limited
CAM	Comisión Ambiental Municipal (Municipal Environmental Commission)
CAPRA	Central American Probabilistic Risk Assessment
CAPRADE	Comité Andino para la Prevención y Atención de Desastres (Andean Committee for Disaster Prevention and Response)
CAR	Comisión Ambiental Regional (Regional Environmental Commission)
CARICOM	Caribbean Community
CAS	Country Assistance Strategy
CAT DDO	Catastrophe Deferred Draw Down Option
CATHALAC	Water Center for the Humid Tropics of Latin America and the Caribbean
CCCCC	Caribbean Community Climate Change Center
CCRIF	Caribbean Catastrophe Risk Insurance Facility
CDB	Caribbean Development Bank
CDEMA	Caribbean Disaster Emergency Management Agency
CDERA	Caribbean Disaster Emergency Response Agency
CDMP	Comisión de Demografía y Movimiento Poblacional (Demography and Population Migrations)
CDPC	Comité Départementaux de Protection Civile (Departmental Disaster Risk Management Committees)
CEDERI	Centro de Estudios sobre Desastres y Riesgos (Disaster and Risk Study Center)
CEOT	Comité Ejecutivo de Ordenamiento Territorial (Executive Committee of Territorial Planning)
CEPLAN	National Center for Strategic Planning
CEPREDENAC	Centro de Coordinación para la Prevención de los Desastres Naturales en América Central (Coordination Center for Natural Disaster Prevention in Central America)
CIDES	Comisión Interagencial de Datos Espaciales (Interagency Technical Commission on Spatial Data)
CIIFEN	Centro Internacional para la Investigación del Fenómeno de El Niño (International Center for El Niño Research)
CISMID	Japan-Peru Center for Earthquake Engineering and Disaster Mitigation
CMRRD	Multisectoral Commission on Risk Reduction in Development
CNAES	Comisión Nacional de Asentamientos Humanos, Infraestructura y Equipamiento Social (National Commission on Human Settlements, Infrastructure and Social Tooling)
CNE	National Risk Prevention and Emergency Management Commission
CNGR	Comisión Nacional de Gestión de Riesgos (National Risk Management Commission)

CNGRD	National Disaster Risk Management Council
COE	Center for Emergency Operations
COHEP	Honduran Council of Private Enterprise
COLRED	Local Coordinator for Disaster Reduction
COMRED	Municipal Coordinator for Disaster Reduction
CONARADE	National Council of Risk Reduction and Disaster Response
CONARE	National Deans' Commission
CONOT	Consejo Nacional de Ordenamiento Territorial (National Council of Territorial Zoning)
CONPES	Consejo Nacional de Política Económica y Social (National Council of Social and Economic Policy)
CONRED	National Coordinator for Disaster Reduction
COPECO	Comisión Permanente de Contingencias (Standing Commission of Contingencies)
CORRED	Regional Coordinator for Disaster Reduction
COVIAL	Unidad de Conservación Vial (Road Conservation Unit)
CPNTC	Comisión de Patrimonio Natural, Cultural y Turismo (Natural and Cultural Heritage and Tourism Commission)
CRI	Climate Risk Index
CRID	Regional Disaster Information Center for Latin America and the Caribbean
CRNAP	Comisión de Recursos Naturales Renovables y No Renovables y de Áreas Protegidas (Commission on Renewable and Non-Renewable Natural Resources, and Protected Areas)
CRTV	Catastrophic Risk Transfer Vehicle
CRV	Cellule de Réduction de la Vulnérabilité (Vulnerability Reduction Cell)
CSS	Caja del Seguro Social (Social Security Administration)
CuBIC	Caribbean Building Code
CHAMP	Caribbean Hazard Mitigation Capacity Building Program
DCA	Development Control Authority
DFID	UK Department for International Development
DGODT	General Directorate for Land Use Planning and Development
DGOT	Dirección General de Ordenamiento Territorial (National Directorate of Territorial Zoning)
DGR	National Directorate for Disaster Prevention and Management
DHN	Dirección de Hidrografía y Navegación de la Marina de Guerra de Perú (Hydrographical and Naval Authority of Peru)
DIPECHO	ECHO's Disaster Preparedness Program
DNP	Departamento Nacional de Planeación (National Planning Department)
DPC	Directorate of Civil Protection
DPL	Development Policy Loan
DRM	Disaster Risk Management
D-SNET	Division of the National Service of Territorial Studies
EC	European Commission
ECLAC	Economic Commission for Latin America and the Caribbean
ECOPETROL	Colombian Oil Company
ECHO	European Commission Humanitarian Aid and Civil Protection
EIA	Environmental Impact Assessment

EMAAP-Q	Empresa Metropolitana de Alcantarillado y Agua Potable de Quito (Quito Metropolitan Sewerage and Drinking Water Company)
ENCC	Office of the National Strategy on Climate Change
ENSO	El Niño/La Niña-Southern Oscillation
EOC	Emergency Operations Center
ERN	Evaluación de Riesgos Naturales
ETESA	Empresa de Transmisión Eléctrica S.A. (Electricity Transmission Company)
EWS	Early Warning System
FAO	Food and Agriculture Organization
FEDEHCAMARA	Federation of the Commerce and Industry Chambers
FEWS	Flood Early Warning Systems
FGHI	Tropical Storm Fay and Hurricanes Gustav, Hanna and Ike
FISE	Social Investment Fund
FNC	First National Communication
FONAPAZ	Fondo Nacional para la Paz (National Fund for Peace)
FONAPRE	Fondo Nacional de Preparación y Respuesta a Emergencias (National Emergency Preparedness and Response Fund)
FOREC	Reconstruction Fund for the Coffee Region
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
GIS	Geographic Information System
GNP	Gross National Product
GPSP	Government of Panama Strategic Plan
GRIP	Global Risk Identification Program
GruS	Grupo de Socios para el Desarrollo de Bolivia (Group of Partners for Development of Bolivia)
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Society for Technical Cooperation)
HDI	Human Development Index
HFA	Hyogo Framework for Action
HPI	Human Poverty Index
IADB	Inter-American Development Bank
ICA	International Cooperation Agency
ICT	Information and Communication Technologies
IDA	International Development Association
IDEAM	Instituto de Hidrología, Meteorología y Estudios Ambientales de Colombia (Colombian Institute for Hydrology, Meteorology and Environment Studies)
IDF	Institutional Development Fund
IDP	Internally Displaced Person
IFI	International Financial Institution
IFRC	International Federation of Red Cross and Red Crescent Societies
IG-EPN	Instituto Geofísico de la Escuela Politécnica Nacional
IGN	National Geographic Institute of Guatemala
IGP	Instituto Geofísico del Perú (Geophysics Institute of Peru)

IMARPE	Instituto del Mar de Perú (Marine Institute of Peru)
IMAS	Institute of Social Assistance
INA	National Agrarian Institute
INAMHI	Instituto Nacional de Meteorología e Hidrología
INDECI	National Civil Defense Agency
INEC	Instituto Nacional de Estadísticas y Censos
INEI	Instituto Nacional de Estadísticas e Informática (National Institute of Statistics and Information Technology)
INETER	National Institute for Territorial Studies
INFOM	Municipal Development Institute
INGEMMET	Instituto Geológico, Minero y Metalúrgico de Perú (Geological, Mining, and Metallurgical Institute of Peru)
INGEOMINAS	Instituto Colombiano de Geología y Minería (Colombian Institute for Geology and Mining)
INS	National Insurance Institute
INSIVUMEH	National Institute of Seismology, Volcanology, Meteorology and Hydrology
INVIAS	Instituto Nacional de Vías (National Institute for Roads)
IOM	International Organization for Migration
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
LCR	Latin America and the Caribbean Region
MADRNR	Ministry of Agriculture, Rural Development and Natural Resources
MAGA	Ministry of Agriculture
MARN	Ministry of the Environment (and Natural Resources)
MAVDT	Ministry of Environment, Housing and Territorial Development
MDE	Ministry of the Environment
MDG	Millennium Development Goal
MEF	Ministry of Economy and Finance
MHCP	Ministry of Finance
MICT	Ministry of Interior and Collective Territories
MIDEPLAN	Ministry of National Planning and Economic Policy
MLSS	Ministry of Labour and Social Security
MPCE	Ministry of Planning and External Cooperation
NaDMA	National Disaster Management Agency
NATHAT	Analysis of Multiple Natural Hazards in Haiti
NCCC	National Communication on Climate Change
NCDPMR	National Council of Disaster Prevention, Mitigation and Response
NDC	National Disaster Committee
NDE	National Disaster Executive
NDP	National Development Plan
NDPMRF	National Disaster Prevention, Mitigation and Response Fund
NEC	National Emergency Coordinator
NEF	National Emergency Fund

NEMA	National Emergency Management Agency
NEMAC	National Emergency Management Advisory Committee
NEMO	National Emergency Management Organization
NEOC	National Emergency Operations Centre
NERO	National Emergency Relief Organization
NGO	Non-Governmental Organization
NMC	National Meteorological Center
NOAA	National Oceanic and Atmospheric Administration
NODS	National Office for Disaster Services
NORSAR	Research Council of Norway
NPRM	National Plan for Risk Management
NRMS or NSRM	National Risk Management System/National System for Risk Management
NTC	National Technical Committee
NWS	National Weather Service
OAS	Organization of American States
OCD	Oficina de Defensa Civil (Office of Civil Defense)
ODIPERC	Office of Disaster Preparedness and Emergency Relief Coordination
ODM	Office for Disaster Management
ODPEM	Office of Disaster Preparedness and Emergency Management
OECS	Organization of Eastern Caribbean States
OFDA	Office of US Foreign Disaster Assistance
OSOP	Western Earthquake Observatory
PAHO	Pan American Health Organization
PATH	Program for Advancement through Health and Education
PDC	Parish Disaster Committee
PDNA	Post-Disaster Needs Assessment
PEOC	Parish Emergency Operations Centre
PIOJ	Planning Institute of Jamaica
PNGR	Política Nacional de Gestión del Riesgo (National DRM Policy)
PNGRD	Plan National de Gestion des Risques et des Désastres (National Disaster Risk Management Plan)
PNODT	Plan Nacional de Ordenamiento y Desarrollo Territorial (National Plan for Territorial Zoning and Development)
PNPMD	National Program for Disaster Prevention and Reduction
PNRDR	National Program for Disaster Risk Reduction
POT	Territorial Organization Plan
PPCR	Pilot Program for Climate Resilience
PREDECAN	Prevention of Disasters in the Andean Region
PREVDA	Vulnerability Reduction and Environmental Degradation Regional Project
PREVEN	Resilience-Building Program to Manage Recurring El Niño Events
PRRES	National Plan for Sustainable Rehabilitation and Reconstruction
PRSP	Poverty Reduction Strategy Paper

PSA	Public Service Announcement
RENOT	Registry of Territorial Organization Norms
RSN	National Seismological Network
RSS	Regional Security System
SAA	Secretaría de Asuntos Agrarios (Secretariat of Agrarian Matters)
SEARPI	Piraí River Water Channeling and Regulation Service
SEC	Sector Económico del Canal (Canal Economic Sector)
SE-CONRED	Executive Secretariat of the National Coordinator for Disaster Reduction
SEGEPLAN	Ministry of Planning
SEMENA	Amazon Navigation Improvement Service
SENACYT	National Secretariat for Science, Technology and Innovation
SENAMHI	National Meteorology and Hydrology Service
SENPLADES	Secretaría Nacional de Planificación y Desarrollo (National Secretariat of Planning and Development)
SERNA	Secretary of Natural Resources and Environment
SE-SINAPRED	Executive Secretariat of the National System for Disaster Management and Prevention
SIAPAD	Sistema de Información Andino para la Prevención y Atención de Desastres (Andean Disaster Prevention and Response Information System)
SICA	Sistema de Integración Centro Americano (Central American Integration System)
SINADECI	National Civil Defense System
SINAGER	National Information System for Risk Management
SINAGER	Sistema Nacional de Gestión de Riesgos (National Risk Management System)
SINAPRED	National System for Disaster Management and Prevention
SINAPROC	Sistema Nacional de Protección Civil (National Civil Protection System)
SINIT	National System Information for Territorial Planning
SINPAD	National Information System on Disaster Prevention and Management
SIREDECI	Regional Civil Defense System
SISRADE	National System of Risk Reduction and Disaster Response
SNCyT	Sistema Nacional de Ciencia y Tecnología (National System of Science and Technology)
SNDGR	Sistema Nacional Descentralizado de Gestión del Riesgo (Decentralized National System of Risk Management)
SNET	National Service of Territorial Studies
SNGRD	Système National de Gestion des Risques et des Désastres (National Disaster Risk Management System)
SNIP	National Public Investment System
SNPAD	National System for Disaster Management and Prevention
SOP	Standard Operating Procedures
SPGRD	Permanent Secretariat for Disaster Risk Management
SUCA	System of Central American Universities
SUME	Sistema Único de Manejo de Emergencias (Unified Emergency Management System)
TCDPM	Technical Committee for Disaster Prevention and Mitigation
TFP	Technical and Financial Partners
UES	University of El Salvador
UN	United Nations

UN ISDR	United Nations International Strategy for Disaster Reduction
UNAM	Autonomous University of Mexico
UNDAC/OCHA	United Nations Disaster Assessment and Coordination/Office of Coordination of Humanitarian Affairs
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNI	National Engineering University
UNICEF	United Nations Children's Fund
UNOPS	United Nations Office for Project Services
USAC	United States Army Corps
USAID	United States Agency for International Development
UWI	University of the West Indies
UWI-SMC	University of the West Indies Seismic Research Center
VCA	Vulnerability and Capacity Assessments
VIDECI	Vice-Ministry of Civil Defense
WB	World Bank
WFP	World Food Program
WHO	World Health Organization

Figure 1. Map of Latin America and the Caribbean Region (LCR). Countries profiled in this publication are highlighted.

INTRODUCTION

Latin America and the Caribbean Region (LCR) is exposed to a wide variety of natural hazards including earthquakes, volcanoes, storms, extreme temperatures, droughts, floods, landslides, etc., many of which are regularly aggravated by the recurrent El Niño/ENSO[1] phenomenon. The global trend toward increasing climate variability is likely to exacerbate many of these hazards. The World Bank Natural Disaster Hotspots study (Dilley et al. 2005) indicates that seven among the world's top 15 countries exposed to three or more hazards are located in LCR. Similarly, 15 among the world's top 60 countries exposed to two or more hazards are LCR countries.[2]

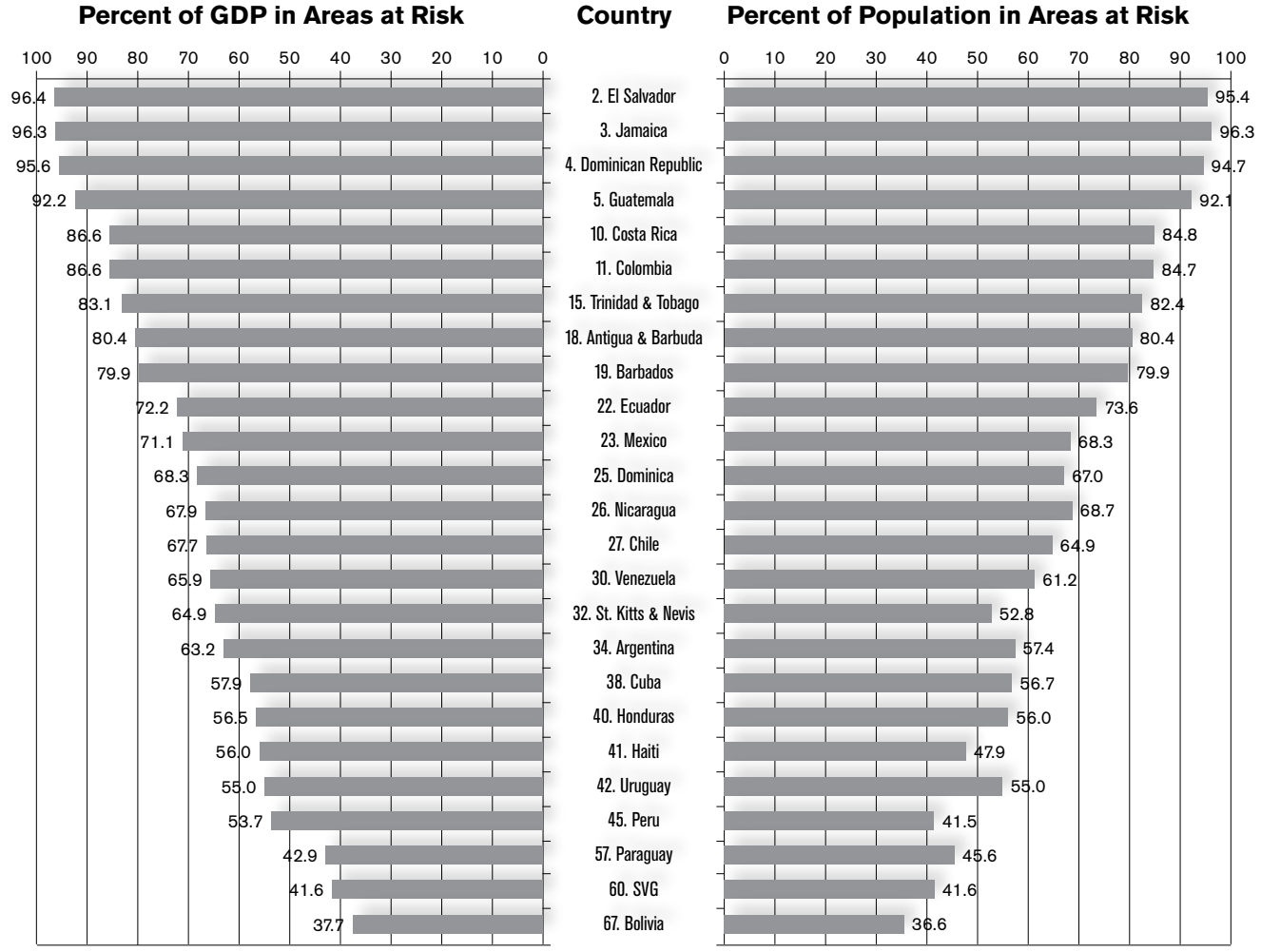


Table 1. Countries at Relatively High Economic Risk from Multiple Hazards: Two or more hazards (top 75 based on GDP).[3]

[1] El Niño/La Niña-Southern Oscillation.
[2] Dilley et al. (2005). Table 1.1.
[3] Ibid. Table 7.2.

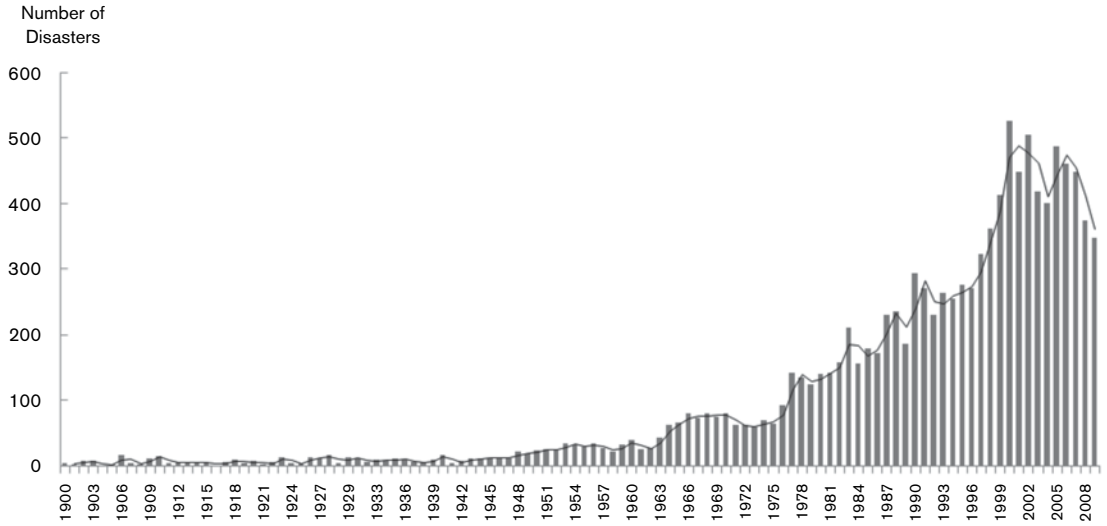


Figure 3. Occurrence of Disasters of Geological and Hydrometeorological Origins Worldwide (1900-2009).

Source: EM-DAT.

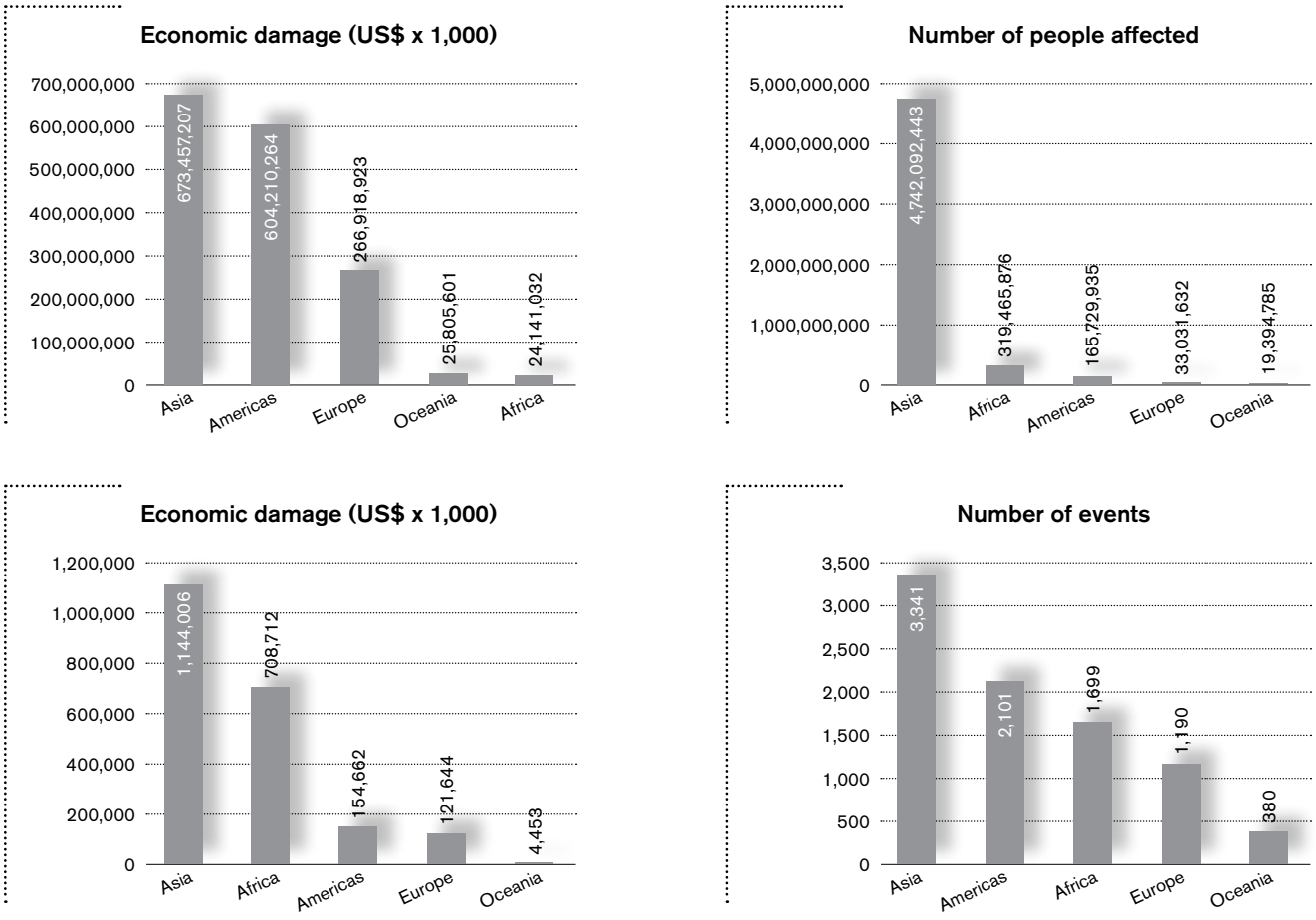


Figure 4. Global Data by Region.

This concentration of geophysical and hydrometeorological hazards points to the needs to include disaster risk management (DRM) as a key element in development programs in the region. Indeed, many of LCR's main cities are located close to or on top of seismic faults. Population growth and rapid urbanization means that many cities are expanding into flood plains or on hillsides susceptible to landslides and other hazards. Lack of appropriate territorial planning, building standards, and other risk mitigation measures can only result in increasing disaster losses. While disaster numbers are not entirely predictable, the overall trend is fairly clear, with every decade bringing larger losses and affecting millions.

The Latin American and Caribbean governments have long recognized the need to address disaster risk, and their efforts "to develop the tools to effectively mainstream disaster risk management into development activities" (ibid., p. 1) have evolved over the last few decades. Since the mid-20th century, most of the countries in the region were working to address disasters through their respective civil protection agencies. Just like elsewhere in the world, efforts focused on ex-post response and recovery needs. While these efforts are undeniably important, they are increasingly proving to be insufficient. Over the last decade, governments, inter-governmental, non-governmental, and development organizations have gradually shifted the focus of their efforts towards ex-ante approaches to disaster risk management, with a special focus on disaster risk reduction via reducing vulnerability, capacity building, better information, and institutional strengthening.

Over time, various institutional efforts have resulted in not only local and national DRM outcomes, but also in cooperation on regional levels. One of the most active regional DRM institutions, CEPREDENAC (*Centro de Coordinación para la Prevención de los Desastres Naturales en América Central,* or the Coordination Center for Natural Disaster Prevention in Central America) has been active in Central America since 1987 as a specialized secretariat of the SICA (*Sistema de Integración Centro Americano*, or the Central American Integration System).[4] The Caribbean Community (CARICOM) countries have benefited from the work of the Caribbean Disaster and Emergency Management Agency (CDEMA).[5] The Andean countries have been cooperating on DRM issues through CAPRADE (*Comité Andino para la Prevención y Atención de Desastres*, or Andean Committee for Disaster Prevention and Response).[6] Other regional DRM organizations include CIIFEN (*Centro Internacional para la Investigación del Fenómeno de El Niño*, or International Center for El Niño Research)[7] and the Department of Sustainable Development of the Organization of American States.[8]

Bilateral donors have been actively supporting these efforts, including DFID, European Comission, GTZ, JICA, NORSAR, Spain, USAID, and others, each in their own area of influence and expertise. Similarly, multilateral organizations such as the United Nations (UN), the Inter-American Development Bank (IADB), and the World Bank, are also deeply involved in the region and continue to support the countries on DRM issues as well. Today, all of the LCR countries participate in the UN ISDR Hemispheric Platform and report bi-annually on the achievement of the Hyogo Framework for Action, endorsed by 168 UN member states at the World Conference

[4] http://www.cepredenac.org. The member countries include Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama.
[5] http://www.cdema.org.
[6] http://www.caprade.org.
[7] http://www.ciifen-int.org.
[8] http://www.oas.org/dsd/Working%20Documents/Naturaldesasterandland.htm.

on Disaster Reduction in Kobe, Japan in 2005. The Global Facility for Disaster Reduction and Recovery (GFDRR) currently funds 25 projects in 25 LCR countries.

The LCR region has been in the forefront of disaster risk management in a variety of areas. In February 2010, Chile's earthquake-resistant standards provided a clear demonstration that risk can be contained even in highly seismic areas. Costa Rica is often cited as a showcase of how efficient environmental management can reduce disaster risk. Cities like Bogota are regularly ranked among the most proactive in addressing disaster risk. Two recent initiatives supported by the donor community are also worth mentioning. The Caribbean Catastrophe Risk Insurance Facility (CCRIF), which works as a joint reserve mechanism for Caribbean countries, is an example of how innovative financial engineering can help smaller economies cope with disaster risk. The Central American Probabilistic Risk Assessment (CAPRA) initiative, which was conceived as an open-source platform for risk assessment in selected countries, is now being replicated in similar programs throughout LCR and beyond.

The world was reminded of the reality and potency of the natural hazards on January 12, 2010, when a magnitude 7.0 earthquake hit Port-au-Prince, killing more than 200,000 people. The headlines during the following months were also filled with news about the devastating storms in El Salvador, volcanic eruptions in Guatemala, and floods in Brazil. While these events appear to be increasingly frequent and devastating, they are not entirely new. Table 2 below presents a selection of the most significant disasters that have occurred in the region over the last hundred years.[9]

Dates	Location	Disaster			Numbers		
		Type	Subtype	Name	Killed	Total Affected	Est. Damage (US$ Million)
02/2010	Chile	Earthquake			562	2,600,000	30,000
01/2010	Haiti	Earthquake			222,570	3,700,000	8,000
11/2008	Brazil	Flood	General flood		151	1,500,015	750
2008-2009	Colombia	Flood	General flood		76	1,200,091	n/a
10-11/2007	Mexico	Flood	General flood		22	1,600,000	3,000
10/2007	Colombia	Flood	General flood		35	1,162,135	n/a
10/2005	Mexico	Storm	Tropical cyclone	Wilma	7	1,000,000	5,000
10/2005	Mexico	Storm	Tropical cyclone	Stan	36	1,954,571	2,500
07/2005	Cuba	Storm	Tropical cyclone	Dennis	16	2,500,000	1,400
06-07/2004	Peru	Extreme temp.	Cold wave		90	2,137,467	n/a
07-08/2003	Peru	Extreme temp.	Cold wave		339	1,839,888	n/a
11/2001	Cuba	Storm	Tropical cyclone	Michelle	5	5,900,012	100
01/2001	El Salvador	Earthquake			844	1,334,529	1,500
12/1999	Venezuela	Flood	Flash flood		30,000	483,635	3,160
01/1999	Colombia	Earthquake			1,186	1,205,933	1,857

Table 2. Major Natural Disasters in Latin America and the Caribbean.

[9] EM-DAT. Accessed on August 9, 2010. Supplemented by CRED CRUNCH Issue No. 21. August 2010.

Dates	Location	Disaster			Numbers		
		Type	Subtype	Name	Killed	Total Affected	Est. Damage (US$ Million)
10/1998	Honduras	Storm	Tropical cyclone	Mitch	14,600	2,112,000	3,793
04/1998	Brazil	Drought				10,000,000	122
11/1994	Haiti	Storm	Tropical cyclone	Gordon	1,122	1,587,000	50
07/1992	Peru	Drought				1,100,000	250
08/1990	Peru	Drought				2,200,000	36
03/1988	Argentina	Flood	General flood		25	4,600,000	490
02/1988	Brazil	Flood	General flood		289	3,020,734	1,000
11/1985	Colombia	Volcano	Volcanic eruption		21,800	12,700	1,000
09/1985	Mexico	Earthquake			9,500	2,130,204	4,104
05/1985	Argentina	Flood	General flood		25	1,000,000	230
03/1985	Chile	Earthquake			180	1,482,275	1,500
09/1983	Brazil	Drought			20	20,000,000	n/a
05/1983	Argentina	Flood				5,830,000	1,000
04/1983	Bolivia	Drought				1,583,049	417
01/1983	Brazil	Flood			68	3,008,300	12
08/1980	Haiti	Storm	Tropical cyclone	Allen	220	1,165,000	400
08/1979	Dom. Rep.	Storm	Tropical cyclone	David & Frederick	1,400	1,554,000	150
01/1979	Brazil	Flood			300	1,500,000	n/a
02/1976	Guatemala	Earthquake			23,000	4,993,000	1,000
12/1972	Nicaragua	Earthquake			10,000	720,000	845
03/1972	Peru	Earthquake			12	1,575,000	20
07/1971	Chile	Earthquake			85	2,348,973	236
11/1970	Colombia	Flood			307	5,105,000	138
05/1970	Peru	Earthquake			66,794	3,216,240	530
01/1966	Brazil	Mass movement wet	Landslide		350	4,000,000	0.027
05/1960	Chile	Earthquake			6,000	2,003,000	550
10/1949	Guatemala	Flood			40,000	n/a	15
01/1944	Argentina	Earthquake			10,000	155,000	n/a
01/1939	Chile	Earthquake			30,000	58,500	920
08/1906	Chile	Earthquake			20,000	n/a	100

Table 2. Major Natural Disasters in Latin America and the Caribbean *(Continued).*

The Global Facility for Disaster Reduction and Recovery (GFDRR)[10] has been working in the region ever since its inception in 2006. By mid 2010, the LCR portfolio of current GFDRR grant-financed activities had grown to about 30, mostly belonging to Track II (Mainstreaming Disaster Risk Reduction in Development). There are also a small number of Track III (Sustainable Recovery) activities, mostly in response to the January 2010 earthquake in Haiti. To date, the GFDRR has invested over US$15 million into Track II (Risk Reduction) and US$2.7 million into Track III (Sustainable Recovery) activities in the region. The current Track II program supports 21 activities with a total budget of US$11 million. A number of activities supported by the GFDRR, such as the first phase of CAPRA, or the Global Catastrophe Mutual Bond Risk Modeling for Mexico, have already been completed.

This publication aims to provide a brief overview of the DRM strides made in several LCR countries to date. What follows is a set of country notes organized by country priority levels determined by the GFDRR. We first focus on the two GFDRR Priority Countries (Haiti and Panama), then the four Donor Earmarked Non-Core Countries

[10] http://www.gfdrr.org.

(Colombia, Costa Rica, Ecuador, and Guatemala), and finally, a number of countries which do not at present appear in the GFDRR priority country lists but where GFDRR has been working with the governments and either has had or is discussing possible projects for the near future. Future iterations of this publication will likely include additional country notes in addition to the updates on all the countries profiled here.

Haiti 2010 earthquake

GFDRR Priority Countries

- Haiti
- Panama

COUNTRIES AT RELATIVELY HIGH MORTALITY RISK FROM MULTIPLE HAZARDS
(Top 96 based on population with 2 or more hazards)[a]

1. Bangladesh
2. Nepal
3. Dominican Republic
4. Burundi
5. **HAITI**
10. Guatemala
13. Trinidad and Tobago
20. Niger
37. Peru
54. St. Vincent and the Grenadines
55. Mexico
57. St. Kitts and Nevis
61. Belize
63. United States
78. Bolivia
96. Thailand

[a] Dilley et al. (2005). Table 1.2.

The implications of climate variability and change on the intensity and frequency of adverse natural events underscore the importance of a proactive approach to disaster risk management.

HAITI

Natural Disasters from 1980 - 2008[b]

Affected People

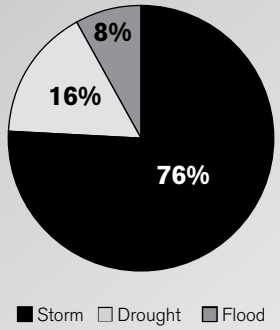
Disaster	Date	Affected (Number of People)
Storm	1994	1,587,000
Storm	1980	1,165,000
Drought	1992	1,000,000
Storm	1988	870,000
Storm	2004	315,594
Flood	2003	150,000
Storm	2008	125,050
Storm	2007	108,763
Drought	1980	103,000
Flood	1986	98,860

Economic Damages

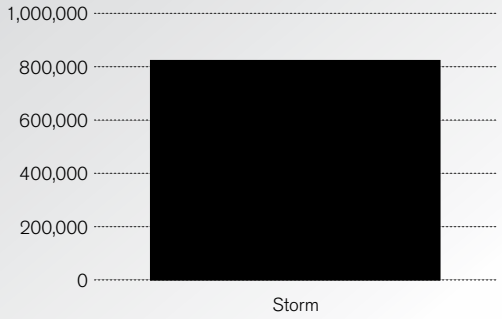
Disaster	Date	Cost (US$ x 1,000)
Storm	1980	400,000
Storm	1998	180,000
Storm	1988	91,286
Storm	1994	50,000
Storm	2004	50,000
Storm	2005	50,000
Flood	2002	1,000
Storm	2004	1,000
Storm	2005	500
Storm	1996	100

Statistics by Disaster Type[b]

Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=74. Source data from EM-DAT. Data displayed does not imply national endorsement.

This DRM Country Note updates the April 2009 version. The Note was prepared following consultations with members of the World Bank's Haiti DRM Country team and the task team leaders overseeing projects in Haiti. The programmatic DRM approach proposed within this document has been presented to the World Bank's development partners. Following discussion with the Government of Haiti, a workshop was organized in mid September 2010 to further discuss the strategic vision of the National Disaster Risk Management System and the subsequent program to support the realization of this vision. The Note will be updated following the conclusion of this exercise.

DISASTER RISK PROFILE

Haiti ranks as one of the countries with the highest exposure to multiple natural hazards, according to the World Bank's Natural Disaster Hotspot study.[1] Haiti has been heavily exposed to natural hazards, and suffered the associated losses, throughout its recorded history (Table 1). With 96% of its population living at risk, Haiti has the highest vulnerability rating in terms of cyclones[2] among the region's small island states (12.9 on a scale of 13).[3] The effects of cyclones include wind damage, flooding, landslides, torrential debris flows, and coastal surges. In addition to the hydrometeorological hazards, Haiti is also located in a seismically active zone, intersected by several major tectonic faults. The country's high population density (up to 40,000 per km^2 in Port-au-Prince) coupled with the large number of informal structures, and weak public and private infrastructure, render the country and its population particularly vulnerable.

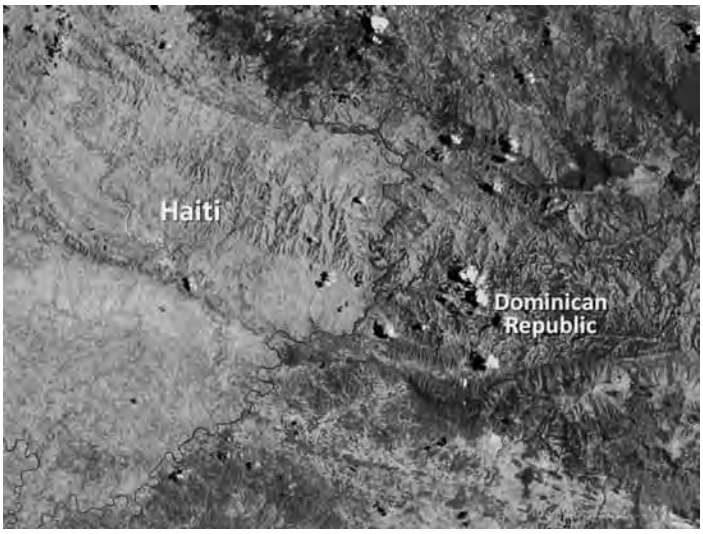
Table 1. Most destructive natural hazards in Haiti since the 18th century.

Hazards	No. Events	%	Fatalities	%	Affected	%
Hydrometeorological	97	69.29	19,262	7.53	5,363,876	45.60
Droughts	20	14.29	-	-	2,668,000	22.68
Earthquakes and tsunamis	13	9.29	235,952	92.22	3,721,730	31.64
Landslides and torrential debris flows	10	7.14	635	0.25	10,509	0.09
TOTAL	140	100.00	255,849	100.00	11,764,115	100.00

Sources: Observatoire du Petit Séminaire Saint-Martial (1701-1963; in Mora 1986); Haitian Red Cross (1968-1985); OPDES (1983-1997); DPC (2000-2010); CRED (2002-2008).

Period lacking or without complete/reliable information: 15th to 19th centuries; September 1997 to October 2000; October 2002 to April 2003.

Figure 1. Difference in vegetation cover between Haiti (left) and the Dominican Republic (right). The border in this area is drained by the Artibonite River.[4]



Severe environmental degradation (Figure 1), and the presence of settlements in low-lying

[1] Dilley et al. (2005). Table 1.2.
[2] Includes tropical depressions, storms and hurricanes.
[3] UNDP (2004).
[4] NASA (2010).

areas and floodplains are key contributing factors towards the country's vulnerability. Further contributing factors include high levels of poverty, weak public infrastructure, weak environmental and risk governance, a history of ineffective governments, and serious fiscal problems.

Economic losses from adverse natural events are increasing in Haiti. As assets are created and concentrated, losses from adverse natural events are increasing. This was demonstrated in August and September of 2008 with the passage of Tropical Storm Fay and Hurricanes Gustav, Hanna and Ike (herein referred to as "FGHI") during a three-week period, resulting in damage and losses equivalent to 15% of the country's GDP. FGHI represented one of the largest disasters in Haiti's recent history, second only to the January 12, 2010 earthquake. The 7.0 earthquake resulted in more than 222,570 deaths, 300,572 injuries, 2.3 million displaced and an estimated US$7.8 billion in damage and losses, slightly more than Haiti's GDP in 2009.[5]

The implications of climate variability and change on the intensity and frequency of adverse natural events underscore the importance of a proactive approach to disaster risk management (DRM). According to the report of the Climate Investment Fund's Pilot Program for Climate Resilience (PPCR) Expert Group, Haiti is one of the 10 global climate-change hotspots.[6] The inability or failure of the government to address its vulnerability and to support the reduction of risk has drastically undermined the rate of development and growth, and the overall poverty reduction efforts.

Major Natural Hazards

A multiple-hazard assessment (NATHAT) performed in Haiti after the January 12, 2010 earthquake identified the spatial, temporal and relative intensity of the most severe natural hazards.[7] The assessment is preliminary and subject to further review and improvement as the quantity and quality of available data improves. The multi-hazard perspective has been designed to serve as the platform for the ensuing risk assessments; orient the vision for integrated risk management; serve as a tool to understand and communicate risk; serve to assist political and managerial decision-making for development investments; and serve to assist with land use planning, risk reduction and transfer, financial protection, and emergency and disaster management.

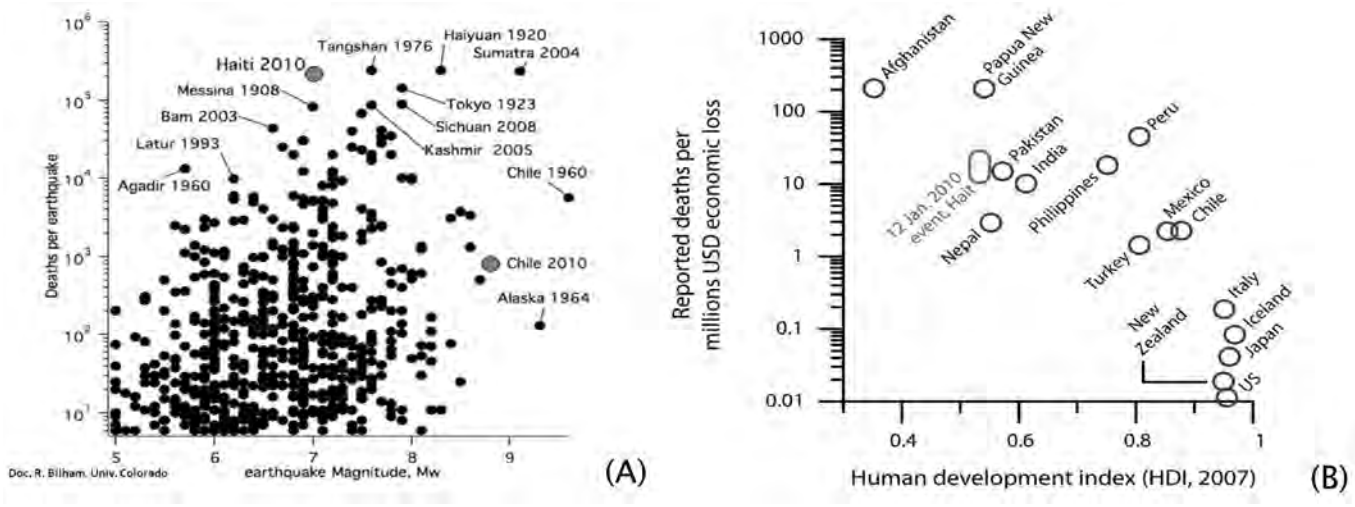
The most intense natural hazards are seismic and hydrometeorological (Table 1). Seismic hazards are associated with the interaction of the Caribbean and North American tectonic plates. Hydrometeorological hazards are related to the precipitation caused by northern polar fronts, tropical cyclones and waves, the Inter-Tropical Convergence Zone, and convective-orographic activity. El Niño/ENSO episodes have tended to delay the arrival of the rainy season, create drought conditions, and increase the number and intensity of cyclones, some of which could approach and hit Hispaniola. Other secondary hazards impacting Haiti include landslides, torrential debris flows, soil liquefaction and tsunamis.

Exposure and Vulnerability

The collapse of several buildings prior to the earthquake, and the stunning impact of the January 12, 2010 earthquake serve as a sharp reminder of the weak and unregulated public construction sector and the potential implications involved. This resulted in the disproportionate number of deaths and injuries and amount of damage, given the magnitude (Figure 2). Unless enforceable national building norms are

[5] Government of Haiti (2010a).
[6] PPCR (2009).
[7] Understanding Risk (2010). See also Government of Haiti (2010b).

Figure 2. The ratio of deaths.



The ratio of deaths: (A) In relation to the magnitude of the earthquake (Bilham 2010). The January 12, 2010 earthquake resulted in the highest number of deaths for the given 7.0 magnitude. More fatalities only occurred in instances of higher magnitude. (B) Deaths per economic losses, inversely related to socio-economic development level. Circles show direct, tangible earthquake losses (1950–2009) for some countries commonly affected by earthquakes (blue) as well as recently estimated losses from the January 2010 Haiti earthquake (red) (Roberts et al. 2010).

created, Haiti, particularly Port-au-Prince due to its adverse soil conditions, will suffer equivalent or worse damage in future, inevitably larger, seismic events.

Haiti suffers from severe environmental degradation, as evidenced by only 2% forest coverage and the overall degradation of the country's land and watersheds (Figure 1). In past decades, water catchment areas have suffered an accelerated process of expansion of the agricultural frontier and deforestation to satisfy local food, energy and other income-generating demands. Most of the forested lands have been converted to agricultural and livestock use, or simply deforested for charcoal production, without replanting. This has provoked reductions in infiltration capacity and led to extensive erosion and loss of nutrients and biomass. This, combined with intense demand pressure in urban areas, further reduces the availability of potable water from surface and underground sources.

These pressures, exacerbated by Haiti's mountainous topography, changing climatic environment, environmental degradation and the movement of small land title holders to increasingly fragile upland soils, have resulted in extensive deforestation, accelerating erosion, depleting fertility, and silting of waterways, lakes, reservoirs and shorelines. This, in turn, diminishes the agrarian bearing capacity of the land and contributes to a downward socio-economic and environmental spiral.

With 77% of the Haitian population living on less than US$2 a day and 52% living on less than US$1 a day, extreme poverty represents a significant social vulnerability. This translates into precarious living conditions for the majority of the population, drastically decreasing their coping abilities and resilience to the impact of adverse natural events, further enhancing the vicious circle of poverty, environmental degradation, rapid urbanization and vulnerability. Currently, more than 60% of Haiti's 9.8 million inhabitants live in urban areas. The high population density (average up to 35,400/km^2 in Haiti, and higher in Port-au-Prince) coupled with

unregulated construction, weak social and economic public infrastructure, lack of land-use planning, and unstable governance, further aggravates the extensive social vulnerability.

Additionally, Haiti suffers from significant governance issues that further increase its vulnerability to natural hazards. Haiti's long history of political instability has greatly weakened its institutions and governance mechanisms (Haiti has the lowest index of corruption perception[8]) which contribute to, inter alia, serious fiscal, regulatory and planning issues. The lack of political stability has a significant impact on the continuity and effectiveness of the National Disaster Risk Management System (Système National de Gestion des Risques et des Désastres, SNGRD), in particular its risk management components. Often the Government of Haiti (GoH) is not afforded the time to develop strategic policies, programs and ensuing coordination, monitoring and evaluation tools, to successfully implement an effective DRM program. Rather, the GoH chooses short-term reactive actions to cope with disasters rather than develop longer-term strategies and programs to address their causes.

Recent Disasters and Tendencies

Recent disasters in Haiti confirm an increasing level of vulnerability facing its hard-won development gains. During the 20th century, Haiti experienced 97 internationally recognized disasters of hydrometeorological nature. Approximately 80% of the disasters happened after 1954 and 40% occurred in the 1990s alone. This trend is expected to continue due to climate change, continued concentration of assets and expected seismic activity. In the last few years alone, a number of particularly significant disasters affected Haiti. In 2004, Tropical Storm Jeanne affected over 315,000 people; in 2008, FGHI affected more than 865,000 people; and in 2010, the January 12 earthquake directly affected more than 1.5 million people. The impact of the disaster on the national economy in terms of damage and losses for Tropical Storm Jeanne (2004) was evaluated at 7% of the GDP[9], 15 % of GDP for FGHI (2008)[10], and 120% of GDP for the January 12 earthquake (2010).[11]

Climate change may also have adverse impacts in Haiti, classified as one of the 10 global climate change hotspots.[12] With a possible increase in the frequency and severity of storms and a decrease in average rainfall associated with climate change, the potential impact on populations and livelihoods will require a comprehensive and integrated approach towards the management of hazards associated with changing global and regional weather patterns.

DISASTER RISK MANAGEMENT FRAMEWORK

The January 12th earthquake has led the GoH, with support from its technical and financial partners, to undertake a broad reconsideration of the country's National Disaster Risk Management System (System National de Gestion des Risques et des Désastres - SNGRD). The broad consultative process held for the Post-Disaster Needs Assessment (PDNA) in conjunction with the elaboration of the GoH's Action Plan for National Recovery and Development of Haiti have contributed to the development of the proposed revision of the system. These documents, presented by the GoH during the UN Donor Conference in New York in March 2010, emphasize the need to

[8] Transparency International (2006) classifies Haiti as 163rd among 163 countries.
[9] ECLAC (2005).
[10] Post-Disaster Needs Assessment (PDNA). 2008. UN, World Bank, European Commission.
[11] Government of Haiti (2010c).
[12] PPCR (2009).

(i) strengthen the operational capacities for disaster response; (ii) set up a permanent structure for crisis management; and (iii) continue work on risk prevention. The period leading to the upcoming presidential and senatorial elections, and subsequent political transition, offers an opportunity to discuss different institutional and policy options for each of these priorities. This process will form the foundation for a legislative framework which, for the first time, will clearly define roles and responsibilities of all stakeholders.

Haiti's SNGRD was signed into effect in 2001 by 10 key line ministers and the President of the Haitian Red Cross. The SNGRD has achieved significant results in disaster preparedness and response since its inception. While the 2004 hurricane season resulted in 5,000 casualties over 300,000 affected people, FGHI resulted in less than 800 casualties over 865,000 affected people. Strong collaboration between the key members of the SNGRD and its technical and financial partners (TFP)[13] was critical to improving the speed and efficiency of the response capacity. It is to be stressed that the crisis following the January 12, 2010 earthquake was beyond the capacity of the SNGRD due to its unexpected catastrophic nature.

Haiti's hard-won development gains are often jeopardized by adverse natural events. To ensure a rapid and effective transition from the emergency response phase to the subsequent recovery and reconstruction phases following the January 12, 2010 earthquake, it is important to begin integrating DRM activities and to set the foundation for a successful recovery process and reducing vulnerability throughout the reconstruction phase. This process ensures that DRM will be mainstreamed as a core component of sustainable poverty reduction and economic growth strategy.

While efforts to further strengthen the SNGRD's preparedness and response capacities continue, there is a greater need to focus on protecting investments as well as livelihoods, to facilitate the transition from a "living at risk" to "living with risk" approach. DRM has been included as a key cross-cutting priority in the Government of Haiti's (GoH) Poverty Reduction Strategy Paper (PRSP: 2008-2011) and as a principle pillar of the United Nations Development Assistance Framework (UNDAF: 2009-2011), as well as the World Bank's Country Assistance Strategy (CAS: 2009-2011). More recently, the Post-Earthquake Disaster Needs Assessment 2010 and the Action Plan for National Recovery and Development of Haiti present DRM as a cross-cutting priority for both the public and private sectors and present it as an opportunity to promote (i) decentralization; (ii) a stronger civil society; and (iii) an innovative private sector. Overall, this demonstrates a growing consensus within the GoH and amongst its TFPs of the importance of integrating DRM as a critical component of a successful poverty reduction and economic growth.

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

Haiti's National Disaster Risk Management System (SNGRD) was signed into effect in 2001 by 10 key line ministers and the President of the Haitian Red Cross. The National Disaster Risk Management Plan (PNGRD) provides the operational framework for the SNGRD and identifies the specific roles and responsibilities of the participating

[13] Including International Financial Institutions (IFIs), bilateral donors, NGOs and the private sector.

institutions. The system is headed by the National Disaster Risk Management Council (CNGRD), which is led by the Prime Minister[14] and composed of the signatory Ministers of the SNGRD and the President of the Haitian Red Cross. At a more operational level, the Directorate of Civil Protection (DPC) and the Permanent Secretariat for Disaster Risk Management (SPGRD) are responsible for the implementation of the PNGRD. Established in 1997, the DPC is the institution most involved in the implementation of the PNGRD, yet as a line ministry Directorate, it does not have the mandate or the technical capacity to design national or sectoral DRM strategies for adoption and implementation by the government and its key line ministries. The SPGRD, led by the Director General of the Ministry of Interior and Collective Territories (MICT)[15], is composed of technical representatives for the signatory Ministries of the SNGRD and the Red Cross and is divided into two branches: a disaster management branch consisting of the Emergency Operation Center; and a risk management branch, composed of thematic and sectoral committees.

While the PNGRD emphasizes a proactive approach vis-à-vis risk reduction and mitigation rather than disaster management, its implementation so far has focused on the latter. The PNGRD identifies the following three axes of intervention: i) risk management at the central level, ii) disaster management at the central level, and iii) disaster and risk management at the local level. The SNGRD has historically focused on disaster preparedness and response with the objective of reducing fatalities associated with adverse natural events. Most of the existing DRM programs evolve around the DPC and SPGRD, but there has recently been an increase in sector integrated DRM projects and activities. Efforts made in 2009 to reinforce and update the national policies for Emergency Response and Risk Management were interrupted by the January 12, 2010 earthquake.

The SNGRD has prioritized the engagement of local communities and the strengthening of their capacities in an effort to decentralize their operations and bolster the system's capacities. The SNGRD has established an extensive network of Departmental Disaster Risk Management Committees (Comité Départementaux de Protection Civile, CDPC) present at the departmental level (all 10 departments) and municipal level (more than 110 of the existing 165 municipalities). Under the leadership of relevant senior government officials (the delegate of the President at the departmental level and the mayor at the municipal level), the CDPCs are composed of the representatives of government, civil society and international technical partners. Trained initially to focus on disaster management activities (preparedness and response), the CDPCs are acquiring the tools and capacities to assume greater responsibility in the development of their respective DRM strategies and execution of local risk reduction activities.

Currently, most line ministries do not have the legal mandate, strategic framework or technical capacity to effectively fulfill their DRM role and responsibilities as defined within the PNGRD. Although the PNGRD was signed in 2001 by 10 ministries and the Red Cross, the MICT is the only institution with a clear DRM mandate. The existing insufficient legal framework makes it difficult to allocate financial resources and limits the involvement of the signatory ministries at the institutional level. As a result, the SNGRD has come to rely mostly on multi-sectoral coordination committees without the necessary corresponding institutional involvement.

At the highest level, the GoH has yet to assume full ownership over the SNGRD. The apex political body of the SNGRD, the CNGRD has never officially met and the SPGRD, headed by the DPC, is in the difficult position of attempting to 'chair' the system and streamline cooperation

[14] Leadership delegated to the Minister of the Interior and Collective Territories (MICT).
[15] Leadership delegated to the Director of the Directorate of Civil Protection.

and coordination among international actors. This task has become ever more challenging since the January 12, 2010 earthquake on account of a significant increase in international actors.

While the support to a central coordination body remains a priority, the need to re-think format and level of political engagement for this structure is imperative. As outlined by the Action Plan for National Recovery and Development of Haiti, a National Council for Civil Protection will be established, responsible for defining a new vulnerability reduction strategy and a more general crisis response strategy, for both natural and man-made crises. In support of this council, legal frameworks and decrees have been proposed to render the SNGRD more operational and raise the status of the DPC to the level of General Directorate. While no effort has been spared to modernize the risk management structure, its effectiveness and the required political will has yet to take root.

HFA Priority #2: Disaster risk assessment and monitoring

Over the last 8 years, the SNGRD has made some improvements in data collection for risk assessments. Although there is currently no updated national, departmental or sectoral comprehensive risk assessment, there exist a number of initiatives, namely: i) Oxfam elaborated in 2002 the first national natural hazard and disaster vulnerability maps, ii) the National Center for Geospatial Information has developed two pilot local flood maps, and iii) the Ministry of Planning and External Cooperation (MPCE) and several line ministries are interested in developing sectoral risk assessments to better inform their strategic investment program decisions. At the local level, risk assessment has improved over the last five years. The close collaboration between the DPC and its technical and financial partners (TFPs)[16] has allowed for each CDPC to develop a rudimentary risk map based on available data.

Following the January 12, 2010 earthquake, the GoH requested funding from the World Bank for a multiple-hazard assessment (NATHAT). The study was funded by the World Bank-hosted Global Facility for Disaster Reduction and Recovery (GFDRR) and carried out with the collaboration of UNESCO, the Inter-American Development Bank, and several Haitian institutions and professionals. The study was designed to:

- Conduct an inventory of natural hazards across the country;
- Provide an assessment of imminent hazards and vulnerability of disaster victims in light of the approaching rain season and potential of another severe earthquake;
- Summarize recommendations for a medium- and long-term strategy to improve risk management;
- Formulate an action plan and offer recommendations for the reconstruction phase.

The analysis and outcomes were intended to inform a varied target audience (decision-makers, general population, international community, scientists and engineers). In view of the quantity, quality of data collected and the time available, the work was prioritized along the following lines:

- In the very short term, during humanitarian and rehabilitation work, determine the hazards at temporary transitional camp sites (nearly 1.2 million people);
- Considering the likelihood of another major earthquake striking Haiti in the future, examine the possible magnitude, intensity, acceleration, and secondary effects (aftershocks, soil liquefaction, landslides and tsunami);

[16] Including International Financial Institutions (IFIs), bilateral donors, NGOs and the private sector.

- Evaluate the hydrometeorological hazards (tropical cyclones and waves, El Niño/ENSO, polar thrusts) and their secondary effects (heavy rainfall, floods, windstorms, surge, drought, torrential debris flows, landslides).

Haiti relies on limited natural-hazard-specific data collection and monitoring capacity and there is currently no structured national observatory or early warning (alert-alarm) system. The systems that are currently operational fail to provide the coverage and data-sharing required. Haiti's National Meteorological Center (NMC) relies on two weather-monitoring stations and a network of volunteer observers around the country to provide the data necessary to supplement the United States' National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) forecasts. With 13 unique microclimates, Haiti's capacity to accurately forecast the local weather conditions and provide timely early warning is limited. Although several institutions and organizations have local rainfall monitoring capacity, a formal network to gather, share and action the data does not exist, thereby undermining the ability of the NMC to fulfill its mandate. Similar situations exist for other major hazards including seismic activity, landslides, liquefaction and tsunamis, where the combination of a lack of equipment, formal networks, databases, and limited institutional capacities constitute a challenge.

The SNGRD has successfully managed to reduce mortality rates associated with hydrometeorological events from thousands to hundreds as a result of better diffusion of warning messages and increased local awareness. The current flood and hurricane warning system depends heavily on the regional data provided by the NWS's Hurricane Center in Miami and from local observers. More work is needed to improve the forecasting capacities and further decentralize the monitoring capacity. Several pilot activities have been executed on flood early warning systems (FEWS) financed by USAID and UNDP, a national program covering the installation of FEWS across 13 priority watersheds funded by the Inter-American Development Bank and a simulation exercise carried out by the SPGRD. The United States Geological Survey is providing assistance for the installation of seismic stations on the main active tectonic faults.

While analyses, studies and data collection mechanisms exist, there are no established updating and integration mechanisms. Due to the tightly coupled relationship between Haiti's different vulnerability factors, it is essential to create a work dynamic among the ongoing observatory initiatives (poverty, environment, food security, etc.) under one platform that can be used as the basis for formulating a comprehensive risk assessment. The implementation of such an initiative will require considerable funding, technical assistance, networking and partnership building. With required resources not yet mobilized and the drive for quick and visible interventions, this may take some more time.

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

The SNGRD has benefited from significant increases in financial and technical support from the GoH's TFPs, for the purposes of, *inter alia,* institutional strengthening activities. The technical expertise mobilized in support of the institutional strengthening agenda has resulted in improved procedures and products and the development of new tools as well. To ensure that the acquired knowledge and tools are institutionalized, thus contributing to long-term impact of the outputs, the implementation of a knowledge management system is essential. While there is an ongoing initiative to set up a disaster management database (following the guidelines of the Regional Center for Disaster Information) with support from UNDP, more resources are required to establish a dynamic knowledge and

information management system for the promotion of a culture of vulnerability reduction.

Through the CDPC network and efficient partnerships with the media, the SNGRD has made progress in raising the public's awareness on DRM. The SNGRD has targeted national, departmental and local government officials, the general public and the vulnerable groups (women, elderly and children) with specific messages for preparedness and response. The SNGRD also disseminates general DRM information through the media on various occasions. The thematic committee working on public awareness and education is developing a more structured public communication strategy and plans for raising awareness in schools. In addition, the thematic committee is supporting the development of a DRM module for integration into the national curriculum. Also, the World Bank is supporting an additional initiative focused on the production of diverse risk communication tools based upon the results of the NATHAT analysis, addressed to the general public (in Kréyole Ayisien, and accessible in French), to the decision makers (in French) and to the international donor community (in French and English).

The development of human capital with the necessary strategic and technical expertise remains a major challenge. In order to capitalize on the improved institutional capacities and effective outreach programs, additional human capital with DRM expertise is needed to successfully promote the introduction of safety and resilience into the culture. This is also critical to protect against the potential loss of knowledge and expertise through the anticipated turnover of the limited staff working within the SNGRD. Through an academic partnership between the University of Florida and the University of Quisqueya Haiti, 20 people completed a DRM Masters program during the 1990s. Unfortunately this partnership no longer exists, although recent efforts to reestablish new university-level graduate and postgraduate programs partnership are underway.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

The PRSP represents a significant opportunity for the integration of DRM into the national development process, with the objective being to transition from "living at risk" to "living with risk". Following FGHI in 2008, the GoH revised the PRSP to place a much greater emphasis on the integration of DRM into the national and sectoral strategies and investment programs as a means of securing its investments.

The integration of DRM at the strategic level translates into more effective operations at the sectoral level. In addition to the Ministry of Planning and External Cooperation (MPCE) and the Ministry of the Environment (MDE), numerous line ministries are interested in strengthening their respective DRM capacities as evidenced by emerging ministerial rhetoric. The GoH's TFPs have taken notice and are beginning to support the GoH's shift in strategy by allocating significant portions of post-disaster recovery and reconstruction assistance towards mitigation and DRM capacity-building activities. While the World Bank is working with select line ministries through its existing portfolio to mainstream DRM[17], it has launched an advocacy campaign - in support of the SNGRD - to further orient pipeline investments of the GoH's TFPs.

Risk management at the departmental level has increased, yet departments require additional technical and financial support to successfully

[17] Emergency Recovery and Disaster Management Project, Emergency Bridge Reconstruction and Vulnerability Reduction Project, Emergency School Reconstruction Project.

address the high level of vulnerability. Departmental and local governments are acutely aware of the risk they face, yet struggle to implement a comprehensive DRM program due to limited technical and financial resources. The World Bank, the EC and the UNDP currently finance local risk management activities (using a community-driven approach) and capacity-building activities at the departmental level. However, additional resources are required to ensure the integration of DRM in local governance activities, i.e. through land use planning, local development plans, etc.

The next step on the risk management agenda is a multi-layered approach to strengthen both the institutional capacities at national, sectoral and local levels and to increase the volume of investments and projects taking into account DRM factors. For the institutional component, the objectives are to i) establish a central strategic and coordination capacity within the ministries of Planning and Economy, ii) build up the sectoral DRM capacities of line ministries and support investment securing activities, and iii) strengthen local governments for the integration of DRM in their plans and the execution of risk management activities through the sectors. For this, the World Bank is working in close collaboration with the most relevant TFPs, including UNDP, EC, IADB, and USAID.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

The SNGRD has achieved significant results in the areas of disaster preparedness and response, effectively reducing the mortality rate. Although the mortality associated with the impact of natural hazards remains high, significant advances were made based upon a strategy encompassing the areas of working towards i) strengthened local capacities, ii) increased early warning capacity and effective public awareness campaigns, iii) development of partnerships with key actors, iv) establishment or strengthening of the PNGRD coordination mechanisms, and v) development and operationalization of technical tools for disaster preparedness and response. It is clear that all stakeholders involved must undertake additional and sustainable measures to support this capacity-building.

In the wake of the January 12, 2010 earthquake, the local structures of the SNGRD played a critical, though relatively unknown, role in search-and-rescue operations as well as in the management of IDP camps and food distribution, among other things.

At the local level, the establishment of the CDPCs has been effective in the development of local knowledge and capacity. With close to 4,000 people involved through the departmental and local CDPCs, the true operational capacity of the SNGRD is at the decentralized level. The CDPCs bring local actors together to plan for the hurricane season and coordinate and conduct disaster response operations with support from the SNGRD's TFPs.

The SNGRD is working on improving its flood warning system capacity. The number of evacuated people (6,000 in 2006; 33,000 in 2007; and 122,000 in 2008) is an indicator of the improved structuring and dissemination of warning messages and the public responsiveness to the warnings. The establishment of warning protocols and their application by the majority of institutions involved in the SNGRD has also contributed to a faster and more efficient mobilization for response operations.

The recent creation of municipal evacuation plans (including the related communication strategy) and shelters in 31 municipalities at high risk of floods throughout the country (an IADB-supported initiative) is a stepping stone in this direction. Next steps include scaling this initiative up throughout the entire country, expanding it to several types of hazards, and creating and improving observation and surveillance capacities.

To increase its span of work, the SNGRD has established or strengthened a number of coordination mechanisms as defined in the PNGRD. To support the DPC and the SPGRD, the two central institutions in charge of DRM activities, the SNGRD has strengthened the thematic committees (early warning system, public awareness and education, environment, shelter management) and plans to establish several more. These committees are composed of all institutions involved and other partners working on a specific theme for strategy development, activity planning and coordination. The committees often need technical assistance, as most of the expertise is not available. The SNGRD has also put in place and improved the Emergency Operation Centers (EOCs), with one at the central level and several at the departmental and municipal level, enabling faster and more efficient initial disaster response.

Strengthening the operational capacities for disaster preparedness and response remains the key priority for the SNGRD. Specifically, this will include:

1. **Streamlining operational emergency procedures and technical tools procedures for disaster preparedness and response at national, departmental and municipal levels.** For instance, the SNGRD devises annual hurricane preparedness strategies (contingency planning, simulation exercises, communication campaigns, etc.) as well as post-cyclone-season evaluation activities. However, these activities need to be further institutionalized and developed at the local level.
2. **Completing construction and adequate equipment of Emergency Operation Centers at the departmental and municipal level.** This needs to be completed with the allocation of small operational budget for DRM Committees at the departmental and municipal level to allow mobilization of their members.
3. **Creating a body of professional first responders to include fire brigades, police, and medical doctors.** This will be complemented by a reorganization of the civil protection volunteer sector to allow broader mobilization of human resources in response to disasters.
4. **Strengthening technical capacities and professionalization of NDRMS members** through (internal and external) training, study visits and exchanges with foreign DRM institutions, etc.
5. **Strengthening government's training delivery capacity** through the standardization of training modules, creation of a pool of nationally recognized instructors, and introduction of a training certification process.

One of the greatest challenges facing the SNGRD is to facilitate a rapid and smooth transition from recovery to development following disasters. Typically, emergency response operations begin immediately following a disaster. However, as evident by the results of the GoH and their TFPs' response to Jeanne in 2004 and the current efforts after the January 12, 2010 earthquake, failure to identify and launch recovery activities designed to bring the affected communities back to a self-sustainable situation through social and economic activities can prove a hindrance for the reconstruction effort. Furthermore, the reconstruction suffers from the lack of land use planning and normative tools and often fails to reduce the underlying risk factors. The next steps would be to strengthen the recovery-planning capacities through institutional support and work at strategic and technical levels to raise awareness for such needs and their critical role to ensure proper return from crisis management to development. It is clear that only with adequate risk knowledge and risk information tools would this be a reachable goal. The World Bank is currently working on developing such tools and on the design and implementation of an institutional framework to acquire, stock and share data and information on risk.

ADDITIONAL OBSERVATIONS

The GoH has successfully introduced DRM as a condition for sustainable development and is working to build consensus among its institutions and partners. The consensus represented within the respective strategic documents is of particular importance because the international community has financed more than 60% of the investment prior to the earthquake, only to be multiplied given current circumstances.

More work lies ahead to ensure that DRM priorities identified in the national development plans are integrated within sectoral agendas. There is currently no ministry or any other agency or entity integrating DRM into their respective strategies, although there is now a strong political will to act on the extreme level of vulnerability. Key coordination ministries such as the MPCE, MICT and MEF and several line ministries have expressed interest. Funding from the GFDRR is available to provide technical assistance to the MPCE and comes in addition to World Bank financed emergency reconstruction projects. Now that the MPCE has an operational DRM cell (Cellule de Réduction de la Vulnérabilité, CRV), the next stage will focus on building the necessary institutional capacity (both strategic and technical) and fostering consensus among the actors involved in each specific sector. Among the TFPs, there is a clear adjustment of overall strategy among the most influential actors (G10) and there are more organizations integrating DRM in their assistance plans. In addition to the World Bank and the UN system, USAID is planning for greater investment in DRM over the coming years: USAID in the form of technical assistance to the Ministry of Agriculture, Rural Development and Natural Resources (MADRNR) and the Ministry of the Environment (MDE in the context of national risk reduction through a watershed rehabilitation program.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)[18]
Emergency Reconstruction and Disaster Management Project	World Bank (IDA), UNDP, European Commission	19.4 million 2005-2011	1, 2, 3, 4, 5
SNGRD Development Program	UNDP, USAID, European Commission	4 million 2009-2011	1, 2, 3, 5
National Early Warning System Program	IADB, UNDP, World Bank	6 million 2006-2010	2, 3, 5
Haiti Integrated Growth through Hurricane Emergency Recovery	USAID, UNDP, IADB, World Bank	96 million 2009-2011	1, 3, 5
Emergency Bridge Reconstruction and Vulnerability Reduction Project	World Bank (IDA), IADB, UNDP	20 million 2009-2012	1, 2, 4
Emergency School Reconstruction Project	World Bank (IDA), Canadian International Development Agency, IADB	5 million 2009-2013	1, 3, 4
Haiti Transportation and Territorial Development Project	World Bank, European Commission, Agence Française de Développement, IADB, Canadian International Development Agency	16 million 2007-2012	5
Hurricane Noel Reconstruction Project	European Commission	3.9 million 2009-2011	4, 5
Technical Assistance to Support the Creation of the DRR Unit at the Ministry of Planning and External Cooperation (MPCE)	World Bank (GFDRR), Ministry of Planning and External Cooperation (MPCE)	1.9 million 2009-2011	1, 2, 4
Haiti Institutions and Infrastructure Emergency Recovery Project	World Bank	65 million 2010-2013	5
Support to National Institutions for Haiti Earthquake Recovery	World Bank (GFDRR)	1.1 million 2010-2012	1, 3, 5
Haiti Structural Assessment Program	World Bank (GFDRR), Ministry of Public Works, Transport and Communications	1.3 million 2010-2012	1, 3, 4, 5
Haiti Multi-Hazard Assessment	World Bank (GFDRR)	0.9 million 2010-2012	2, 3, 4, 5
Strengthening Crisis Management Capacities (communication; equipment; training)	European Commission Instrument for Stability	19.2 million 2010-2012	1, 3, 5
Strengthening Disaster Preparedness at National and Departmental Level, including community level and IDP camps	European Commission/ECHO, UNDP, IFRC, THW, other NGOs	7.6 million 2010-2012	3, 5
DIPECHO/Disaster Preparedness Program	European Commission/ECHO, UNDP, IFRC, NGOs	8.3 million[19] 2011-2012	3, 5

GLOBAL FACILITY FOR DISASTER REDUCTION AND RECOVERY (GFDRR): ACTION PLAN

Given Haiti's risk profile and its existing framework for disaster risk management, the key priority in Haiti is to reduce the level of extreme vulnerability through a comprehensive risk management approach targeting all phases (risk knowledge and communication, recovery, reconstruction, prevention, and mitigation). Strategic actions are needed in the following areas to enhance disaster risk management in Haiti: (i)

[18] HFA Priority Action Areas: 1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation; 2. Identify, assess, and monitor disaster risks—and enhance early warning; 3. Use knowledge, innovation, and education to build a culture of safety and resilience at all levels; 4. Reduce the underlying risk factors; 5. Strengthen disaster preparedness for effective response at all levels.

[19] Forecast.

strengthen institutional capacity for strategic planning and coordination at central and local levels, (ii) mainstream DRM in specific sectors, and (iii) develop a comprehensive risk identification, assessment and monitoring capacity.

The following activities have been identified in consultation with local authorities and their technical and financial partners and reflect HFA priority action areas. These actions support Haiti's disaster risk management program.

Indicative Program for GFDRR Funding (Projects and engagement areas being considered for GFDRR funding)	Implementing Agency / International Partners	Indicative Budget and Period (US$)	HFA Activity Area(s)
Technical Assistance to support institutional capacity building for mainstreaming of DRR	Prime Minister's Office (CIAT) , Ministry of Planning and External Cooperation, Ministry of Interior/World Bank	1.2 million 2011-2013	1, 2, 4
Development of local DRM expertise through pilot DRM activities within priority sectors*	Ministry of Planning and External Cooperation, Ministry of Interior/World Bank	2.8 million 2011-2013	1, 2, 4
Building Risk Identification, Assessment and Monitoring Capacity*	Prime Minister's Office (CIAT), Ministry of Planning and External Cooperation, Ministry of Interior/World Bank, UNDP, IADB, USAID, European Commission	2.9 million 2011-2013	2
Social Infrastructure Structural Assessment and Construction Norms	Ministry of Public Health/World Bank, PAHO	1.5 million 2010-2011	2, 4
Initial Budget Proposal:		**US$7.9 million**	

* The local DRM pilot activities and the risk identification, assessment and monitoring capacities will focus on the same priority sectors to complete the institutional strengthening efforts previously identified for programs for GFDRR financing: Agriculture, Public Work, Social Affairs, Education, and Environment.

There is now a strong political will and a window of opportunity to act on the extreme level of vulnerability; key coordination ministries such as the MPCE, MICT and MEF and several line ministries have expressed interest in taking the lead. This initial step aims to build capacities at the central planning level, with a DRM-specific cell within the MPCE. Initial funding from the GFDRR is available to provide technical assistance to the MPCE. Based on the lessons learned and the resources expected to be assigned to this first DRM cell, the second step will focus on the priority sectors with a dual approach: institutional strengthening at the central level and DRM pilot activities at the local level. The pilot activities will focus on designated vulnerable communities, which will receive technical assistance for DRM mainstreaming in local development plans. Based on these initial two steps, the next phase will focus on expanding the scope of work to other line ministries (such as Commerce and Trade, Health, Tourism, Culture, etc.) and increasing the geographic coverage of efforts to reduce the vulnerability in the most exposed communities. A request for additional financing will be elaborated for this next phase. It is expected that the experience and the reduction of natural hazards' impact on the development process will be the base for mainstreaming DRM within the legal mandates of national institutions and will provide additional capacity for further work.

COUNTRIES MOST EXPOSED TO MULTIPLE HAZARDS
(Top 15 Based on Land Area with 3 or more hazards)[a]

1. Taiwan, China
2. Costa Rica
3. Vanuatu
4. Philippines
5. Guatemala
6. Ecuador
7. Chile
8. Japan
9. Vietnam
10. Solomon Islands
11. Nepal
12. El Salvador
13. Tajikistan
14. **PANAMA**
15. Nicaragua

[a] Dilley et al. (2005). Table 1.1.

Panama ranks 14th among countries most exposed to multiple hazards based on land area, according to the World Bank's Natural Disaster Hotspot study.

Bridge of the Americas, Panama

PANAMA

Natural Disasters from 1983 - 2008[b]

Affected People

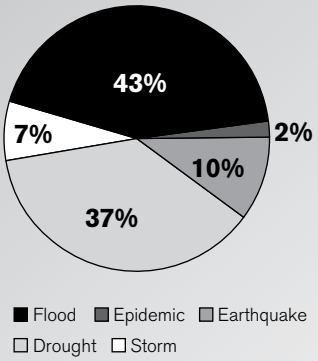
Disaster	Date	Affected (Number of People)
Drought	1993	81,000
Flood	2008	23,292
Flood	1991	20,061
Earthquake*	1991	18,060
Flood	2002	15,000
Flood	2004	11,650
Flood	2002	11,500
Storm	1988	8,732
Flood	2004	7,698
Storm	1998	7,500

Economic Damages

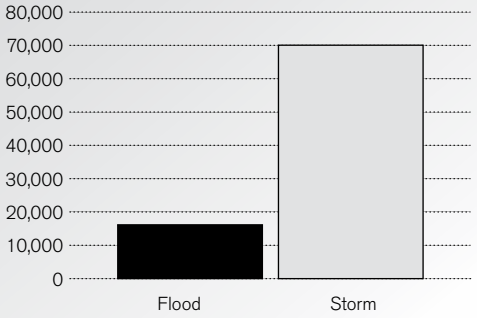
Disaster	Date	Cost (US$ x 1,000)
Storm	1988	60,000
Storm	1992	10,000
Flood	2008	10,000
Flood	1995	7,000
Flood	2005	7,000
Flood	2000	1,300
Flood	2002	500
Flood	1996	350
Storm	1998	50
Drought	1983	0

Statistics by Disaster Type[b]

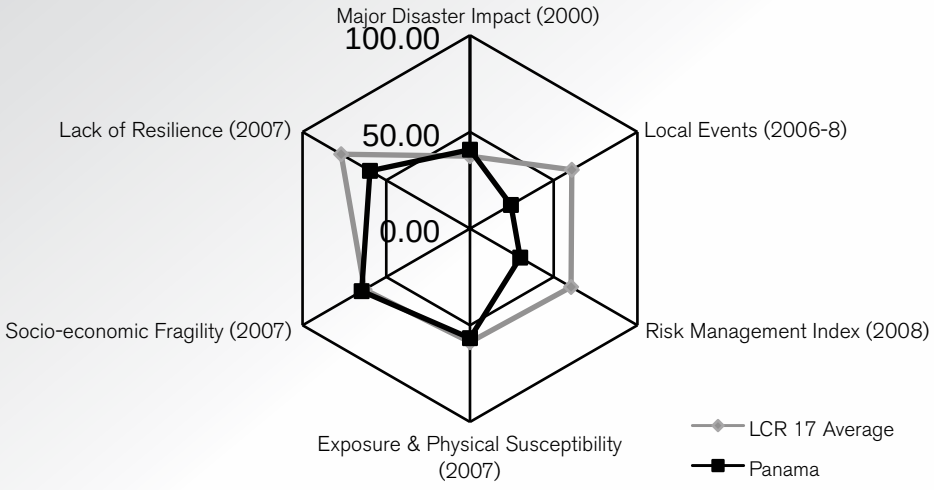
Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



Relative Vulnerability and Risk Indicators[c]



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=131. Source data from EM-DAT. Data displayed does not imply national endorsement.

[c] Relative Vulnerability and risk Indicators are adapted from IADB-IDEA-ERN (2009). Values are normalized on scale of 0 – 100 and presented against the average for 17 LCR countries. Major disaster Impact taken from disaster deficit Index: the ratio of economic losses which a country could suffer during a Maximum Considered event and its economic resilience. Local events taken from Local disaster Index: the propensity of a country to experience recurrent, small-scale disasters and their cumulative impact on local development. risk Management Index is presented as the negative (i.e. 0 = optimal, 100 = incipient) of IADB's risk Management Index: measures a country's risk management capability in (i) risk identification, (ii) risk reduction, (iii) disaster management, and (iv) financial protection. resilience, Fragility and exposure are taken from the component indices of Prevalent Vulnerability Index. Date for local event data depends on information available for each country. Data, and the respective LCR 17 average, from 2000 is used for Dominican Republic, El Salvador, Guatemala, Jamaica and Nicaragua. Data, and the respective LCR 17 average, from 2006-08 is used for Bolivia, Colombia, Costa Rica, Ecuador, Panama and Peru. All LCR 17 averages are calculated based on available data.

DISASTER RISK PROFILE

Panama ranks 14th among countries most exposed to multiple hazards based on land area, according to the World Bank's Natural Disaster Hotspot study.[2] Panama has 15% of its total area exposed and 12.5% of its total population vulnerable to two or more hazards. The same study ranks Panama 35th among countries with the highest percentage of total population considered at a "relatively high mortality risk from multiple hazards."

Major Natural Hazards

Due to its geographical location and geotectonic characteristics, Panama is exposed to a variety of natural hazards, including hydrometeorological and geophysical hazards. The Isthmus of Panama is only 60 to 90 km wide between the Caribbean Sea and the Pacific Ocean, with a mountain divide well known for its slope instability, intense rainfall and active tectonics.

Panama is characterized by very intense and long lasting rainfalls, windstorms, floods, droughts, wildfires, earthquakes, landslides, tropical cyclones, tsunamis and ENSO[3]/El Niño-La Niña episodes. Natural Disaster Data from Panama published on the Prevention website[4] indicates that the country experienced 32 natural disaster events between 1983-2008, with total economic damages estimated at US$86 million, with a total of 249 people killed by these events.

The country is located over a segment of the Caribbean tectonic plate, namely the Panama Deformed Belt (also known as the Panama micro-plate), at the border of the Cocos and Nazca Plates, with influence from the nearby South American Plate. This is one of the most important seismogenic sources in the region as part of the Circum-Pacific Belt.

Earthquakes have continued to strike Panama. In 2003 a magnitude 6.0 earthquake struck Panama near the Costa Rican border; the event was followed by more than 60 aftershocks (of magnitude higher than 4.0) during the following few weeks. Soil liquefaction occurrences were widespread, creating more damage to the infrastructure and at least three fatalities.[5] Tremors of magnitude 4.0 or less are common in Panama, particularly near the borders with Costa Rica and Colombia. According to local experts from the University of Panama's Geosciences Institute, there is a considerable amount of active geologic faults in Panama, and at some point a powerful earthquake is going to happen. The seismic history of Panama shows that there have been many earthquakes greater than 7.0 on the Richter scale throughout recorded history.

Volcanism and tsunamis are also present in Panama with a volcanic range stretching from the border with Costa Rica to the East, dividing the country into two main North-South watersheds (Caribbean and Pacific). The Chiriquí volcano, also known as Barú, is the highest mountain peak of the country, reaching 3,475m.[6] The latest eruptions of the Barú and La Yeguada Volcanoes were recorded around 1550 and 1620, respectively. Tsunamis have been recorded as affecting both Panama's Caribbean and Pacific shores with up to 5m surge wave height.

[2] Dilley et al. (2005).
[3] El Niño-Southern Oscillation; commonly referred to as simply El Niño, a global coupled ocean-atmosphere phenomenon.
[4] Prevention Web (2010b).
[5] Damage caused by the 2005 earthquake: http://www.igc.up.ac.pa/info.jpg.
[6] *Instituto de Geociencias* (2010).

Exposure and Vulnerability

The most important recent disasters in Panama have resulted from vulnerability to floods, landslides, earthquakes, windstorms, wildfires and storm. A high proportion of the low-income population in Panama lives in areas most exposed to natural hazards and resides in poorly designed and inadequately built structures. The poor enforcement of national and local land use regulations, the uncertainty about compliance with building codes, rapid demographic growth and unplanned urban and industrial expansion are responsible for most of the current and significant increases in vulnerability. Panama City's skyline is growing steadily and concerns are widespread about adherence to construction codes.

In light of its significant economic growth, the Government of Panama must be proactive to ensure the country reduces its long-term exposure to hazards. The integration of disaster risk management is essential in large infrastructure investments such as the ongoing US$5.25 billion Panama Canal Expansion project, the planned construction of the Panama subway, and other road and urban development projects. In 2004, the cluster of operational and economic activities linked to the Panama Canal operations - locally known as the Canal Economic Sector (Sector Económico del Canal, SEC) - generated direct and indirect contributions totaling 25% of the revenues received by the National Treasury.[7] In 2009, the Panama Canal Authority's direct transfers to the National Treasury represented about 3.4 percent of Panama's GDP and about 12.5 percent of its fiscal revenues[8], and a permanent 0.6 to 0.8 percentage-point boost to real GDP growth upon conclusion of the canal expansion project is projected. Special attention in Panama is required to protect these assets by reducing the country's increased vulnerability.

Global climate change models[9] have predicted that Panama will undergo several climatic shifts such as increases in temperatures, droughts, higher-intensity rainfalls and storms, and rising sea level. It is known that ENSO events have already severely impacted water availability and canal operations. It is also known that inter-annual climate variability of either the Pacific (i.e. ENSO) or the Atlantic (i.e. North Atlantic subtropical highs) causes a significant amount of the total variance in rainfall in the Caribbean and throughout Central America.[10] There are geological, geomorphologic, and hydrometeorological studies, developed or sponsored by the Panama Canal Authority, that can be interpreted as studies on natural hazards exclusively for the Panama Canal watershed.

As is the case in most Central American countries, cities in Panama have grown steadily and have thereby heightened vulnerability due to the increased concentration of the population, infrastructure and production of goods and services. Although the country has a comprehensive anti-seismic building code (based on the State of California's construction code), its implementation in new buildings and towers is uncertain, and provisions for retrofitting existing buildings are not efficiently enforced.

DISASTER RISK MANAGEMENT FRAMEWORK

Panama has improved its legal and institutional framework for disaster risk management (DRM). The authority for Panama's DRM National Platform stems from Law No. 7, Resolution 28 which

[7] Panama Canal Authority (2006).
[8] World Bank (2010).
[9] Hadley Centre Coupled Model, Version 2 (HADCM2), as reported in Mulligan (2003). Same modeling data as used by the Intergovernmental Panel on Climate Change (IPCC).
[10] Giannini et al. (2002).

created the National Civil Protection System (*Sistema Nacional de Protección Civil,* SINAPROC) in 2005. SINAPROC is responsible for coordinating DRM in Panama as the highest-ranking authority in the event of a natural catastrophe or man-made emergency. SINAPROC is also charged with executing the actions, regulations and directives towards the removal or reduction of the impacts of disasters on human lives, goods and society.

The Government of Panama is making important efforts in the Strategic Plan 2010-2014 (GPSP) toward mainstreaming environmental protection in the sectoral planning processes. The GPSP recognizes that current efforts to promote sustainable land use have been incomplete, with poor planning, and without effective enforcement of zoning regulations. It also highlights the need for protecting the country's natural resource base as a fundamental ingredient for maintaining the growth performance of key economic sectors, including the operation of the Panama Canal and tapping the very high potential of the country's tourism industry to induce economic growth and generate employment.

Panama has adopted the recommendations and priority actions of the "Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters" as part of the Government of Panama's efforts to improve its DRM capacity. Panama is an active participant in regional and international DRM forums, including the Central American Coordination Center for the Prevention of Natural Disasters (CEPREDENAC) and the United Nations International Strategy for Disaster Reduction (UN ISDR). The Government of Panama established and maintains an active CEPREDENAC's National Commission. In addition, as part of its increasingly proactive DRM agenda, the Government of Panama signed the Central American Policy for Comprehensive Disaster Risk Management, adopted at the 35th Central American Integration System (SICA)'s Ordinary Meeting of Heads of State and Government, held in Panama in June 2010.

As the leading DRM authority in Panama, SINAPROC maintains responsibility for the development and implementation of the National Emergencies Plan and the country's Risk Management Plan. The National Emergencies Plan defines roles, responsibilities and general procedures for institutional preparedness and response, establish an inventory of resources, coordinate operational activities, and assessments in order to safeguard life, protect property, and restore normalcy as soon as possible after the occurrence of a hazardous event. The Risk Management Plan guides risk reduction activities, emergency preparedness, and disaster recovery efforts. These measures are intended to improve safety against various risks while greatly reducing the economic impacts and social consequences of disasters.

The Government of Panama acknowledges that there is still a need to further strengthen existing DRM institutions and policies. Actions explored by the Government to improve disaster risk management in Panama include: (i) strengthening the National Civil Protection System (SINAPROC)'s institutional capacity, (ii) reducing vulnerability in urban areas, (iii) developing the country's risk assessment and monitoring capacity, (iv) developing risk reduction strategies for emergency response and diversified risk management instruments, and (v) strengthening the environmental institutions.

The National Environment Authority (ANAM) and the Canal Watershed Inter-Institutional Committee have integrated DRM and climate change in their national agendas. This is in recognition of the fact that each year during the rainy season, from May to November, floods and landslides are the most destructive natural disasters in the country, affecting people and communities, agricultural productivity, the road system and housing. In addition, the Panama Canal Watershed is particularly vulnerable to wildfires and the canal itself is vulnerable to earthquakes that can cause floods, damages to dams, and loss of life and property. Contingency measures

have been developed to retrofit infrastructure, train staff, acquire necessary equipment and enhance inter-institutional coordination.

Panama has nationwide networks of volcanological and meteorological monitoring stations and has implemented regional and local flood early warning systems. The country also has a national emergency toll-free phone number: "*335". By calling the "*335" number flooding, landslides, earthquakes, high winds, falling trees, falling ceilings, missing persons along rivers or beaches, infrastructure collapses, and fires, among other incidents, can be reported. Since February 2009, the Unified Emergency Management System (*Sistema Único de Manejo de Emergencias*, SUME), or 911, began operations in Panama. The 911 emergency number is available for common EMS emergencies. These numbers are integrated with modern ICTs[11] that allow efficient delegation of authority and responsibilities to the appropriate responders. Government agencies involved in emergency response are working on educational campaigns to ensure that the population understands the importance of such emergency services and uses them responsibly.

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

SINAPROC is in charge of planning, scientific research, direction, supervision, assessment, information, education, organization, public policy implementation and all other DRM actions in Panama. The execution of the National DRM Plan, including proactive initiatives and coordination with all national and international entities, is also within SINAPROC's responsibilities. Emergency management and disaster response are prescribed in Articles 6, 7 and 8 of Law No. 7 of 2005.

Emergencies are managed by the Center for Emergency Operations (COE[12]). This entity was created in 2000 with funding from the Southern Command of the United States Army. Equipped with the latest ICT, GIS and Remote Sensing technology and managed by civil servants, the COE has a command-and-control structure, with clearly defined hierarchical authorities and responsibilities. Alerts, supervision and command-control operatives are executed during emergency situations for both natural and man-made hazards.

CEPREDENAC's National Commission is comprised of a multisectoral and multidisciplinary set of governmental and non-governmental entities involved in DRM. Led by SINAPROC, the Commission is playing an increasingly important role in mainstreaming DRM activities in the country.

The Government of Panama signed the Central American Policy for Comprehensive Disaster Risk Management, adopted at the 35th Central American Integration System (SICA)'s Ordinary Meeting of Heads of State and Government, held in Panama in June 2010.

Panama's progress towards achieving the goals of the Hyogo Framework for Action[13] includes the following:

[11] Information and Communication Technologies.

[12] http://www.sinaproc.gob.pa/index.php?option=com_content&view=article&id=80&Itemid=56.

[13] Speech made by the Ambassador Deputy Representative of the Permanent Mission of Panama to the United Nations in Geneva before the first meeting of the Global Platform for Disaster Risk Reduction. J une 2007. Geneva. http://www.preventionweb.net/files/2271_PanamaStatementGP07.pdf.

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

As part of the Government's efforts to mainstream disaster risk reduction and to implement its risk reduction strategy the following actions have been implemented:

- A National DRM Policy (*Política Nacional de Gestión del Riesgo,* PNGR) was drafted, under the guidance of SINAPROC, with participation of a multidisciplinary team of governmental and non-governmental stakeholders. This draft is yet to be approved by the Government of Panama. However, the leadership role played by SINAPROC during its preparation ensures that the Government's DRM goals and perspective are incorporated in the proposal.
- SINAPROC, working closely with relevant DRM stakeholders, who were also involved in the drafting of the PNGR, has begun the consultation process for the preparation of the National Risk Management Plan, as mandated by Executive Decree No. 177 of April 30, 2008, which regulates Law No. 7 of 2005.
- The Ministry of Economy and Finance has recently created a new unit within the Directorate of Investments, Concessions and State Risks, responsible for integrating natural disaster risks as a variable in the planning process for infrastructure investments.
- As part of its regional binding commitments, through Executive Decree No. 402 of November 12, 2002, the Government of Panama created the National Commission of CEPREDENAC (CEPREDENAC-PANAMA). The Commission was delegated the responsibility for coordinating CEPREDENAC's activities in Panama. The Commission is comprised of a representative of SINAPROC, who presides; along with representatives of the Ministries of Foreign Affairs, Economy and Finance, Education, Public Works, Health, Housing, and Agricultural Development; a representative of the National Environment Authority (ANAM); a representative of the Social Security Administration (*Caja del Seguro Social*, CSS); representatives of the Civil Engineering Department and the Institute of Geological Sciences of the University of Panama; and a representative of the governmental Electricity Transmission Company (*Empresa de Transmisión Eléctrica S.A.,* ETESA). This commission remained inactive until 2005 when it was re-launched, as part of the restructuring of SINAPROC, under the mandate of Law 7. Since then, the commission, with the leadership of SINAPROC, has become the country's National DRM Platform, and is involved in mainstreaming the country's legal and institutional DRM framework, as well as preparing the country's progress reports towards the achievement of the Hyogo Framework for Action's DRM goals. The incorporation in 2006 of the Panama Canal Authority as a member of the National DRM Platform represents an important recognition of the platform's increasing role in promoting DRM in Panama.
- The Government of Panama signed the Central American Policy for Comprehensive Disaster Risk Management in June 2010. This agreement, signed by all the Central American Presidents, positions DRM as one of five pillars for sustainable development in the region, and commits its signatories to integrate DRM in their countries' national development plans.

Important efforts have also been made to mainstream DRM into the development of sectoral policies. Panama has developed several environmental policies that address DRM in an attempt to foster sustainable environmental development, such as the national policies for water, climate change, cleaner production, environmental monitoring, and environmental information, among others. The National Environment Authority is playing an increasingly proactive role in promoting the enforcement of these

policies into the urban and rural planning processes. In addition, the Ministry of Health has developed and implemented a proactive program for risk reduction within its health facilities.

HFA Priority #2: Disaster risk assessment and monitoring

Earthquakes in Panama are monitored by two seismological networks: the Western Earthquake Observatory (OSOP[14]) and the National Seismological Network (RSN[15]). Earthquake hazard has been probabilistically assessed in Panama through the RESIS II Project (NORSAR 2008). Volcanic hazards have only been preliminarily assessed in the western region, near the Barú volcano.[16] The Institute of Geological Sciences of the University of Panama is the leading agency responsible for monitoring seismological events in Panama. The Government of Panama has adopted the seismic code of California as the standard for construction in the country.

The Hydrometeorological Management Office of the Electric Transmission Company (GH-ETESA[17]) acts as the national climatologic, meteorological and hydrological monitoring service in Panama. Hydrometeorological hazards are also assessed at this bureau with coordination links to SINAPROC and COE.

The Government of Panama reported the following accomplishments and outcomes within HFA Priority #2[13]:

- The disaster inventory database was updated and improved.
- Flood-prone and landslide-prone areas were identified in the district of San Miguelito: Villa Greece and 8 communities of the Bocas del Toro province.
- Several early warning systems for floods were implemented in vulnerable communities prone to floods from the Mamoni, Cabra, and Chico rivers.
- Monitoring tools were customized for the Cabra, Tocumen and Tatar rivers and hazard maps of floods were developed to support decision-making in vulnerable districts. Additional hazard maps were created for rainfall, temperature, runoff patterns, and volcanic risk to benefit communities and enhance DRM activities.

Progress has been made to develop structural and non-structural risk assessment and risk reduction programs pertaining to health infrastructure. The Ministry of Health has developed protocols to ensure that health facilities exposed to natural or human hazards are retrofitted to withstand the impact of a disaster and remain in operation after the event, to assist victims in the aftermath of such an event. This requires the timely reduction of the vulnerability of the infrastructure, in addition to preparedness for providing a timely and effective response. National risk assessments of hospitals and health centers have been supported through the Social Security Fund and 95% of related staff have been trained in risk management.

Monitoring systems and related networks have been advanced in Panama. The University of Panama's Geosciences Institute has a real-time data-gathering system with 20 seismological stations that continuously monitor seismic activity at national and local levels. Also, twelve research projects were implemented to develop monitoring networks of urban hazards throughout Panama.

[14] http://www.osop.com.pa/index.html.
[15] http://www.igc.up.ac.pa/.
[16] *Instituto de Geociencias* (2010).
[17] http://www.hidromet.com.pa/sp/InicioFrm.htm.

Inspections have been conducted by the National Civil Protection System in prevention and mitigation activities, developing changes in home-building processes, erosion control in urban development, and integrated watershed management, towards reducing the impact of flooding in the most vulnerable areas of the country.

The hydrometeorological network was implemented and expanded through the Electric Power Company to monitor climatic conditions and support DRM initiatives across the country. Long-term, weekly and daily weather forecasts have also been prepared. These forecasts are provided to the Ministry of Agrarian Development to support decision-making and are shared with the Ministry of Health, the Smithsonian Institution, the National Civil Protection System, the National Environment Authority, and international organizations.

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

The National Secretariat for Science, Technology and Innovation (SENACYT) is charged with fostering all research, development, training and education efforts related to natural hazards, risk, and DRM in Panama.

The Government of Panama reported the following accomplishments and outcomes within HFA Priority #3[13]:

- An initiative was proposed to develop a National Strategic Education Plan for Risk Management and Sustainable Development in order to mainstream a culture of prevention that strengthens the Panamanians' way of life and advances sustainable development.
- The inter-agency coordination between the Social Investment Fund, the General Accounting Office, the Tommy Guardia Institute, and SINAPROC was strengthened to facilitate the management and sharing of scientific and technical DRM information.
- SINAPROC organizes public education campaigns to mainstream Disaster Risk Prevention through printed media, and radio and TV broadcasting.
- SINAPROC's Academy of Civil Protection (a technical body created by Law 7 of 2005) serves as a national and regional training center for professional first responders by providing specialized courses in risk reduction and emergency response.

The National Civil Protection System and the Ministry of Education have begun incorporating risk management and disaster topics in the programs and curricula of early childhood education, primary, middle and high schools, and the first DRM manual has been released for teachers at primary levels. The National Civil Protection System and the University of Panama's Faculty of Education initiated coordination activities towards developing qualified DRM personnel to strengthen the Operative Plan for the School Safety Program.

Community outreach on environmental concepts, information and actions was carried out through the World Meteorological Day celebrations and other activities. For instance, a training project between the Electric Power Transmission Company and the Ministry of Education called "Rain, Source of Life" sought to develop awareness of the natural environment among fifth- and sixth-graders, facilitating the training of teachers. Also, a contest was developed for children as a tool to raise awareness about disasters, the environment and how to protect their environment, sponsored by the Electric Transmission Company (ETESA) and the Ministry of Education.

The Technological University of Panama has integrated DRM topics by delivering programs on safe housing construction, quality control of

construction materials, and seismic instrumentation for high-rise buildings.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

The Government of Panama reported the following accomplishments and outcomes within HFA Priority #4[13]:

- Climate change scenarios were adapted for the Santa Maria River Watershed to facilitate the identification and implementation of adaptation measures.
- The "Strengthening of Forest Fire Prevention and Control Management" program was developed in the Soberania and Camino de Cruces National Parks.

In the context of community capacity development for disaster risk prevention and mitigation, the National Civil Protection System has strengthened local capacity for DRM and emergency response capabilities in several communities. Local DRM Civil Protection Committees have been established in twenty-nine vulnerable communities. Communal Civil Protection bases have also been created to foster effective DRM practices and response in the event of a disaster or emergency in areas identified as high risk. These areas include the province of Panama, Western Panama and the countryside, Chiriquí, Bocas del Toro, Colón, Herrera and Los Santos.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

The Government of Panama reported the following accomplishments and outcomes within HFA Priority #5[13]:

- Based on a regional plan, the Ministry of Public Works developed a risk reduction master plan, and Emergency Operation Centers were established in the Provinces of Chiriquí and Coclé.
- Panama implemented the first early warning system in Central America that integrates voice and text messaging for communities at risk. This service, known as Line *335, is toll-free for landline and mobile phones for all users requesting information about disaster-related emergencies. This information is accessible 24 hours a day, 365 days a year.
- Since February 2009, the Unified Emergency Management System (Sistema Único de Manejo de Emergencias, SUME), 911, began operations in Panama. The 911 emergency number is available for common EMS emergencies.
- Six technical cooperation agreements on the topics of disaster risk reduction, preparedness, and emergency response have been signed with governmental agencies and international organizations (e.g. the Southern Command of the United States, Water Center for the Humid Tropics of Latin America and the Caribbean, Japan's International Cooperation Agency and the United Nations Development Program).
- Significant effort was made to improve emergency response capabilities at the local level by training water rescue personnel, providing courses on the Incident Command System, and piloting a project to promote procedures for standard search and rescue and pre-hospital care.

Panama will benefit from building on these initial efforts to ensure local governments are accountable for the implementation of critical DRM activities, such as the design and enforcement of building codes and establishment of an adequate regulatory framework for the zoning of urban and industrial developments.

It is expected that Panama will continue mainstreaming the concepts of risk reduction into the national planning process while promoting further integration of DRM into development plans. It is also expected that improving strategic risk management planning in relevant sectors such as health, environment, education, agriculture, public works and investments, housing, and human settlements, will continue.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget (US$)	HFA Activity Area(s)
Integration of Climate Change Adaptation and Mitigation Measures for the Natural Resources Management in Two Priority Watersheds in Panama	FAO, PAHO/OMS, UNDP, UNEP, WHO, UNDP, UNEP	4,000,000 2008-2011	2, 3, 4
Development of disaster risk management capacity at the local level	Japan International Cooperation Agency	300,000 2008-2011	2, 4
Strengthening of CEPREDENAC and National Commissions for disaster vulnerability reduction in Central America	Spanish International Cooperation Agency	130,000 2005-2009	1
Earthquake Risk Reduction In Guatemala, El Salvador and Nicaragua with regional cooperation support to Honduras, Costa Rica and Panama (RESIS II)	Norway	2.4 million 2007-2010	2
Regional Program of Environment in Central America (PREMACA)	Danish Cooperation (DANIDA)	675,112 2005-2010	2, 4
Program for the Reduction of Vulnerability and Environmental Degradation Panama (PREVDA)	European Commission	3.34 million 2007-2011	2, 3
Support to advance a Regional Plan for Disaster Reduction (PRRD)	Norway, Spanish International Cooperation Agency	400,000 2006-2011	1
Mesoamerican coordination system for territorial information	IADB	800,000 2009-2011	2
Strengthening of Information and Communication for CEPREDENAC and National Commissions	World Bank (Institutional Development Fund)	446,000 2007-2009	1, 2

GLOBAL FACILITY FOR DISASTER REDUCTION AND RECOVERY (GFDRR): ACTION PLAN

Given Panama's disaster risk profile and its existing framework for disaster risk management, the key priority in Panama is to mainstream disaster risk reduction at the sectoral level. Strategic actions are needed in the following areas to enhance disaster risk management in Panama: (i) strengthen institutional capacity of members of the national platform for DRM, under SINAPROC's leadership; (ii) reduce vulnerability in urban areas; and (iii) develop a comprehensive risk assessment and monitoring capacity.

GFDRR has included Panama in its list of priority countries. The most immediate activity approved for Panama is the incorporation of a comprehensive risk assessment platform by joining efforts with other countries in the region that are actively involved with the Central American Probabilistic Risk Assessment (CAPRA).[18] CAPRA is expected to improve the country's capacity to prepare for and respond to natural disasters.

The following activities have been identified in consultation with local authorities and international donor agencies. These actions support Panama's disaster risk management program and reflect the HFA priority action areas.

1. It is important to continue supporting and enhancing SINAPROC's technical capacity and leadership role in risk prevention and mitigation.
2. The development of an Emergency Fund – with an effective mechanism to ensure its proper capitalization - is needed.
3. It is important to develop strategies for mainstreaming DRM, as a cross-cutting theme, into the budgeting and planning processes of all Ministries and other governmental institutions (e.g. ensuring that new hospitals and educational buildings are built away from flood-prone areas and according to the seismic code. Old buildings should be retrofitted to withstand the impact of earthquakes).
4. The Ministry of Public Works should incorporate disaster risk reduction and mitigation measures in its infrastructure construction and maintenance activities.
5. Mainstreaming DRM among local municipalities is critical. In the particular case of Panama City and its surrounding areas (the Panama City Metropolitan Area), the construction boom and fast-growing population are exerting serious pressures on the land and the quality of water resources. Even though there is a Metropolitan Territorial Zoning Plan and many other land use regulations, unplanned urban development and new infrastructure projects are increasing the conditions of vulnerability in the Panama City metropolitan region.

Finally, the Government of Panama has developed a substantial regulatory framework to guide urban development in the Metropolitan Areas of Panama City and Colón. The main objective has been to ensure the sustainability of the Panama Canal operations. Most of the Panamanian population lives in or around the Panama Canal Watershed, and migration from rural areas continues. The pressure on land and (planned and unplanned) new urban development projects is threatening the environmental health of the watershed, affecting water resources, and forest areas – which in turn is affecting the quality of the water for human consumption. The proposed targeted sectors are based on the Government of Panama and WB assessments of activities with the highest positive impact in disaster risk reduction.

[18] http://ecapra.org.

Indicative Program for GFDRR Funding (Projects and engagement areas being considered for GFDRR funding)	Implementing Agency / International Partners	Indicative Budget and Period (US$)	HFA Activity Area(s)[19]
Disaster risk management development policy loan with a Catastrophe Deferred Drawdown Option (CAT DDO)	Ministry of Economy and Finance, World Bank	35 million	1, 2, 4, 5
Support for the development of a Risk Assessment Platform (CAPRA) for Panama	SINAPROC, Universities, Ministry of Finance	914,000 2009-2011	1, 2, 3
Support capacity building and integrate risk reduction into national planning systems to mitigate urban risk	SINAPROC, Municipality of Panama, Other Municipalities, UNDP	2.2 million 2009-2012	1, 2, 4
Technical assistance to mainstream disaster risk management in the water and transport sectors	Ministry of Health, Ministry of Transport, SINAPROC	600,000 2009-2011	1, 2, 4
Support to mainstream disaster risk management in other priority sectors	Ministry of Finance, SINAPROC	980,000 2009-2012	1, 2, 3, 4, 5
Technical assistance to raise public awareness and proactively engage the private sector in disaster risk reduction activities	SINAPROC, Private Sector Entities	500,000 2009-2011	1, 3, 4
Initial Budget Proposal:		**US$5.194 million**	

In addition to the above-mentioned activities, there is ongoing dialogue with national and local officials to identify disaster risk management measures that consider climate change as part of adaptation strategies in Panama.

[19] HFA Priority Action Areas: 1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation; 2. Identify, assess, and monitor disaster risks—and enhance early warning; 3. Use knowledge, innovation, and education to build a culture of safety and resilience at all levels; 4. Reduce the underlying risk factors; 5. Strengthen disaster preparedness for effective response at all levels.

Guatemala City seen from Pacaya Volcano

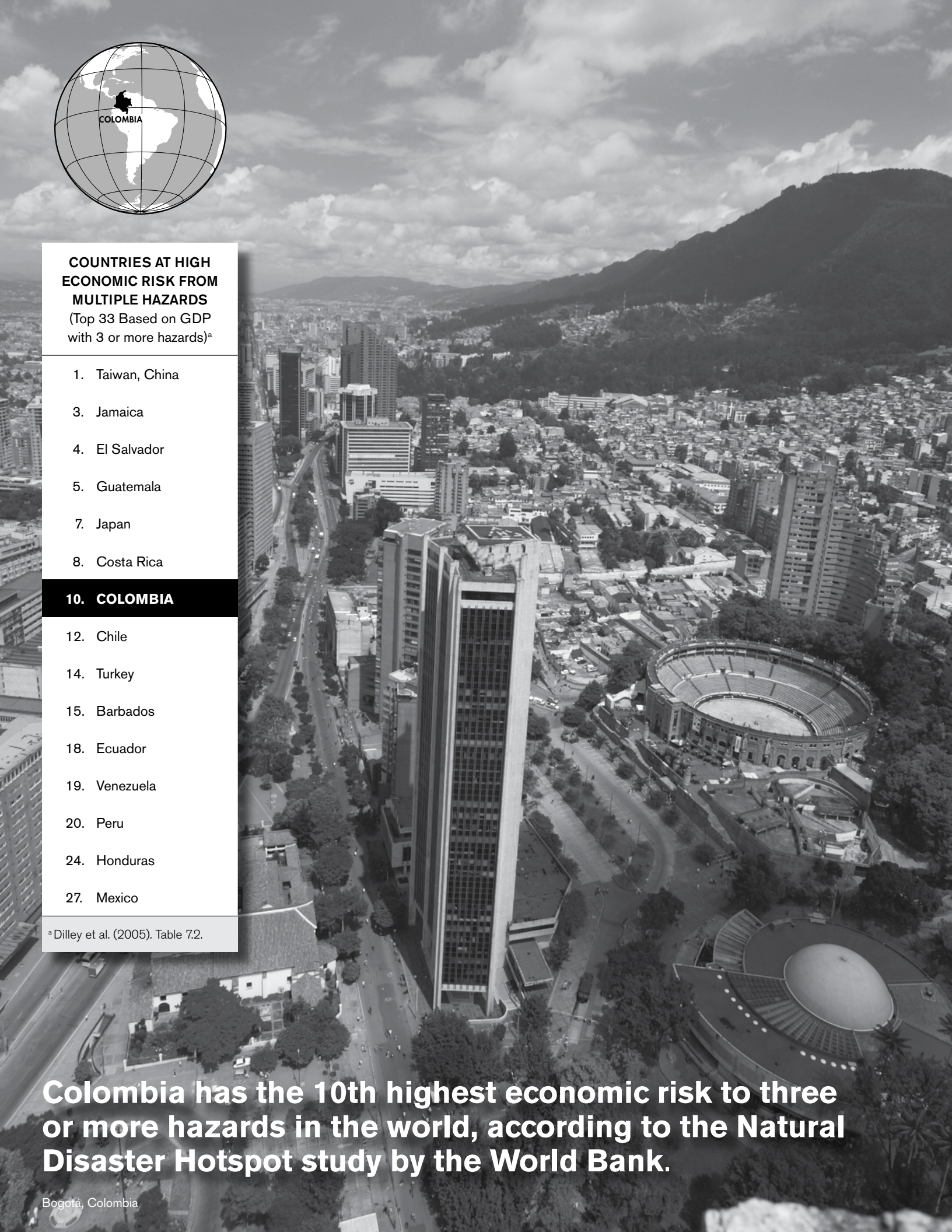
Donor Earmarked Countries

Colombia

Costa Rica

Ecuador

Guatemala



COUNTRIES AT HIGH ECONOMIC RISK FROM MULTIPLE HAZARDS
(Top 33 Based on GDP with 3 or more hazards)[a]

1.	Taiwan, China
3.	Jamaica
4.	El Salvador
5.	Guatemala
7.	Japan
8.	Costa Rica
10.	**COLOMBIA**
12.	Chile
14.	Turkey
15.	Barbados
18.	Ecuador
19.	Venezuela
20.	Peru
24.	Honduras
27.	Mexico

[a] Dilley et al. (2005). Table 7.2.

Colombia has the 10th highest economic risk to three or more hazards in the world, according to the Natural Disaster Hotspot study by the World Bank.

Bogotá, Colombia

COLOMBIA

Natural Disasters from 1980 - 2008[b]

Affected People

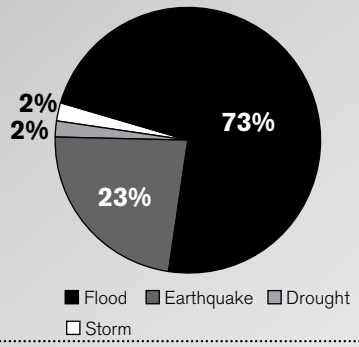
Disaster	Date	Affected (Number of People)
Earthquake*	1999	1,205,933
Flood	2008	1,200,091
Flood	2007	1,162,135
Flood	2005	474,607
Flood	2007	443,173
Flood	2004	345,386
Flood	1986	250,000
Flood	2006	221,465
Flood	2004	186,096
Flood	1996	180,000

Economic Damages

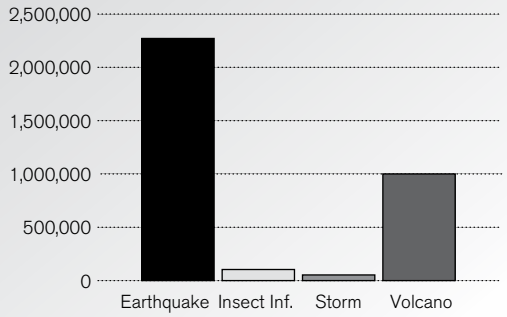
Disaster	Date	Cost (US$ x 1,000)
Earthquake*	1999	1,857,366
Volcano	1985	1,000,000
Earthquake*	1983	410,900
Insect Inf.	1995	104,000
Storm	1988	50,000
Flood	2005	10,000
Flood	1981	5,000
Flood	1997	3,000
Storm	1986	2,500
Earthquake*	1994	2,400

Statistics by Disaster Type[b]

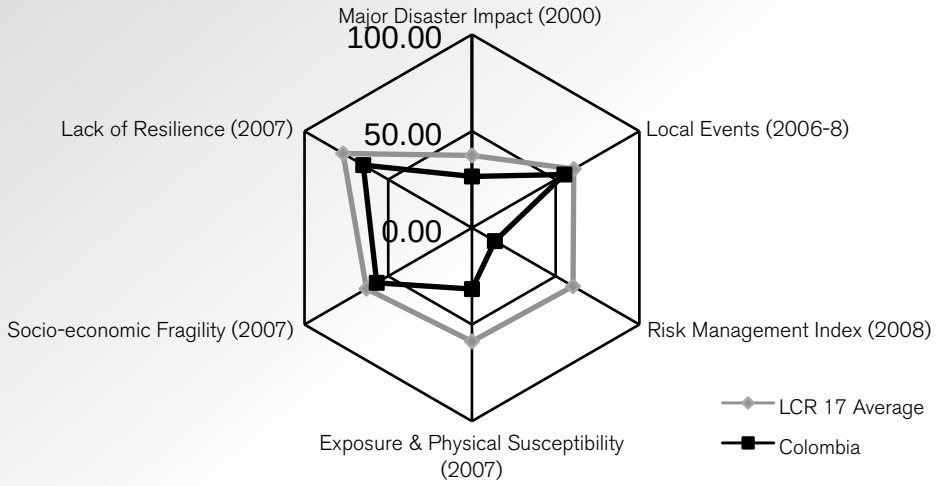
Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



Relative Vulnerability and Risk Indicators[c]



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=37. Source data from EM-DAT. Data displayed does not imply national endorsement.

[c] Relative Vulnerability and risk Indicators are adapted from IADB-IDEA-ERN (2009). Values are normalized on scale of 0 – 100 and presented against the average for 17 LCR countries. Major disaster Impact taken from disaster deficit Index: the ratio of economic losses which a country could suffer during a Maximum Considered event and its economic resilience. Local events taken from Local disaster Index: the propensity of a country to experience recurrent, small-scale disasters and their cumulative impact on local development. risk Management Index is presented as the negative (i.e. 0 = optimal, 100 = incipient) of IADB's risk Management Index: measures a country's risk management capability in (i) risk identification, (ii) risk reduction, (iii) disaster management, and (iv) financial protection. resilience, Fragility and exposure are taken from the component indices of Prevalent Vulnerability Index. Date for local event data depends on information available for each country. Data, and the respective LCR 17 average, from 2000 is used for Dominican Republic, El Salvador, Guatemala, Jamaica and Nicaragua. Data, and the respective LCR 17 average, from 2006-08 is used for Bolivia, Colombia, Costa Rica, Ecuador, Panama and Peru. All LCR 17 averages are calculated based on available data.

DISASTER RISK PROFILE

Colombia has the 10th highest economic risk to three or more hazards in the world, according to the Natural Disaster Hotspot study by the World Bank. 84.7% of Colombia's population and 86.6% of its assets are located in areas exposed to two or more natural hazards.[2] The exposure is to both low-frequency/high-impact events such as earthquakes, volcanic eruption, and an occasional Atlantic hurricane, and to high-frequency but lower-impact events, such as floods and landslides. Climate change is already thought to exacerbate flooding and landslides in large parts of the country.

Geological Hazards

Most of Colombia, including all major urban areas, is located in zones of high or very high seismic activity. Colombia is situated on the confluence of three tectonic plates–the Nazca Plate, the Caribbean Plate, and the South American plate–and is traversed by various geological fault lines: the Romeral fault line, Cauca and Magdalena, and Palestina and Frontal de la Cordillera Oriental.[3]

There are six very active volcanoes in Colombia distributed along the central mountain range of the country. The six active volcanoes are: Nevado de Ruiz, Galeras, Dona Juana, Purace, Tolima, and Huila. Galera and Huila have had eruptions in the last five years causing severe damages and forcing significant evacuations.

Floods and Landslides

Large parts of Colombia's territory are susceptible to flooding, especially in the lower basins and valleys of the principal rivers: the Magdalena, Cauca, Sinnu, Atrato, and Putumayo. These regions are susceptible to flooding, as demonstrated by the area's topography and previous events that have occurred.

Landslides are the most frequently occurring disasters in the country. These are most frequently attributed to hydrological phenomena. The main causes stem from the softening of the ground from heavy rains and the flooding of bodies of water. The Natural Disaster Hotspot study by the World Bank[4] indicates that Colombia has the highest landslide risk in the South American region, in terms of the number of fatalities per year per square kilometer.

Determinants of Vulnerability to Adverse Natural Events in Colombia

Rapidly increasing urban population has concentrated exposure to adverse natural events. As is the case in most Latin American countries, Colombia has seen a large increase in its urban population in the last fifty years. From 1950 to 2005, the percentage of Colombia's population living in urban areas increased from 39% to 73%[5], and it is projected that by 2020, 80% of the population, or approximately 43 million people, will live in cities. This trend will bring with it important economic, social, and environmental challenges.[6] In Colombia, the seven most important cities house 40% of the country's households and 60%

[2] Dilley et al. (2005). Table 7.2.
[3] IADB-IDEA (2004).
[4] Dilley et al. (2005).
[5] *Departamento Administrativo Nacional de Estadística* (2005).
[6] *Departamento Nacional de Planeación* (2006).

of total household income.[7] The biggest city is by far Bogotá, accounting for 18% of households and 30% of the nation's household income generation.

Unplanned urban growth has disproportionately increased Colombia's vulnerability to adverse natural events. Most Colombian cities have followed an unplanned growth pattern. Some of the most important challenges in urban areas include: the predominance of unplanned expansions, a sharp increase in informal settlements, lack of adequate construction practices, environmental degradation, poor transport infrastructure, and a lack of adequate public spaces.

Informal settlements are a physical and spatial manifestation of poverty and inequality in cities. According to the latest census conducted in 2005, in four of Colombia's main cities, 18% of the residential area corresponds to informal settlements. These areas usually suffer from a lack of basic and social services and from prevalent unemployment. Currently close to 1.3 million homes in the country are in this situation (affecting 16% of the total urban families in Colombia). Of these homes, 63% suffer from poor construction quality, and 20% are located in high-risk areas. It has been estimated that 17% of homes are in such inadequate quality or high risk that it is not possible to retrofit them.

Colombia has made substantial progress through important urban reforms and comprehensive legislation on territorial planning,[8] but implementation of these laws has been weak. For example, by 2005, eight years after the Territorial Planning Law # 388 passed in 1997, 97% of all the municipalities in the country and every major city with more than 100,000 inhabitants had adopted a Territorial Organization Plan (POT in Spanish). The quality of the POTs varies substantially–there are a few very high-quality plans, but most are weak. Only a few of these plans have implemented the management and financial tools made available by the legislation. For most, the relation between the POTs and the Municipal Development Plans is not very clear. The Government of Colombia is working to change the perception of the POTs so that they are understood as a valuable tool for long-term planning and not just another document to comply with.

DISASTER RISK MANAGEMENT FRAMEWORK

Colombia is widely considered a leader in instituting a policy and legal framework that enables a comprehensive, multi-sectoral approach to disaster risk management. Colombia has built a National System for Disaster Management and Prevention, articulated around a comprehensive National Disaster Prevention and Attention Plan. Since the early 2000s, Colombia has decentralized disaster risk management responsibilities and made disaster risk management a national development priority.

Under the presidency of Álvaro Uribe, the Government of Colombia has integrated disaster risk management into its development plans. Chapter 5 of the National Development Plan 2006-2010 presents and describes the areas of actions for disaster risk management: (i) to develop policies and strengthen institutions, (ii) to identify and monitor risk and to disseminate its knowledge, (iii) to reduce and prevent risk, and (iv) to reduce fiscal vulnerability using risk transfer instruments. These efforts need to continue to be supported and enhanced to ensure long-term, effective disaster risk management in Colombia.

[7] Including Bogotá, Medellín, Cali, Barranquilla, Cartagena, Bucaramanga, and Pereira.
[8] Law 9 on Urban Reform, 1989, and Law 388 on Territorial Development, 1997.

Investments in disaster risk management, including risk reduction, are done at three levels in Colombia involving the national government, departmental governments, and municipal governments. Significant investments are also carried out by the agencies dedicated to infrastructure.

For both hydrometeorological and geological hazards, Colombia is probably the most densely monitored country in Latin America. At the same time Colombian experts and their graduate-level trainees in disaster risk management have played an important role in developing a knowledge base and a political space for disaster prevention. The country is a leader in such risk-reduction approaches and measures as the introduction of building codes and enforcement, municipal programs, and the integration of science and technology with public policy making.

In spite of great progress, the task remains to address existing disaster risk through corrective actions, while simultaneously improving planning processes to avoid unreasonable accumulation of new vulnerability. For a country with more than 600 declared natural disasters every year, this is a daunting task that will require continued and improved attention by the Colombian Government.

For both hydrometeorological and geological hazards, Colombia is probably the most densely monitored country in Latin America.

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

Colombia has built a National System for Disaster Management and Prevention, articulated around a National Disaster Prevention and Attention Plan. The system (SNPAD in Spanish) has its mandate in Law 46 from 1988 and includes both public and private agencies with responsibilities for risk mitigation and prevention as well as emergency response and rehabilitation. The system is coordinated by the Directorate of Disaster Prevention and Management presided over by the Minister of Government. Furthermore, the system has an operative arm coordinated by a National Operative Committee and a technical/scientific arm coordinated by the National Technical Committee. Vertically, the system has regional committees presided over by the provincial governors and local committees presided by mayors. SNPAD is responsible for (a) the prevention and mitigation of risk, (b) attention to emergencies, and (c) the rehabilitation of territories affected by disasters.

Colombia, through its National System for Disaster Management and Prevention, has been a leader in instituting a policy and legal framework that enables a comprehensive, multi-sectoral approach to disaster risk management. The role of Colombian experts and graduate-level trainees in disaster risk management in the country has been important in this shift and in the effectiveness of this consolidated framework.[9] The country is a leader in such risk reduction approaches

[9] See resources under La Red at http://www.desinventar.org.

and measures as the introduction of building codes and enforcement, municipal programs, and the integration of science and technology with public policy making.

Since the early 2000s, Colombia has decentralized disaster risk management responsibilities and made disaster risk management a national development priority. In 2001, recognizing the high cost that disasters extract from local authorities and the need to encourage investment in disaster mitigation, the national government created an investment category[10] for disaster prevention and response in the list of investments permitted under the national revenue-sharing system. According to Law 715/2001, Articles 76.5, 76.9, and 79, municipalities can now elect to spend budgetary transfers on disaster prevention and response. At the close of the Pastrana administration, a National Policy Statement[11] (CONPES, 3146 of December, 2001) followed up on the earlier decree, raising disaster vulnerability reduction to the level of national development priority for the first time, and stipulating its inclusion in the National Development Plan.

One institutional challenge for Colombia is to resist pressures to fall back into an emergency focus. To resist these pressures implies the need to upgrade, integrate, and further consolidate the National System for Disaster Management and Prevention. Though good work is being done in most institutions in the system, technical capacity is a limiting factor in several institutions, particularly at local levels, and institutional coordination remains a challenge. The World Bank, through a disaster vulnerability reduction investment loan, is supporting improved inter-institutional coordination and strengthening capacity building for risk management at local levels.

Despite great progress, the task remains to address existing disaster risk through corrective actions, while simultaneously improving planning processes to avoid unreasonable accumulation of new vulnerability. This remains a difficult challenge and will require continued and improved attention by the Colombian Government.

HFA Priority #2: Disaster risk assessment and monitoring

Colombia has strengthened information collection and analytic capacity for early warning and risk mapping related to hydrological, seismic and volcano events. With national budget and technical as well as financial support from the World Bank, the Colombian Institute for Geology and Mining (*Instituto Colombiano de Geología y Minería* – INGEOMINAS) and the Colombian Institute for Hydrology, Meteorology and Environment Studies (*Instituto de Hidrología, Meteorología y Estudios Ambientales de Colombia* – IDEAM) have purchased and installed equipment to update existing systems for monitoring catastrophic events. The three regional volcanic observatories and the national earthquake monitoring network managed by INGEOMINAS are fully operational and provide real-time information and early warnings also available via the Internet. IDEAM has recently modernized the hydrometeorological monitoring network, installing close to 500 new automatic stations, in addition to the 2,500 existing conventional stations. This likely positions Colombia as the most densely monitored country in Latin America. The new stations provide real-time information on river levels and rainfall through satellite communication used with daily satellite imagery to provide early warnings on flooding, forest fires land slides. Over the next three years, both

[10] Indexing numbers in parentheses refer to the categories assigned in the DNP publication, *"Sistema General de Participaciones—Informe de Ejecución Presupuestal Municipal Vigencia* 2003."

[11] *Consejo Nacional de Política Económica y Social* (National Council of Social and Economic Policy, CONPES) are policy statements issued by the *Departamento Nacional de Planeación* (National Planning Department, DNP).

agencies will continue to update and expand their monitoring capacity seeking to enhance coverage by an additional 5-10 percent.

Colombia has improved and organized information and information flows for disaster vulnerability, risk evaluation, and risk reduction programs. At a national scale, risk maps for the main river basins and for Galeras volcano have been updated. At the local level, earthquake risk maps have been produced for more than 15 cities (including Bogotá, Medellín, Cali, and Manizales). Urban landslide and flooding maps have been produced for Bogotá, Medellín, Manizales and Bucaramanga. This information is publicly available and has been used for prioritizing investment in risk reduction, such as relocating communities and retrofitting hospitals in Bogota, conducting land planning and urban slope stabilization in Manizales, and protecting urban streams in Medellín.

Colombia has worked to build a culture of risk reduction through integration of disaster risk management in education and research. DGR has worked with Colciencia and the National System of Science and Technology *(Sistema Nacional de Ciencia y Tecnología*, SNCyT) to develop a strategy to strengthen science and technology for disaster risk management. The strategy was adopted in 2002. DGR has also worked with the Ministry of Education to include risk management into environmental education.

The National Planning Department (DNP in Spanish) is with support from the World Bank and financing from GFDRR working to develop decision making support tools based on Probabilistic Risk Assessment platforms[12]. The platform will help establish standards for sharing data and a common language for understanding risk. Initially four tools will be developed for volcano, tsunami, flood and earthquake risk. The transparent nature of the models and open architecture of the platform ensure that future users can understand, adjust, and continue to evolve their tools as their needs change.

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

One of the reasons for Colombia's relative success in moving towards a proactive disaster risk management institutional environment is the existence of a human capital base with the appropriate technical training. There are at least 10 higher-education institutions in Colombia that offer post-graduate training and specialization in risk management. At primary and secondary school levels, the curricula include concepts and good practices for risk management. The legal basis for the inclusion of disaster risk management in school curricula is the 1991 Constitution. The school curricula have gradually been improved, in particular since the promulgation of the National Policy for Environmental Education (2002). The Government of Colombia has developed and implemented various tools and strategies to train teachers and community leaders to incorporate disaster risk management into the school curriculum.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

Corrective action to address existing disaster risk is one of Colombia's main disaster risk challenges. Investments in risk reduction can involve both structural mitigation works, such as seismic retrofitting, and nonstructural investments, such as relocating people from high-risk areas. Most often these decisions should be made at a

[12] http://ecapra.org.

decentralized level, as close as possible to the assets and people at risk. Given that the legal responsibility for disaster risk reduction has been placed with the municipalities and the relatively high quality of its risk identification information, the basic conditions then exist for municipalities to make significant and efficient investments in disaster risk reduction. With such a high exposure to natural hazards, the political challenge is to define the acceptable level of risk and to finance the mitigation of the unacceptable risk.

Investments in disaster risk management, including risk reduction, are done at three levels in Colombia involving the national government, departmental governments, and municipal governments. Compared to the national government, municipalities invest a larger share of their total disaster risk management budgets in preventive work. The highest volume of investments in risk reduction is also done by municipalities through their regular budgets.

In addition to investments by the three levels of core public administration, agencies dedicated to infrastructure also invest significantly in risk reduction. The Colombian National Institute for Roads (*Instituto Nacional de Vías* – INVIAS) is responsible for risk mitigation work related to roads, ports, and riverine infrastructure. With financing from the World Bank, INVIAS invested more than US$30 million in risk mitigation works in 2007 and US$35 million in 2008. The Colombian Oil Company (ECOPETROL) recently finalized a large program retrofitting all its critical installations to become seismic-resistant.[13]

Most of the investments in risk reduction in Colombia at the municipal level are done by a handful of the larger municipal entities. This is a logical consequence of the larger municipalities bearing most of the natural hazard exposure and possessing the capacity to address the issue. Due to the combination of legal responsibility, capacity and needs to invest in disaster risk reduction, the larger municipalities in Colombia are currently a good entry point for promoting risk reduction investments. Both the Bogotá River Management Project and the proposed Barranquilla Flood Mitigation Projects. GFDRR financing is playing an important role for integration of disaster risk reduction in the Barranquilla project and thereby potentially will leverage significant amounts of additional resources for reducing disaster risk.

Much work still needs to be done in terms of building awareness and capacities among local governments in smaller municipalities. One indicator of the status is that only 20% of municipalities reporting floods in the period from 2004 to 2007 have invested in risk reduction measures for flood protection in the same period. This is likely to be linked to a generally weak capacity for territorial planning. Although 97% of all municipalities in the country have adopted a Territorial Organization Plan (POT), the quality of the POTs varies substantially–there are a few very high-quality plans, but most are weak. Only a few of these plans have implemented the management and financial tools made available by the legislation. For most, the relation between the POT and the Municipal Development Plans is not very clear. Both the Ministry of Environment, Housing and Territorial Development (MAVDT) and the National Directorate for Disaster Prevention and Management (DGR) have active programs in building capacity and awareness among municipalities for disaster risk reduction and in integrating risk reduction with the territorial and development planning processes which the Bank is supporting. These programs, supported by the World Bank through a loan with the National Government, will expand coverage to reach up to 40% of municipalities in the country over the next three years and thereby form the basis for

[13] In accordance with the existing Colombian building code, all new construction must be seismic-resistant, and existing key public buildings must be retrofitted or rebuilt to be earthquake-resistant (Law 400 of 1997).

more widespread and more effective investments in risk reduction at the municipal level. In addition, the DNP (National Planning Department) is monitoring municipal investments in risk reduction to track if the capacity building efforts have any impact on municipal decision-making with regards to risk reduction.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

In Colombia, the disaster response structure has four levels of organization. Response to a given natural event starts with the local level determining if the event is of a magnitude that the local response committee can manage or if help needs to be requested at the municipal, departmental or national level.

Since 2006, the National Directorate of Disaster Prevention and Response has been providing training at local, municipal, and departmental levels through the Local, Municipal and Departmental Committees for Disaster Prevention and Response. A new plan for training municipalities was approved in 2007 and is under implementation with support of the APL 1. In 2008, 60 municipalities were trained and another 150 in 2009.

To test existing capacity, simulations and drills have been carried out in major cities. The latest and largest exercise was an earthquake simulation in Bogotá supported by USAID/OFDA and UNDP in October 2009. First responders, national and district authorities, and the general population all participated in the exercise as part of the mass prevention campaign "with feet on the ground" (www.conlospiesenlatierra.gov.co). Bogotá has developed advanced disaster recovery plans based on sophisticated and detailed risk assessment models.

The response capacity of all levels in the system activated at the same time has only been tested once since its creation. This was in 1999 after the Armenia earthquake, which caused thousands of deaths and a high level of structural damage. Immediately after the earthquake, the Government of Colombia established the Reconstruction Fund for the Coffee Region (FOREC). FOREC reported to the Office of the President with the National Planning Department (DNP) acting as secretariat. FOREC was to finance, execute and coordinate the economic, social and environmental reconstruction of the disaster-affected region. Judging from the response and reconstruction after the Armenia earthquake, Colombia has a well functioning response system.

With regard to disaster response, the main challenge for the Government of Colombia is to finance and rapidly initiate the recovery phase in the aftermath of a natural disaster. In June 2009 The World Bank and Colombia signed a Development Policy Loan (DPL) with a Catastrophe Deferred Draw Down Option (CAT DDO) which has been designed to provide a financing bridge—after a disaster of a scale that cannot be funded with the internal reserve—to other sources of relief as they become available. As part of a catastrophe risk-financing strategy, this instrument will provide the Government with bridge financing in response to adverse natural events generating losses beyond the capacity of the annual budget allocation to the Risk Management Directorate (DGR) for responding to disasters.

CONPES[14] 3146 of 1998 raised the issue of the fiscal vulnerability of the state to natural disasters and identified concerns for the financing of reconstruction should a major

[14] A CONPES is a cross-sector socio-economic policy document.

catastrophic event occur. Cardona et al. (2005) estimate that the Government of Colombia would face a long-term resource gap, that is, a shortfall of funding available compared to funding needs, if confronted with a disaster with a return period of 100 years.[15]

The Government of Colombia is working on a series of policy documents related to the retention and transfer of the residual risk in Colombia. In Colombia, all public buildings are required by law to be insured (Law No. 42 of 1993). The Ministry of Finance (MHCP) is currently investigating options to design a cost-effective insurance program for public assets and a catastrophe insurance program for private dwellings. The MHCP has conducted a series of technical studies on earthquake risk assessment to evaluate the physical damage caused by a major earthquake on public assets. This complements other studies carried out by the District of Bogotá on the impact of earthquakes on public buildings and private dwellings. These studies, based on state-of-the art catastrophe risk-modeling techniques, provide the Government of Colombia with very detailed information on earthquake risk assessment.[16]

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Colombia Disaster Vulnerability Reduction Project	World Bank	110 million 2005-2011	1, 2, 3, 4, 5
Bogota Disaster Vulnerability Reduction Project	World Bank	80 million 2006-2011	1, 2, 3, 4, 5
Colombia Disaster Risk Management Development Policy Loan	World Bank	150 million 2009-2012	1, 2, 3, 4, 5
Colombia Probabilistic Risk Assessment Platform	GFDRR/World Bank	500,000 2010-2011	1,2
Technical assistance for the preparation of Barranquilla Flood Mitigation Project	GFDRR/World Bank	150,000 2010-2011	4
Project preparation of Barranquilla Flood Mitigation Project	Spanish Trust Fund/World Bank	725,000 2010-2011	4
Support for DesInventar online disaster database creation of National online Disaster Prevention and Management Information System (SIAPAD)	European Commission through the PREDECAN project	140,000[17] 2003-2009	2

[15] See Annex 9, "Potential Economic Losses of Disasters in Colombia."
[16] These studies include ERN (2005a), ERN (2005b), and CEDERI (2005).
[17] Approximate amount to support Colombia directly, although broader program has larger resource allocations.

Cartagena

GLOBAL FACILITY FOR DISASTER REDUCTION AND RECOVERY (GFDRR): ACTION PLAN

Although there have been significant advances in disaster risk management, remaining challenges have been identified based on Colombia's risk profile and indicative program. Strategic actions are needed in the following areas to enhance disaster risk management in Colombia: (i) increase awareness and resilience at local levels, (ii) mainstream disaster risk management (DRM) in priority sectors, and (iii) institutionalize disaster risk financing.

In spite of the important advances in data gathering and knowledge production and some advances in awareness raising, Colombia still has significant challenges. The main challenge lies in knowledge creation among decision-makers and citizens at local levels. This is critical for improving urban planning processes that will avoid development patterns that exacerbate vulnerability. Successful implementation of the probabilistic risk assessment platform will help address this challenge. GFDRR support for the platform is essential for its success.

Due to the combination of legal responsibility, capacity and needs to invest in disaster risk reduction, the larger municipalities in Colombia are currently a good entry point for promoting risk reduction investments. GFDRR could continue to play an important role by providing grant funds for integration of disaster risk reduction in urban development projects and thereby leverage significant amounts of additional resources for reducing disaster risk.

While progress has been made to institutionalize disaster risk management in general, work remains for Colombia to institutionalize its disaster risk financing. A

main challenge relates to the risk to private housing. Legally this is private risk, but in the event of a major disaster, the Government is likely to be called upon as the insurer of last resort. A solution is being sought that involves collaboration between the national government and key municipalities, as well as public-private partnerships involving the national and international insurance markets. GFDRR resources would support work among the Ministry of Finance, the Secretary of Finance of the District of Bogotá, as well as the insurance association, in an attempt to launch an insurance scheme to protect both private and public assets from natural disasters.

The following activities have been identified in consultation with local authorities and reflect HFA priority action areas. These actions support Colombia's disaster risk management program.

Indicative Program for GFDRR Funding *(Projects and engagement areas being considered for GFDRR funding)*	**Implementing Agency / International Partners**	**Indicative Budget and Period (US$)**	**HFA Activity Area(s)**[18]
Strengthening the policy framework, tools and institutional coordination of the national system for disaster risk management	National Planning Department, Directorate of Disaster Prevention and Management	800,000 2011-2012	1
Implementation framework for Climate Change Adaptation activities focused on disaster risk management	National Planning Department	500,000 2011-2012	1, 2, 3
Development of a Risk Assessment Platform for Colombia (2nd phase)	National Planning Department	500,000 2011-2012	2, 3
Municipal Disaster Vulnerability Reduction Project	Municipality to be determined	1.2 million 2011-2012	4
Insurance of public assets and risk financing	Municipality of Bogotá	200,000 2011	5
Initial Budget Proposal:		**US$4.834 million**	

In addition to the above-mentioned activities, opportunities are under consideration to maximize South-South cooperation in the Andean countries with key participation of Colombia. Continued dialogue with the Government of Colombia will lead to the prioritization of future initiatives to ensure adequate mainstreaming and implementation of disaster risk management measures.

[18] HFA Priority Action Areas: 1.Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation; 2. Identify, assess, and monitor disaster risks—and enhance early warning; 3. Use knowledge, innovation, and education to build a culture of safety and resilience at all levels; 4. Reduce the underlying risk factors; 5. Strengthen disaster preparedness for effective response at all levels.

COUNTRIES AT HIGH ECONOMIC RISK FROM MULTIPLE HAZARDS
(Top 33 Based on GDP with 3 or more hazards)[a]

1.	Taiwan, China
3.	Jamaica
4.	El Salvador
5.	Guatemala
7.	Japan
8.	**COSTA RICA**
10.	Colombia
12.	Chile
14.	Turkey
15.	Barbados
18.	Ecuador
19.	Venezuela
20.	Peru
24.	Honduras
27.	Mexico

[a] Dilley et al. (2005). Table 7.2.

Costa Rica has been identified as one of the most earthquake-prone and volcanically active countries in the world.

Poas Volcano

COSTA RICA

Natural Disasters from 1980 - 2008[b]

Affected People

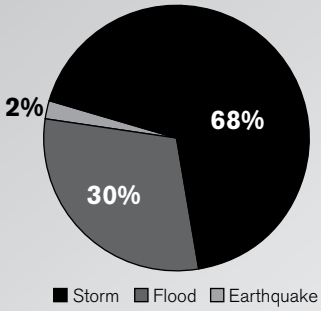
Disaster	Date	Affected (Number of People)
Storm	1996	500,000
Storm	1996	216,000
Flood	1991	185,021
Storm	1988	127,500
Flood	2008	92,000
Flood	2002	75,040
Storm	2008	55,000
Flood	2008	53,000
Flood	1993	38,451
Flood	1996	20,000

Economic Damages

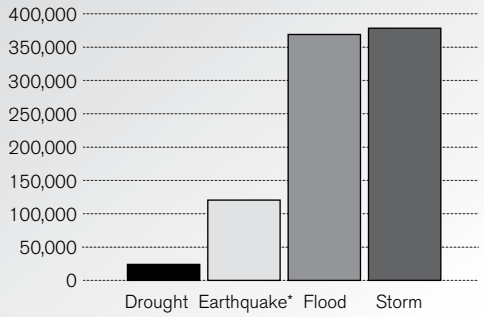
Disaster	Date	Cost (US$ x 1,000)
Flood	1996	250,000
Storm	1996	200,000
Earthquake*	1991	100,000
Storm	1998	91,090
Flood	2007	80,000
Storm	1988	60,000
Flood	2005	25,000
Drought	1998	23,000
Storm	2005	20,000
Earthquake*	1990	19,500

Statistics by Disaster Type[b]

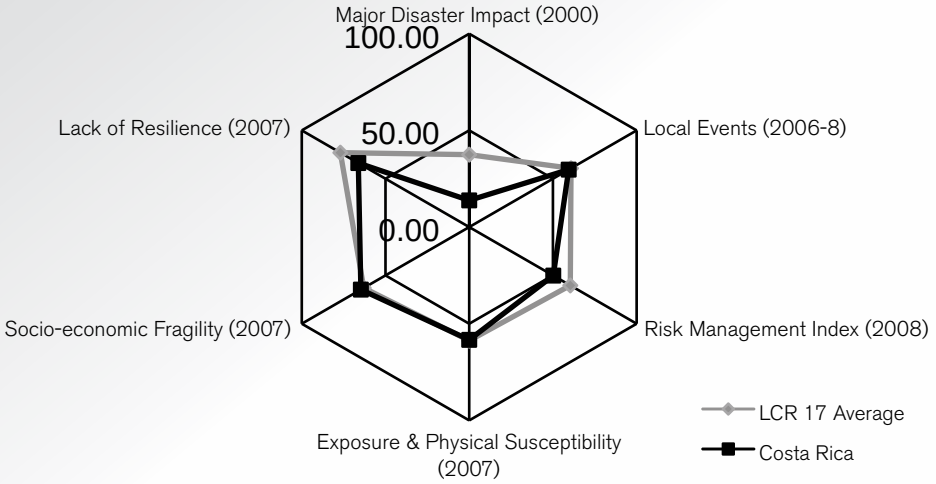
Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



Relative Vulnerability and Risk Indicators[c]



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=41. Source data from EM-DAT. Data displayed does not imply national endorsement.

[c] Relative Vulnerability and risk Indicators are adapted from IADB-IDEA-ERN (2009). Values are normalized on scale of 0 – 100 and presented against the average for 17 LCR countries. Major disaster Impact taken from disaster deficit Index: the ratio of economic losses which a country could suffer during a Maximum Considered event and its economic resilience. Local events taken from Local disaster Index: the propensity of a country to experience recurrent, small-scale disasters and their cumulative impact on local development. risk Management Index is presented as the negative (i.e. 0 = optimal, 100 = incipient) of IADB's risk Management Index: measures a country's risk management capability in (i) risk identification, (ii) risk reduction, (iii) disaster management, and (iv) financial protection. resilience, Fragility and exposure are taken from the component indices of Prevalent Vulnerability Index. Date for local event data depends on information available for each country. Data, and the respective LCR 17 average, from 2000 is used for Dominican Republic, El Salvador, Guatemala, Jamaica and Nicaragua. Data, and the respective LCR 17 average, from 2006-08 is used for Bolivia, Colombia, Costa Rica, Ecuador, Panama and Peru. All LCR 17 averages are calculated based on available data.

DISASTER RISK PROFILE

Costa Rica has the 8th highest economic risk exposure to three or more hazards, according to the Natural Disaster Hotspot study[2] by the World Bank. This study also ranks Costa Rica as second among countries most exposed to multiple hazards based on land area, with 36.8% of the total area exposed to three or more natural hazards. The study estimates that 77.9% of Costa Rica's population and 80.1% of the country's GDP reside in areas exposed to high risk from multiple hazards.

Geological Hazards

Due to its geographic location and geotectonic characteristics, Costa Rica is exposed to a variety of natural hazards, including hydrometeorological and geophysical hazards. The country has recently experienced floods, hurricanes, earthquakes, and landslides.

Costa Rica has been identified as one of the most earthquake-prone and volcanically active countries in the world. The country is located on the subduction zone of the Caribbean and Cocos tectonic plates, and the fracturing movements of these two plates have caused frequent earthquakes. In January 2009, an earthquake reaching 6.2 on the Richter scale, killed 22 people and caused more than US$150 million in losses from damage to infrastructure and the agro-industry (public infrastructure was particularly affected by this event, with damages to eight bridges and several roads. Total insured losses are estimated at US$72 million, most of them caused by damage to several hydroelectric plants). The country also has three mountain ranges that span the entire country—with 16 peaks of known volcanic origin and 9 active volcanoes. Five active volcanoes in Costa Rica have caused significant damage and economic losses in the past.

Floods and Landslides

The frequency of floods has been increasing in Costa Rica and this natural hazard currently represents the main source of losses in the country. During February 2009, heavy rains affected the Pacific Coast and the Central Valley of Costa Rica, causing floods and landslides in at least 65 of the country's 81 counties, with 18 deaths reported. There was serious damage reported to at least 27 major roads, including cutoffs on the Pan-American Highway. At least 2,000 homes were flooded in the northern province of Guanacaste, which forced 1,500 people into temporary shelter.

Triggered by intense rainfall, earthquakes, and volcanic eruptions, landslides and torrential debris flows are among the most costly in terms of human lives. During the heavy rains in October 2007, a total of 14 people died in a landslide in the city of Atenas. After the January 2009 earthquake, at least 10 people died in another landslide in Cinchona, a rural community 50 miles west of the capital city, San José.

Hurricanes

Costa Rica is also exposed to a hurricane hazard on its Caribbean coast. Hurricane Mitch, one of the most destructive events in Central America, caused economic losses amounting to approximately US$98 million.

The following table outlines the estimated losses and budget allocations for declared emergencies between 1999 and 2007. The figures demonstrate a significant gap between budget allocations and resources needed to recover the estimated losses incurred.

[2] Dilley et al. (2005). Table 7.2.

Estimated Losses and Budget Allocation for Declared Emergencies (US$ million)

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007
Estimated Losses	29.8	24.5	23.8	15.8	1.5	1.6	39.6	10.8	50.3
Budget Allocation	8.3	3.1	1.6	1.1	1.5	1.7	7.0	13.1	7.9

Source: CNE.

Additional Vulnerabilities

The fast-growing metropolitan population in the Central Valley generates major stresses on the limited natural resources, public utilities and municipal services. The high concentration of the Costa Rican population in the Central Valley is the result of historical processes, exacerbated by the concentration of industrial developments and other sources of employment. Under these circumstances, affordable housing becomes a major socio-economic constraint that forces low-income families to relocate to higher-risk areas.

DISASTER RISK MANAGEMENT FRAMEWORK

Costa Rica has a comprehensive legal and institutional framework for disaster risk management (DRM). The recent strengthening of the institution and the legal framework is reflected in key disaster risk management actions such as the adoption of Law No. 8488 of 2006 and its consequent regulation (Executive Decree No. 34 361-MP of 2008). The law requires all central government entities and local governments to allocate resources for relevant disaster and risk activities in their programs and budgets. The Law also established a mandatory contribution of 3 percent of financial surplus or profit from all governmental institutions to be transferred to the National Emergency Fund (NEF).

In the event of a national emergency, the National Risk Prevention and Emergency Management Commission (CNE[3]) acts as the highest-ranked coordinating authority. CNE's capacity to coordinate and incentivize disaster risk management emergency activities was enhanced by the approval of the Emergencies and Risk Prevention Law No. 8488 in 2006.

The National Risk Management System (NRMS) has been mainstreamed by the Government of Costa Rica (GoCR). The NRMS integrates all the risk reduction and emergency relief efforts of the public entities, the private sector, and civil society, at the national, municipal, and regional levels.

The National Plan for Risk Management was updated according to Law 8488. A National Forum for Risk Management (October 14-16, 2009) proposed the National Plan for Risk Management (NPRM), which was approved in January 2010.

Disaster Risk Management (DRM) was incorporated into the 2006–2010 National Development Plan through the strategic action on land planning as part of the Social Development and Poverty Reduction component. The incorporation of DRM in this National Development Plan (NDP) obliges all line ministries to include risk analysis and mitigation initiatives in their annual programs. Currently, the Ministry of National Planning and Economic Policy (MIDEPLAN[4]) and CNE are proposing to incorporate the concept of risk management as a transversal policy axis in the new NDP (2011-2015). The

[3] *Comisión Nacional de Prevención de Riesgos y Atención de Emergencias.*
[4] *Ministerio de Planificación Nacional y Política Económica.*

Costa Rica National Platform has also adopted the recommendations of the strategic objectives and priority actions of the "Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters."

MIDEPLAN has strengthened risk management in the selection process of national investment projects to be approved by MIDEPLAN, through the establishment of a legal framework which supports the incorporation of risk analysis into the national investment process.

As an integral part of the strategy for disaster risk management, the GoCR is designing and implementing a strategy for financing catastrophic risk. In the case of the GoCR, the NEF is used to finance emergency rehabilitation and reconstruction for the lower levels of risk (high-frequency/low-cost). This fund consists of mandatory transfers, public entity transfers, and donations from various sources. Law 8488 stipulates that all public institutions should transfer to NEF 3% of its financial surplus or profit. The Catastrophe Deferred Drawdown Option (CAT DDO) loan signed in November 2008 complements the emergency funding system mentioned. The CAT DDO provides bridge financing at the time of a declared emergency. This enables the country to maintain its development programs while mobilizing other sources of funding to address the emergency. This is one of four lending operations agreed upon with the World Bank as part of the Country Partnership Strategy for FY09–FY11. Additionally, in order to reduce its fiscal vulnerability to the occurrence of natural disasters, the GoCR will create a Catastrophic Risk Transfer Vehicle (CRTV) to improve, in a first stage, the financial protection of public buildings and social housing.

The GoCR recognizes the connection between climate change and increased vulnerability and is taking steps to build awareness throughout the country. Under the Ministry of Public Education, the National Educational Plan for the Reduction of Risk to Disasters is being incorporated into environmental education curricula. The GoCR is also implementing the National Strategy on Climate Change, which is expected to generate important recommendations on assessing risks of public and private investment projects.

Costa Rica has nationwide networks of volcanological and meteorological monitoring stations with highly qualified scientists and engineers involved in a wide variety of DRM-related research topics. Public universities and research institutions in Costa Rica cooperate with leading research organizations around the world.

Costa Rica has been effective in the development of building codes and ensuring that private and public works adhere to construction standards that minimize risk exposure. Under the provisions for a declaration of a state of emergency, the phases of immediate response and reconstruction must integrate disaster risk reduction measures.

A major challenge in implementing the DRM national policies is the development of local capacity at the municipal level, where technical and human resources can be very constrained.

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

The Costa Rica National Platform has adopted the recommendations of the strategic objectives and priority actions of the "Hyogo Framework for Action 2005–2015: Building the Resilience

of Nations and Communities to Disasters." In agreement with the Framework guidelines, Costa Rica has a national platform for a DRM framework that includes the National Risk Prevention and Emergency Management Commission (CNE[5]), the National System for Risk Management (NSRM), the NPRM, and coordinating entities. The CNE monitors and reports annually on the country's progress in its "National Report on the Implementation of the Hyogo Framework for Action."[6] Given the emphasis on prevention established by Law 8488, a restructuration process is in progress at CNE. The restructuration proposal was approved by CNE's Board in August 2010.

The Government of Costa Rica (GoCR) strengthened its institutional framework and established the legal framework to guarantee the reduction of the causes of risk and timely, coordinated risk management in times of disaster. Through the 2006 approval of Law No. 8488, the regulations define in greater detail the DRM system, the mandate and role of the CNE, the GoCR's disaster prevention responsibilities, the process of a declaration of a state of emergency, a general emergency plan, and financial resources. To facilitate timely coordination, the CNE's Board of Directors is composed of the CNE President, the Ministers of Presidency, Health, Public Works and Transport, Public Security, Environment and Energy, Housing and Human Settlements, and Finance, the heads of the Institute of Social Assistance (IMAS), the National Insurance Institute (INS), and a representative from the Red Cross of Costa Rica.

The GoCR's institutional framework for disaster risk management (DRM) ensures that disaster risk reduction is a national priority. The NPRM recognizes the need to carry out disaster risk reduction and mitigation activities. This involves coordinated participation of civil society and the private sector, and national and local government institutions throughout the country. The NPRM 2010–2015 emerged from public consultation, with the participation of more than 94 entities involved in risk management, who participated in the National Forum for Risk Management (October 14-16, 2009). Consequently, there is a collective definition of strategic actions and goals from an interagency and interdisciplinary approach. The NPRM was approved by CNE's Board and presented at the Governing Council in January 2010.

The GoCR has greatly enhanced its ability to ensure the effective and efficient allocation of resources for disasters. All central government entities and local governments must allocate resources for relevant disaster and risk activities in their programs and budgets. In addition, 3% of financial surplus or profit from all governmental institutions must be transferred to the NEF to finance the National Risk Management System. This strengthens the government's capacity to effectively support disaster mitigation activities in a sustainable manner. In the event of a declaration of national emergency, NEF funds are readily available to the CNE, which has the authority to allocate those funds as appropriate, without having to follow the lengthy administrative processes needed for allocations of funds during non-emergency situations. Once the emergency has passed, the CNE is still responsible for the proper accounting of any funds disbursed.

The Catastrophe Deferred Drawdown Option (CAT DDO) loan signed in November 2008 complements the NEF. The CAT DDO provides bridge financing at the time of a declared emergency. This enables the country to maintain its development programs while mobilizing other sources of funding to address the emergency. Additionally, there is a proposal for a Catastrophe Risk Transfer Vehicle that would allow for segregation of catastrophic risk from Government assets and social housing, in the first stage. In the second phase the infrastructure of roads and bridges will be included in the CRTV.

[5] *Comisión Nacional de Emergencias.*
[6] PreventionWeb (2009a).

Arenal Volcano, Costa Rica

The integration of the CAT DDO with this proposal and with the NEF would make a robust risk-financing strategy. The CRTV proposal is in line with the goals approved in the NPRM, which included among their goals "(…) the timely use of hedging instruments and financial management, in order to raise the quality, safety and longevity of goods and services", and assigned responsibilities to INS to fulfill this goal. Additionally, the Agreement VI, No. 8987 of INS' Board session, held on February 8, 2010, approved to institutionalize as one of the core projects of the organization the development of a Catastrophic Risk Transfer Program for the GoCR.

The GoCR understands the importance of mainstreaming disaster risk management (DRM) and significant progress has been made in Costa Rica. DRM was incorporated in the 2006–2010 National Development Plan (NDP), through the strategic action on land use planning as part of the Social Development and Poverty Reduction component. The incorporation of DRM in the NDP obliges all line ministries to include risk analysis and mitigation initiatives in their annual programs. A comprehensive monitoring mechanism for disaster risk prevention and reduction investments by key line ministries is being prepared, so that information on DRM mainstreaming activities in all sectors can be used in the future for analysis. In addition, the CNE has been asked to (i) establish the National Risk Management System (NRMS), (ii) design and implement the NPRM, (iii) strengthen early warning systems, and (iv) strengthen risk management at the community level. Continued efforts need to be made to ensure that the integration of DRM priorities within line ministries and other government agencies are not relegated to the back burner when competing mandates arise. In this sense, MIDEPLAN and CNE will incorporate the concept of risk management as a transversal policy axis in the new National Development Plan (2011-2015).

Costa Rica has also integrated risk management considerations into the review process of all investment projects for the country. The Ministry of National Planning and Economic Policy (MIDEPLAN) recently added a disaster risk review in the project proposal format for national investments, through the Executive Orders 34 694-PLAN-H of August 2008 (Public National Investment System), 35 098-PLAN of March 2009 (National Public Investment Plan) and 35 374-PLAN of July 2009 (Technical Standards, Guidelines and Procedures for Public Investment). Under this measure, government agencies submitting investment projects for approval by MIDEPLAN are now required to conduct a disaster risk assessment of the proposed investment and include mitigation measures in case the project is exposed to adverse natural events. This improvement, along with the environmental review, has great potential to control and effectively address disaster risk in future investment programs. The country is currently assessing systems that could assist public officials in the decision-making process by assessing the disaster risk of planned investment projects. Additionally, MIDEPLAN implemented an ambitious training program, which includes risk assessment, for public functionaries involved in the public investment process.

Although significant advances in inter-institutional coordination have been made, Costa Rica has operative and financial constraints that diminish the country's ability to more effectively respond to emergency situations. This was recognized by the GoCR's self-assessment of progress and was highlighted during recent flood events and the recent earthquake of 6.2 on the Richter scale that generated losses of more than US$150 million according to GoCR estimates.

HFA Priority #2: Disaster risk assessment and monitoring

The GoCR has attained significant achievements in the area of DRM and monitoring. The country has a National Risk Atlas at the national and municipal (county) levels. Working closely with several national universities and research institutions, the CNE develops and maintains national- and local-level risk assessment maps for each type of hazard. The goal is to provide each municipality with up-to-date maps that can be integrated—using computer-based technologies such as geographic information system (GIS) mapping—as inputs for the preparation of the municipal urban zoning and land use maps, and enforcement of zoning and building codes. The CNE, in collaboration with these research partners, is also building databases with information on historical events to improve its prediction capabilities.

A major constraint in the process of delivering information to the local municipalities is the level of local technical capacity to absorb this information. Some municipalities have sophisticated mapping systems, while others have very little or no technical or human resources to fully benefit from the available information on hazards and related risks.

The CNE coordinates a national network of early warning stations for monitoring and registering rain data, river flows, and landslides, with the goal of providing local communities with critical, timely information about their level of exposure to flooding events. Every station in the network has access to radios and/or phones to help relay their data in real time. They also compile information on other threats, such as earthquakes, and relay data on intensity and damage to infrastructure and/or personal injuries to local communities, to the CNE, and first responders, using the nationwide 911 system.

The CNE also coordinates a network of 400 community-level, 100 municipal-level, and 6 regional-level Emergency Management Committees. These committees are organized to allow dissemination of critical time-sensitive information and to receive and distribute emergency aid should a localized event occur. Depending on the geographic scope of a given emergency, command and control escalates from

the community level to the municipal level, and so forth. The CNE is authorized by law to disburse funds to local communities in the event of a local level emergency, and to help reduce the risk of threats such as floods and landslides by providing funding to retrofit schools, hospitals, bridges, and levees, and to dredge rivers and creeks, among other activities.

The GoCR is currently developing a set of disaster risk indicators for use in public investment projects, along with better metrics to assess the costs of investment projects and to improve predictions of actual losses caused by disasters.

The country is also working on the implementation of the National Strategy on Climate Change, which is expected to generate important recommendations on assessing risks of public and private investment projects. The implementing agency is under the authority of the Minister of the Environment, who is also a member of the CNE Board, and it is expected that important synergies between work on climate change and DRM will continue to evolve.

In February 2008, the GoCR requested the World Bank's inclusion of Costa Rica within the CAPRA initiative (Central American Probabilistic Risk Assessment)[7] to strengthen its risk management strategy to the occurrence of natural disasters. The CNE is working on the implementation of CAPRA trough the Technical Advisory Committees of the National Risk Management System. This should help facilitate a comprehensive understanding of risk and risk management.

Costa Rica has recognized the link between environmental degradation and disaster risk and is incorporating DRM into the curricula on environmental education.

[7] http://ecapra.org.

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

Costa Rica has a long history of advances in scientific and technical research in areas directly related to DRM. Highly qualified scientists and engineers are involved in a wide variety of DRM topics such as the development of national networks of volcanological and meteorological monitoring stations and detailed geographic and geological studies. Public universities and research institutions in Costa Rica cooperate with leading research organizations around the world.

Costa Rica has recognized the link between environmental degradation and disaster risk and is incorporating DRM into the curricula on environmental education. To further disseminate information on DRM, the GoCR is implementing the "National Educational Plan for the Reduction of Risk of Disasters" under the Ministry of Public Education.

Public universities in Costa Rica are also incorporating DRM training courses in the programs of those careers related to environmental sciences, health, geography, geology, and psychology. Public universities are organized under the National Deans' Commission (CONARE), which dictates general guidelines for their operation. CONARE created a commission composed of representatives from its member institutions charged with coordinating activities for developing DRM curricula in three main target areas: Community Outreach, Research, and Education. Concurrently, each university develops its own internal "Risk Management Program," consolidating relevant activities from all ongoing research and education projects. As part of these efforts, the University of Costa Rica is offering a Masters degree in DRM.

Several government agencies at the municipal level have developed information management systems by incorporating GIS technologies to

improve their capabilities to manage their urban development, titling, and land use data assets. A growing number of municipalities are also developing their presence on the Internet by creating their own websites and thereby increasing information dissemination to local and global communities.

The national government has clear policies on the development of e-government and the CNE has made important progress in developing its own website, where up-to-date information is published and made readily available to the general public. Important resources such as a catalogue of natural hazard maps, along with important studies related to DRM in Costa Rica, can be accessed through CNE's website.

Concerted efforts need to be made to overcome the unevenly distributed technical capacity at the local level, particularly in smaller municipalities. This constraint can be overcome through enhanced use and incorporation of available knowledge into municipal planning processes.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

Given Costa Rica's high exposure to natural and anthropogenic hazards, there is still room for improvement in the reduction of the underlying risk factors despite the progress that has been made. For example, continued efforts are needed to unify the agendas on Climate Change and disaster

risk management, including the enhancement of adaptability to changes in hydrological and water resource management issues.

Costa Rica has been effective in the development of building codes that ensure that private and public works adhere to construction standards that minimize the risk of exposure to certain natural and man-made hazards, such as earthquakes and fires. Along with the implementation of zoning regulations, the country is moving in the right direction.

As noted previously, any public works performed during immediate response and reconstruction phases under the provisions of a declaration of a state of emergency must integrate measures aimed at removing or reducing the conditions that created the risk in the first place. However, financing available for reconstruction is limited while in many instances the amount of financial resources needed to effectively reduce the risk and vulnerability to hazards is greater than the actual losses.

Increased private sector participation is essential to further reduce the underlying risk factors in Costa Rica. The country is trying to improve participation of the private sector in the DRM process by implementing mechanisms on a voluntary basis and also through the enforcement of the existing legal and regulatory frameworks.

The strict enforcement of building codes has become a major challenge for local authorities and it is necessary to reduce risk exposure of vulnerable socio-economic groups living in unplanned settlements in high-risk areas. Frequent, low-intensity emergency events, mostly affecting unplanned settlements in areas unsuitable for urban development, consume an important percentage of the available resources for DRM and social assistance. Relocating vulnerable families to lower-risk areas provides a temporary solution until a new wave of squatters tend to settle into these high-risk areas, repeating the vicious cycle.

The DRM and social themes are linked and supported under the GoCR's commitments to achieving the goals of the Millennium Development Agenda. Although the GoCR's social policy is not explicitly geared to reducing vulnerability to disasters, the National Development Plan includes an annex on "Social Development and the Fight against Poverty." Strategic Action 9 of the annex contains several goals specifically geared to reducing vulnerability, including community organization and development of communal infrastructure, strengthening early warning systems, and implementing the NPRM.

To reduce the generation of new risk, MIDEPLAN established a legal framework for public investment that ensures that new investments to be approved by MIDEPLAN will comply with safe practices for handling disasters.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

The CNE develops and coordinates the early warning system and defines mechanisms for addressing DRM issues at the municipal level throughout the country. The CNE also builds its own technical capacity for the data gathering, analysis, and dissemination of knowledge about threats, and is developing maps of hazards, and databases that are used as inputs for the preparation of municipal and local regulatory plans (zoning plans). Land use and urban development recommendations derived from these zoning plans are legally binding, and the CNE has the authority to stop public and private works that do not abide by them.

[8] http://www.encc.go.cr/.

Many of the components of the National Climate Change Plan relate to the GoCR's ongoing DRM efforts. An Office of the National Strategy on Climate Change (ENCC)[8] was created within the Ministry of the Environment, Energy and Telecommunications to prepare plans to minimize the effects of climate change on the priority axes of the strategy through mitigation, vulnerability and adaptation, and metrics. Other important components of the National Climate Change Plan such as public awareness and local capacity/ technology transfer can further advance the existing DRM efforts in Costa Rica.

In line with the National Development Plan (NDP), Costa Rica is confronted with the challenge of strengthening the institutional capacities for DRM under policies of decentralization of authority and resources, making municipal governments accountable for designing and implementing changes to the regulatory framework for zoning and urban and industrial developments, congruent with the government's principles on "development in harmony with nature." These principles translate, within the DRM, into the promotion of a culture of risk prevention oriented toward preventing loss of human lives, protecting assets, and the reduction of environmental deterioration. This challenge continues, as it is intrinsic to a long-term vision of sustainable development, requiring permanent attention.

It is expected that mainstreaming of risk reduction into the national planning process and promoting the integration of DRM into the development plans will continue. It is also expected that improving strategic risk management planning will continue in relevant sectors such as health, environment, education, agriculture, public works and investments, housing, and human settlements.

With regard to disaster response, one of the main challenges of the GoCR is to finance and rapidly initiate the recovery phase in the aftermath of a natural disaster. The CAT DDO, signed with the World Bank in November 2008, provides bridge financing at the time of a declared emergency. Additionally, there is a proposal for creating a Catastrophe Risk Transfer Vehicle that would allow for segregation of catastrophic risk from Government assets and social housing, in the first stage. Roads and bridges infrastructure will be included in the second phase.

The GoCR used to do emergency drills to prove the response capacity of the CNE and the COE. An earthquake drill in the city of Cartago, involving different search and rescue operations in collapsed structures, and a volcanic eruption drill in different communities of Turrialba, were done in November 2009.

Critical to this process is the implementation of the recently approved NPRM, as a strategic planning tool to drive the actions of government institutions and to promote a more active participation of civil society and the private sector.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Integration of Disaster Risk Information in Costa Rica Planning System	World Bank (IDF)	450,000 2009-2012	2, 3, 4
Support for the Pilot Project on Early Warning Systems for Hydrometeorological Hazards in Central America	World Bank (GFDRR) World Meteorological Organization	262,000 2009-2011	1, 2, 3, 4, 5
Costa Rica Public Asset Catastrophe Risk Insurance Facility Feasibility Study	World Bank (GFDRR)	460,000 2008-2011	1, 3, 4, 5
Probabilistic Risk Measurement for Central America (CAPRA)	World Bank (GFDRR)	360,000 2008-2010	2, 3
Costa Rica Catastrophe Deferred Drawdown Option (CAT DDO)	World Bank	65 million 2008-2009	1, 3, 5
Strengthening a Municipal Information System for Disaster Prevention in Latin America and the Caribbean (SIMPD) Mitigation National Disasters	International Development Research Centre (Canada)	100,000* 2006-2009	2
Awareness Campaign on the Threat of Tsunamis in Some School Districts Within the Regional Directorate in Puntarenas, Costa Rica	Japan International Cooperation Agency	16,000 2007	3
Disaster Risk Management in Talamanca	UNDP	100,000 2006-2008	2, 4
Web-COE Project	Southern Command of the United States Army	not available permanent	5
“Prevention is Better“ Community Intervention Strategy	ProVention Consortium, Organization of American States, British Red Cross, Finland Red Cross, Disaster Preparedness Programme of the European Commission’s Humanitarian Aid Department (ECHO/DIPECHO)	50,000* 2007-2008	3
Regional Humanitarian Information Network (REDHUM) for Latin America and the Caribbean in the event of disasters	Spanish International Cooperation Agency (AECI), Switzerland Cooperation Agency (COSUDE), Government of Kuwait	100,000* 2006-2009	3, 5
Regional Program for the Reduction of Vulnerability and Environmental Degradation (PREVDA)	European Commission	1.65 million 2007-2011	1, 2, 4
Development of disaster risk management capacity at the local level	Japan International Cooperation Agency	300,000 2008-2011	2, 4
Regional Plan for Disaster Reduction (PRRD)	Norway Spanish International Cooperation Agency	400,000 2006-2011	1
Earthquake Disk Reduction In Guatemala, El Salvador and Nicaragua with regional cooperation support to Honduras, Costa Rica and Panama (RESIS II)	Norway	2.4 million 2007-2010	2
Regional Program of Environment in Central America (PREMACA)	Danish Cooperation (DANIDA)	not available	2, 4
Mesoamerican coordination system for territorial information	IADB	800,000 2009-2011	2
Strengthening of Information and Communication for CEPREDENAC and National Commissions	World Bank	446,000 2007-2009	1, 2

* Estimated

GLOBAL FACILITY FOR DISASTER REDUCTION AND RECOVERY (GFDRR): ACTION PLAN

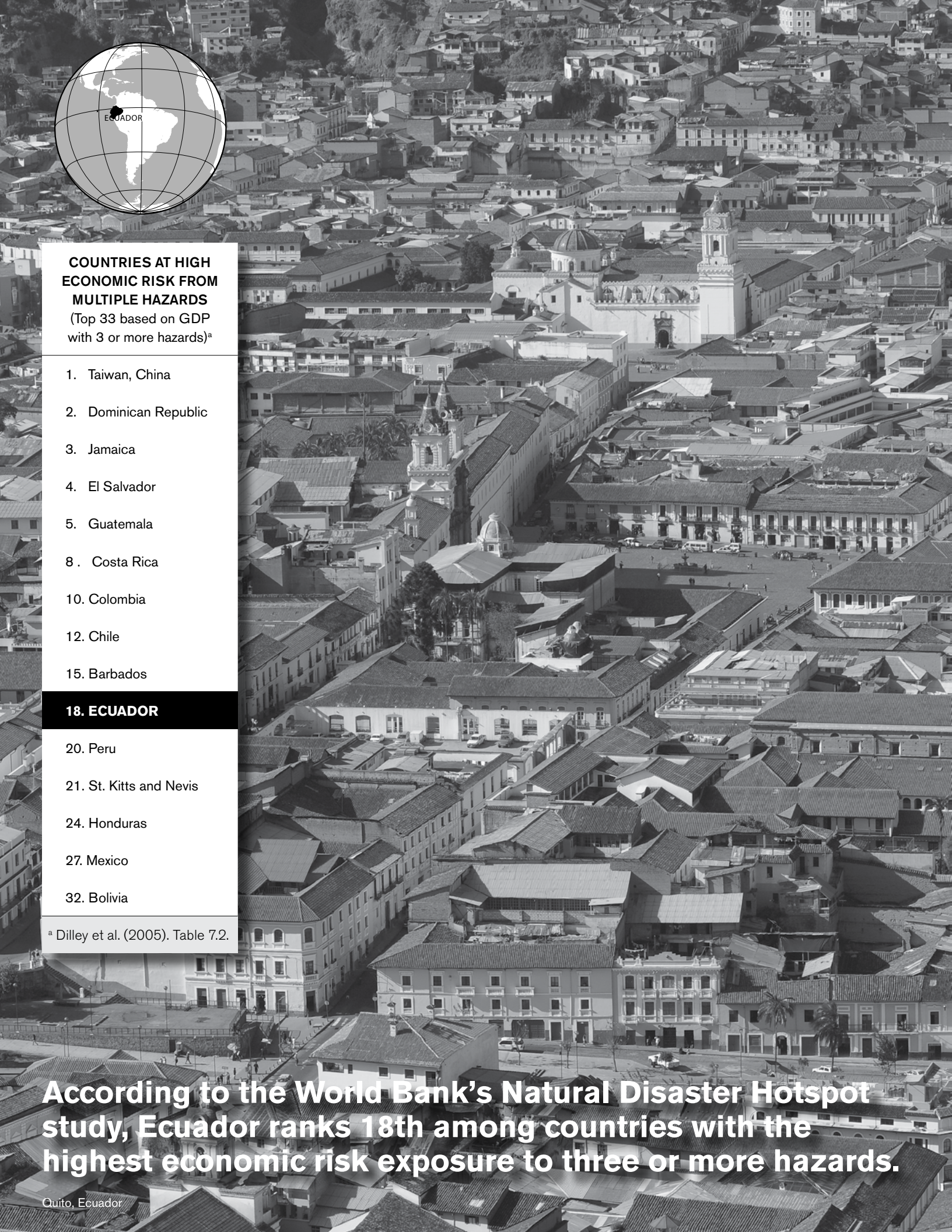
Given Costa Rica's risk profile and its existing framework for disaster risk management, the key priority in Costa Rica is to continue to mainstream disaster risk reduction at the sectoral and local levels. Strategic actions are needed in the following areas to enhance disaster risk management in Costa Rica: (i) strengthen institutional capacity at sectoral and local levels, (ii) develop a comprehensive risk assessment and monitoring capacity, and (iii) advance risk financing strategies.

The following activities have been identified in consultation with local authorities and international donor agencies. These actions support Costa Rica's disaster risk management program and reflect HFA priority action areas.

Indicative Program for GFDRR Funding (Projects and engagement areas being considered for GFDRR funding)	Implementing Agency / International Partners	Indicative Budget and Period (US$)	HFA Activity Area(s)[9]
Support the development and implementation of: (i) a monitoring mechanism for disaster risk prevention and reduction investments by key line ministries, that will support the implementation of the National Plan for Risk Management 2010-2015; (ii) a collection mechanism for the National Emergencies Fund	Ministry of Finance, CNE, MIDEPLAN, Contraloría General de la República	400,000 2010-2012	1, 2, 4
Enhance CNE's institutional capacity and DRM activities by: (i) supporting the implementation of CNE's restructuring plan; (ii) strengthening DRM activities at the sectoral level; and (iii) supporting vulnerability reduction efforts by improving CNE's safety and resilience programs at the community level	National Emergency Commission (CNE), MIDEPLAN	1 million 2010-2012	1, 3, 4
Support phase II of the development of a Risk Assessment Platform for Costa Rica	World Bank (GFDRR)	750,000 2010-2012	2, 3, 4, 5
Support phase II of the development of Costa Rica Public Asset Catastrophe Risk Insurance Facility Feasibility Study for including hydrometeorological risk	World Bank (GFDRR)	500,000 2010-2012	1, 3, 4, 5
Initial Budget Proposal:		**US$2.65 million**	

In addition to the above-mentioned activities, it is expected that dialogue will continue with Costa Rican authorities to assess the feasibility of a Vulnerability Reduction Plan for Crime and Violence in the City of San José.

[9] HFA Priority Action Areas: 1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation; 2. Identify, assess, and monitor disaster risks—and enhance early warning; 3. Use knowledge, innovation, and education to build a culture of safety and resilience at all levels; 4. Reduce the underlying risk factors; 5. Strengthen disaster preparedness for effective response at all levels.



COUNTRIES AT HIGH ECONOMIC RISK FROM MULTIPLE HAZARDS
(Top 33 based on GDP with 3 or more hazards)[a]

1. Taiwan, China
2. Dominican Republic
3. Jamaica
4. El Salvador
5. Guatemala
8. Costa Rica
10. Colombia
12. Chile
15. Barbados
18. ECUADOR
20. Peru
21. St. Kitts and Nevis
24. Honduras
27. Mexico
32. Bolivia

[a] Dilley et al. (2005). Table 7.2.

According to the World Bank's Natural Disaster Hotspot study, Ecuador ranks 18th among countries with the highest economic risk exposure to three or more hazards.

Quito, Ecuador

ECUADOR

Natural Disasters from 1980 - 2008[b]

Affected People

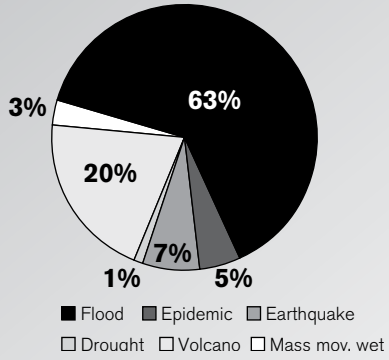
Disaster	Date	Affected (Number of People)
Flood	1982	700,000
Volcano	2006	300,013
Flood	2008	289,122
Flood	1992	205,000
Flood	1983	200,000
Earthquake*	1987	150,000
Volcano	2002	128,150
Epidemic	2000	100,000
Mass mov. wet	1993	75,020
Flood	2006	57,670

Economic Damages

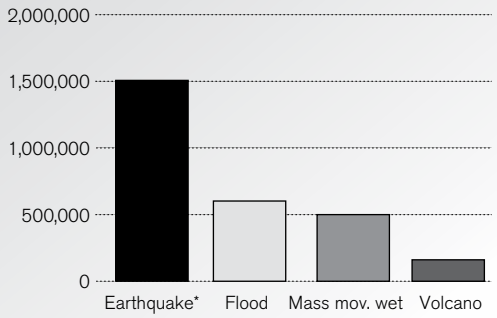
Disaster	Date	Cost (US$ x 1,000)
Earthquake*	1987	1,500,000
Mass mov. wet	1993	500,000
Flood	1997	271,000
Flood	1982	232,100
Volcano	2006	150,000
Flood	2008	45,000
Flood	1992	20,000
Flood	1989	15,000
Flood	2002	13,000
Volcano	2001	10,975

Statistics by Disaster Type[b]

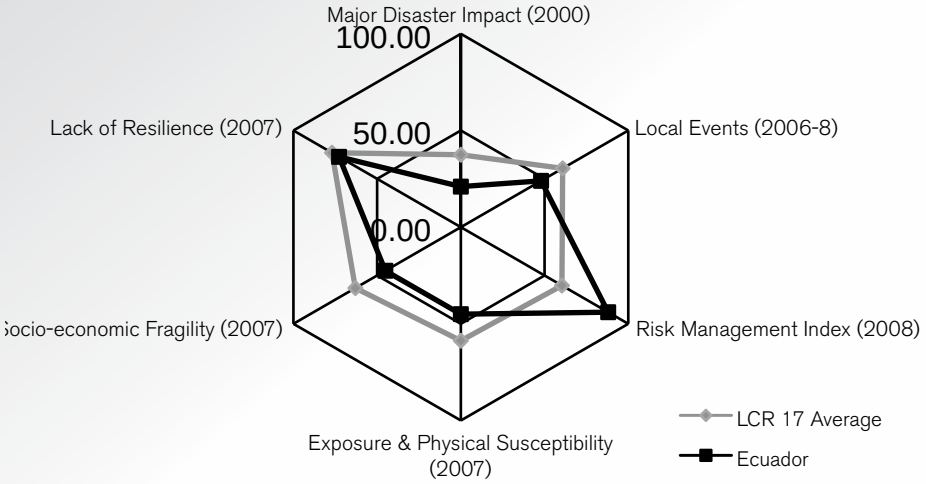
Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



Relative Vulnerability and Risk Indicators[c]



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=53. Source data from EM-DAT. Data displayed does not imply national endorsement.

[c] Relative Vulnerability and risk Indicators are adapted from IADB-IDEA-ERN (2009). Values are normalized on scale of 0 – 100 and presented against the average for 17 LCR countries. Major disaster Impact taken from disaster deficit Index: the ratio of economic losses which a country could suffer during a Maximum Considered event and its economic resilience. Local events taken from Local disaster Index: the propensity of a country to experience recurrent, small-scale disasters and their cumulative impact on local development. risk Management Index is presented as the negative (i.e. 0 = optimal, 100 = incipient) of IADB's risk Management Index: measures a country's risk management capability in (i) risk identification, (ii) risk reduction, (iii) disaster management, and (iv) financial protection. resilience, Fragility and exposure are taken from the component indices of Prevalent Vulnerability Index. Date for local event data depends on information available for each country. Data, and the respective LCR 17 average, from 2000 is used for Dominican Republic, El Salvador, Guatemala, Jamaica and Nicaragua. Data, and the respective LCR 17 average, from 2006-08 is used for Bolivia, Colombia, Costa Rica, Ecuador, Panama and Peru. All LCR 17 averages are calculated based on available data.

DISASTER RISK PROFILE

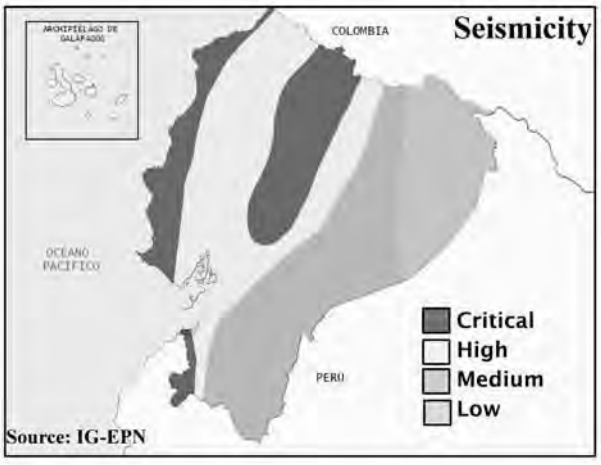
According to the World Bank's Natural Disaster Hotspot study[2], Ecuador ranks 18th among countries with the highest economic risk exposure to three or more hazards. 66% of the population lives in urban areas and 96% of this population lives in the coastal and mountainous regions, exposed to seismic, volcanic, flood, landslide, and El Niño hazards. The volcano Tungurahua is currently active. Floods and landslides occur frequently and affect the population as well as the productive sectors.

Geological Hazards

Ecuador is a highly seismically active territory. The subduction zone of the Nazca and the South American plates has been the source of the major earthquakes of Esmeraldas (1906, 1958, and 1979) and Caraquez Bay (1998). Likewise, the continental fault system which crosses the country in the northeast direction and in the foothills of the Cordillera Real has caused strong earthquakes (1541, 1987). The largest cities in the country (on the coast and in the mountains) are located in areas with high seismic risk (See Figure 1). Quito, the capital, is also in a high-risk area.

Ecuador is home to the greater part of the Northern Volcanic Zone of the Andes range. 41 main volcanoes are distributed in four alignments: the Eastern Range (10), the Inter-Andean Valley (15 volcano junctions), the Cordillera Real (12), and the East (4). An eruption of the Cotopaxi volcano is the most complex volcanic risk scenario for Quito, the capital city. The volcanoes Tungurahua, Pichincha, and El Reventador have all been active within the past decade. Tungurahua is currently (2010) active as well. Due to these events over the past 10 years, the country has had to deal with population resettlement and very important economic losses, mainly in the agricultural and livestock sectors.

Figure 1. Seismic and volcanic hazards in Ecuador (taken from the Instituto Geofísico de la Escuela Politécnica Nacional IG-EPN).



[2] Dilley et al. (2005). Table 7.2.

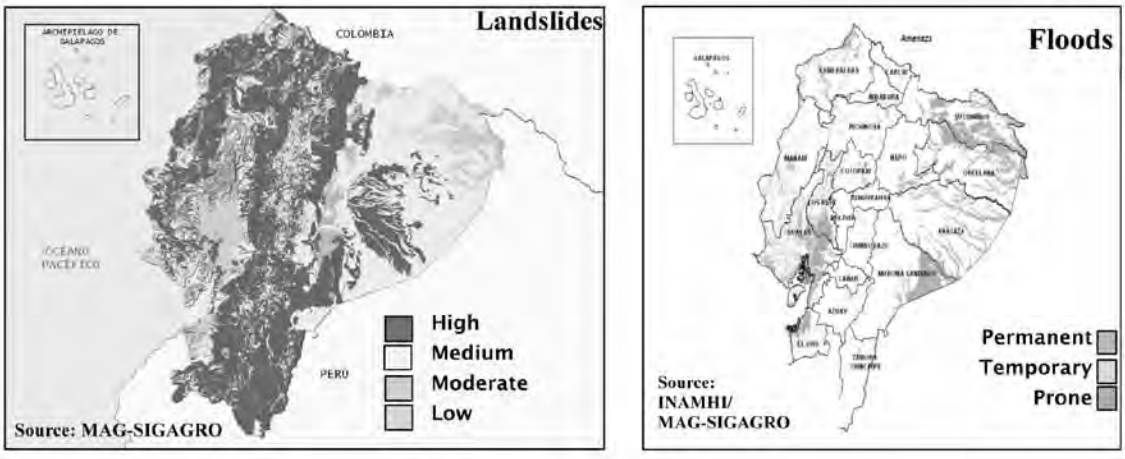
Hydrometeorological Hazards

Ecuador is highly vulnerable to the El Niño phenomenon due to the concentration of the development and the population on the coast and in the mountains. This alteration of the ocean-atmospheric system develops mainly in the Equatorial Pacific. The El Niño of 1997-1998 caused damages in the order of US$280 million, equivalent to almost 15% of the Gross Domestic Product (GDP) in the year 1997.[3] This phenomenon especially increases the frequency and intensity of floods on the coast, and of landslides and storm surges in the mountains. According to the historical records of events[4], the most affected sectors in the central and the eastern regions of the country are health, education, agriculture, and road infrastructure.

The floods are very frequent and have caused major emergencies in the past few years. As is typical of the Andean region, the hydrological regime in the three natural regions (the mountains, the coast, and the jungle) has particular conditions which favor the occurrence of floods. In Ecuador, the major floods have been associated with the El Niño phenomenon (1982-1983 and 1997-1998), affecting especially the coastal region and causing major human and economic losses. Periods of intense rains also cause significant floods, the most recent along the coastline in 2008.

The concentration of development in the mountains leads to the fact that landslides form, a phenomenon that frequently affects urban areas and infrastructure. After floods, landslides are the second most frequent hazard phenomena. In the last two decades, they have caused several river blockages with important losses (Pisque River, 1990; Paute River, 1993; Chanchán River, 1999; Guasuntos River, 2000)[5]. The road infrastructure is also often affected.

Figure 2. Landslide and flood hazards in Ecuador
(taken from the Instituto Nacional de Meteorología e Hidrología – INAMHI).



[3] *"Las lecciones de El Niño 97-98 Ecuador", Corporación Andina de Fomento.*
[4] http://www.desinventar.net.
[5] Rivera Magno. *Consecuencias de los deslizamientos en el Ecuador. IV Jornadas en Ciencias de la Tierra.*

Main determinants of vulnerability to natural events

The concentration and growth of the population in the urban areas increases the level of exposure to adverse natural events. The city populations have continued to grow over the past ten years. In 2001, 61.2% of the inhabitants were living in urban areas (approximately 7.6 million), and it is estimated that in 2009 the number could be around 66% of the population (around 9 million).[6] 96% of the urban population is distributed in the coastal and mountainous regions, where most of the natural hazards are concentrated.

Weaknesses in the policies and land use planning instruments, in combination with migration towards the urban areas, result in inadequate localization of the population. Despite the fact that the Metropolitan District of Quito and a few other cities have made advances in their urban regulation strategies, the country's land use planning in general has not had the legal and institutional framework needed for the consolidation of sustainable development policy and practice. The available regulatory instruments are insufficient and do not adequately incorporate risk reduction criteria. The peripheral urban areas of low value expand because of unregulated informal and unplanned settlements, which have great weaknesses in terms of their location and safe construction.

Environmental deterioration of the river basins and the expansion and intensity of farmland use have entailed an increase in the frequency and intensity of phenomena like landslides and floods. The main causes of degradation of hydrographic basins, which results in changes in the water cycle (behavior of surface and underground currents) and the equilibrium in the surface processes of erosion, meteorization, and landslides are as follows: the accelerated loss of biological diversity (2,180 species endangered due to the destruction of their habitats)[7], deforestation (238,000-340,000 hectares annually)[8], expansion of the agricultural frontier[9], and environmental deterioration due to hydrological contamination and inadequate disposal of industrial and residential waste.

There are a number of weaknesses in the reduction of the existing vulnerabilities and in the planning of new development in the productive sectors. There is an accumulated delay in the evaluation of vulnerability of constructed infrastructure with respect to seismic and volcanic risk in particular. The hydrocarbon sector, which represents between 10-14% of GDP, has an important part of its facilities in the province of Esmeraldas, which is an area with high seismic hazard. However, the facilities were built decades ago according to seismically resistant design parameters inferior to those currently defined in recent studies specific to the region.

Ecuador's current institutional and policy situation is very favorable for structural changes in the area of disaster risk management.

DISASTER RISK MANAGEMENT FRAMEWORK

Ecuador's current institutional and policy situation is very favorable for structural changes in the area of disaster risk management. The new Constitution includes specific aspects of disaster risk management,

[6] National Institute of Statistics and the Census (*Instituto Nacional de Estadísticas y Censos, INEC*).
[7] International Union for Conservation of Nature (IUCN), in its Red List of Threatened Species (2006).
[8] Ministry of Environment et al. (2001).
[9] Modernization Program of Agricultural Services (2001).

creating the Technical Secretariat of Risk Management (*La Secretaria Técnica de Gestión del Riesgo*), which replaces the Civil Defense (*Defensa Civil*), and initiating the organization of the new Decentralized National System of Risk Management (*Sistema Nacional Descentralizado de Gestión del Riesgo*, SNDGR). The results achieved through this process over the upcoming years will be decisive in establishing the long-term disaster risk management conditions in the country.

However, Ecuador faces very important challenges to reduce its seismic and volcanic vulnerability. These two phenomena constitute the highest risks of the country and the vulnerability accumulated over the course of decades is very high. The reduction and management of these risks will require important changes in urban regulation, building codes and regulations, critical investments in structural reinforcements, and land use planning in the areas exposed to the volcanic phenomenon.

The revision and strengthening of the land use planning system in Ecuador is essential to effectively reduce underlying hazards and related risks. The land use planning system in Ecuador requires the integration of disaster risk reduction criteria into the policies, strategies, mechanisms and instruments of the planning institutions. Improved technical capacity, information generation, and development of methodological instruments are critical elements to facilitate this process.

Capacity building of local governments is a necessary condition for consolidating and effectively implementing Ecuador's disaster risk management system. Because of the decentralized nature of the new 'Decentralized' National System of Risk Management, the provinces, districts, and parishes should assume the responsibilities for management and control of risks in their respective territories.

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

The new constitution of Ecuador has set the foundation for consolidating disaster risk reduction as a policy integrated into the country's overall development. The Constitution of September 2008 includes specific aspects for risk management related to planning, environmental rights, land use planning, decentralization, participation, and security.[10] Unlike those of all other Latin American countries, this new Constitution offers the legal and political foundations for the development of a new system that will incorporate the lessons learned from the past and make use of the modern approaches to risk management from the development perspective. The upcoming years will determine the development of the institutional organization, the complementary standards, and the financial instruments necessary to make the said constitutional regulations a reality.

The Technical Secretariat of Risk Management is the key governmental institution for heading the new approach and vision of risk management. In the new institutional organization, this secretariat replaces the former Civil Defense and assumes the management and coordination of SNDGR.[11] It is responsible for creating policies, strategies and regulations to promote capacities oriented at identification, analysis, prevention, and mitigation of risks with the goal of facing and managing disaster events, as well as of recovery and reconstruction

[10] Constitution of Ecuador. Title VII, System of Well-Being. Chapter I, Inclusion and Equity. Section 9, Risk Management.
[11] Constitutional Executive Decree of the President of Ecuador No. 1046, April 26, 2008.

of social, economic and environmental conditions affected by eventual emergencies or disasters.

The risk management institutional development, legal framework, and policies should create capacity for attending to short, medium, and long-term needs. One of the main challenges for the government in this process of the political and administrative reorganization is maintaining an adequate balance for capacity building at all levels, which would on the one hand guarantee the results in the long run, and on the other allow for the management of short-term needs. Because of the high frequency of events such as floods and landslides, the lines of action related to risk mitigation and emergency response are currently of highest priority.

The capacity building of the local governments is a necessary condition to consolidate the system. In general, the new Constitution and the political reform promote the decentralization of the functions of the State. With respect to risk management, the provincial, district, and parish levels have direct responsibility in risk management and consequently should develop their own institutional organization and technical and operational capacity according to national regulations and plans. Thus, significant efforts are necessary in the areas of technical strengthening, information systems, local capacity building, and communication, among others.

HFA Priority #2: Disaster risk assessment and monitoring

The monitoring system of volcanic activity has been strengthened to confront the volcanic eruptions of the past ten years. The recent eruptions of the Pichincha, El Reventador and Tungurahua volcanoes required the government, with international cooperation, to make important investments in the modernization and expansion of the monitoring equipment network, administrated by the Geophysical Institute of the National Polytechnic School (*Instituto Geofísico de la Escuela Politécnica Nacional*, IG-EPN). The level of current development of this system in Ecuador is comparable to that achieved in developed countries like Japan or the United States.[12]

Ecuador has increased the capacity of its national technical institutions and of some local governments to evaluate disaster risk. In the past decade institutions like the IG-EPN, the IRD[13], the *Instituto Nacional de Meteorología e Hidrología* (INAMHI), and the National Secretariat of Planning and Development (*Secretaría Nacional de Planificación y Desarrollo*, SENPLADES) have made important strides in the evaluation and modeling of hazards, vulnerability, and risks.[14] In the same way, the Quito Metropolitan District has developed specific studies on this topic and continues to progress in the strengthening of its technical capacity.

It is necessary to expand the scope of the monitoring systems and apply advanced technological tools for modeling and evaluation. Despite the advances already achieved, coverage of the seismologic and hydrometeorological network still needs to be amplified, and hazard, vulnerability and risk studies need to be expanded, especially with regard to seismic vulnerability of essential buildings and the infrastructure of the productive sector.

[12] http://igepn.edu.ec.

[13] A French public institution of science and technology research with presence in Ecuador since 1974.

[14] See *Informe Nacional para la conferencia mundial sobre la reducción de desastres* (National report for the world conference on disaster reduction in Kobe-Hyogo, Japan, January 18-22, 2005).

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

There is some experience with education projects in emergency response. The country lacked official plans and programs for the inclusion of risk management in school curricula until shortly before the current reform. However, through Civil Defense, and especially with international cooperation, numerous pilot projects were carried out which form an important precedent for the design of a new policy in this sector. The emphasis of these training efforts was on emergency plans and the Ministry of Education is currently designing specific content for the curricula.

Establishing a culture of prevention and preparedness for disaster risk is one of the priorities of the new agenda. The National Strategy for Risk and Disaster Reduction being formulated by the Technical Secretariat for Risk Management defines the promotion of risk prevention in civil society through communication strategies, education, citizen supervision mechanisms, and information dissemination, as one of its most important policies. This policy will be supported by the implementation of an Information System to support these objectives.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

Projects on environmental management and recovery of hydrographic basins have contributed to a reduction of disaster risk. The principal investments for landslide and flood risk mitigation were made through projects of hydraulic recovery of basins and environmental recovery of degraded areas. One of the most notable projects was carried out by the Quito Metropolitan District through the Quito Metropolitan Sewerage and Drinking Water Company (*Empresa Metropolitana de Alcantarillado y Agua Potable de Quito*, EMAAP-Q) on the slopes of Pichincha (34 recovered streams) with financing from the Inter-American Development Bank (IADB). At the national level, projects to highlight include the coastal resource management program and the protection of the water systems in Chimborazo and Tungurahua from ash fall, among others.

The majority of risk reduction projects have had local and community focus. Over the last decade, numerous risk reduction projects have been implemented at the parish and district levels through international cooperation. Especially notable were the projects promoted by the Ecuador Association of Municipalities (*Asociación de Municipios del Ecuador*, AME) for development and land use planning, and for environmental management. The results of these projects yielded important lessons learned, which can be very useful in the current planning process.

In the current process of institutional reorganization, it is crucial to incorporate risk management into the new policies, strategies and instruments of the Development Plan and land use planning, and to build local capacity for its implementation. The government's task to design and implement the new planning systems, and to include effective disaster risk reduction mechanisms, is significant. Some of these instruments include updating and adopting building codes and regulations, generating baseline information for the regions[15], zoning of hazard and/or risk areas and definition of specific regulation of land use and occupation, development of methodological guidelines and training for formulation and implementation of development plans, territorial/land use plans, and implementation of monitoring and evaluation mechanisms.

[15] Physical, economic, and population information.

Cotopaxi Volcano, Ecuador

Seismic vulnerability reduction of the infrastructure in the hydrocarbon sector and of the essential buildings in the main cities is a priority. Because of the direct or indirect impact which can be generated by any of these systems on social and economic stability in the country, it is imperative to press forward in the process of determining the current seismic vulnerability of key buildings and of the different components of the hydrocarbon production, and to take on the necessary vulnerability reduction measures. Because of the level of investment required for this, it is necessary to carry out a cost-benefit analysis and to prioritize such interventions.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

International cooperation has supported projects in this area over several years.

International cooperation has invested the most in this topic in support of Ecuador's Civil Defense. European Commission's humanitarian aid department (ECHO), through its program for Disaster Preparedness (DIPECHO), along with its partners, has implemented more than 20 projects since 2000. The Red Cross of Ecuador, the PREDECAN project[16], the Swiss, Spanish, and US partners, and the US' Comando Sur have been other partners in important projects. The United Nations system has offered support for the strengthening of Ministries of Education and Health, and for SEMPLADES, through the Pan-American Health Organization, UNDP and UNICEF. Even though there are no consolidated numbers available, it is estimated that at least the local populations and institutions in more than 60 districts have participated in disaster preparedness projects, benefiting at least 600,000 people. The provinces that benefited most from these projects are Esmeraldas, Manabí, Los Ríos, El Oro, Tungurahua, Chimborazo, Cotopaxi, Pichincha, Zamora, Loja, and Bolívar.

[16] Prevention of Disasters in the Andean Region.

The response to a 2008 flood disaster demonstrated new possibilities and capacities in the current institutional context. In 2008, the unexpected increase in rainfall produced the most extensive floods registered in the last few decades along the Ecuador coastline. 13 of the 24 provinces of the region and 275,000 inhabitants were affected and 170,000 hectares of crops were lost, among many other impacts.[17] The response to this disaster was carried out in the transition of the new Technical Secretariat of Risk Management and the new Ministry of the Coast. The latter assumes the leadership and coordination of emergency response and recovery. The final result was a successful process which demonstrated a great capacity for response in a region that generally has had inadequate conditions for timely organization and coordination.[18]

The implementation of the capacity building strategy of the Decentralized National System of Risk Management requires a great effort both institutionally and from the local governments. Despite the advances achieved in the past years by the Civil Defense, it is now necessary to design an emergency response capacity-building strategy adjusted to the new institutional structure and organization, and integrate the functions and responsibilities at territorial levels. Because of the decentralized character of the risk management system, the capacity development at subnational levels requires adequate resources and should remain a priority.

It is necessary to develop a comprehensive financial strategy to attend to post-disaster situations. Risk transfer is one of the main propositions for the SNDGR. Similar to other aspects analyzed, it is important to promote the design of a financial protection strategy on the basis of the results of risk analyses and models and the fiscal considerations of the Government of Ecuador.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Emergency grant for Tungurahua and Litoral	IADB	400,000 2008	5
Strengthening of the Technical Secretariat of Risk Management (US$5 million IADB loan and US$1.25 million counterpart financing)	IADB	6.25 million 2006-2011	1,4
Humanitarian assistance for Tungurahua and Litoral	UN (FAO, UNDP, UNICEF, IOM, OPS)	3.76 million 2008	5
Emergency preparedness and response	European Commission's Humanitarian Aid Department (ECHO)	2.6 million 2007-2008	5
Andean program	PREDECAN	16.12 million 2005-2009	1, 3, 4
Quito community safety project	World Bank (GFDRR) UNDP	980,000 2009-2012	1, 3, 4
Protection of slopes in Quito South III (Loan for the Environmental Sanitation Program III)	IADB	42 million 2008-2013	4
South-South Cooperation for City Collaboration: Kathmandu, Makati and Quito	World Bank (GFDRR)	400,000 2009-2012	1, 3, 5

[17] Ministry of the Coast, "Ecuador 2008, response to the coastline floods", with the support from Pan-American Health Organization and UNDP.

[18] Ministry of the Coast, "Compilation of protocols, operative proceedings, and functional structures used for response to the effects of the Ecuador coastline floods of 2008."


Banos, Ecuador

GLOBAL FACILITY FOR DISASTER REDUCTION AND RECOVERY (GFDRR): ACTION PLAN

Given Ecuador's disaster risk profile and its existing framework for disaster risk management, the key priority in Ecuador is to continue to build institutional capacity and ensure long-term vulnerability reduction at local levels. Strategic actions are needed in the following areas to enhance disaster risk management in Ecuador: (i) identification and monitoring of risks, (ii) reduction of vulnerabilities at the local level, and (iii) strengthening of institutional capacity for strategic planning and coordination at national and local levels.

In light of an agenda as broad as the National Strategy for Risk and Disaster Reduction of Ecuador, it is necessary to prioritize and focus support on policies and projects with high impact.

Access to knowledge and advanced technological tools are critical to guarantee the availability of information for decision-making in the current process of institutional change and reorganization. The design and implementation of a probabilistic risk assessment initiative[19] would offer an exceptional opportunity towards this objective. It would help the country to better understand, communicate and support disaster risk management.

Ecuador has a very high deficit in the programs of seismic vulnerability reduction in key buildings and the infrastructure of the hydrocarbon sector. The advances in the assessment and design of medium- and long-term programs which could be achieved with support from GFDRR funds will have a very high impact.

In practice, the incorporation of disaster risk management into development plans and territorial/land use plans is often limited by the lack of information and/or practical methodological tools accessible to non-expert technicians. Ecuador has an opportunity to grow in this direction and GFDRR's support would be very effective.

Institutional development and risk management frameworks should create capacity to attend to short-, medium-, and long-term needs. Emergency and disaster response capacity building is a short-term

[19] Similar to the CAPRA initiative in Central America.

need which should be guaranteed by the Technical Secretariat of Risk Management.

Capacity building of local governments is an essential line of action to ensure that the decentralized system in Ecuador is viable and effective. As its name suggests, the Decentralized National System of Risk Management (SNDGR) assigns the primary responsibility for risk management to the local level and secondarily to higher levels of government.

The following activities have been identified in consultation with local authorities and international donor agencies. These actions support Ecuador's disaster risk management program and reflect HFA priority action areas.

Indicative Program for GFDRR Funding (Projects and engagement areas being considered for GFDRR funding)	Implementing Agency / International Partners	Indicative Budget and Period (US$)	HFA Activity Area(s)[1]
DRM capacity building of local governments in priority areas of the national strategy, e.g. technical assistance, training, tools, etc.	Municipalities UNDP	1.3 million 2009-2012	1, 3
Development of a Risk Assessment Platform for Ecuador to advance technological tools and information systems available for risk evaluation	Technical Secretariat of Risk Management, UN ISDR, PREDECAN	914,000 2010-2011	2
Technical assistance to incorporate risk reduction into Ecuador's new planning system e.g. updating codes, regulations, generating risk information, training, tools, etc.	Technical Secretariat of Risk Management, Secretary of Planning, UNDP, PREDECAN	700,000 2009-2012	1, 4
Technical assistance to reduce seismic vulnerability by supporting the design and prioritization of programs for structural reinforcement of essential city buildings and infrastructure of the hydrocarbon sector	Technical Secretariat of Risk Management, UNDP	1.1 million 2009-2012	4
Support the design and formulation of programs to manage and recover hydrographic basins	Sectoral Ministries	700,000 2009-2011	4
Support emergency/disaster response capacity building activities at territorial and sectoral levels	Technical Secretariat of Risk Management, Sectoral Ministries, UNDP, Disaster Preparedness Programme of the European Commission's Humanitarian Aid Department (DIPECHO)	270,000 2009-2010	5
Initial Budget Proposal:		**US$4.984 million**	

Additional consideration should be given to financial protection against disasters. Initial discussions with the Government of Ecuador have confirmed interest in technical assistance to study and design necessary mechanisms to ensure comprehensive financial protection in Ecuador.

[20] HFA Priority Action Areas: 1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation; 2. Identify, assess, and monitor disaster risks—and enhance early warning; 3. Use knowledge, innovation, and education to build a culture of safety and resilience at all levels; 4. Reduce the underlying risk factors; 5. Strengthen disaster preparedness for effective response at all levels.

COUNTRIES AT HIGH ECONOMIC RISK FROM MULTIPLE HAZARDS
(Top 33 based on GDP with 3 or more hazards)[a]

1. Taiwan, China
2. Dominican Republic
3. Jamaica
4. El Salvador
5. **GUATEMALA**
8. Costa Rica
10. Colombia
12. Chile
15. Barbados
18. Ecuador
20. Peru
21. St. Kitts and Nevis
24. Honduras
27. Mexico
32. Bolivia

[a] Dilley et al. (2005). Table 7.2.

Guatemala is situated in a zone of high seismic risk due to the conjuncture of three tectonic plates: the North American plate, the Caribbean plate, and the Cocos plate.

GUATEMALA

Natural Disasters from 1982 - 2008[b]

Affected People

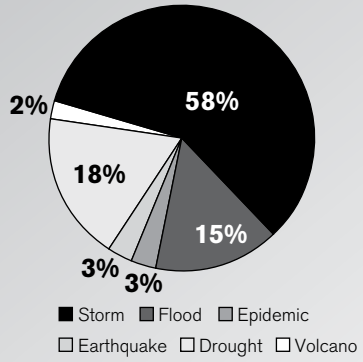
Disaster	Date	Affected (Number of People)
Storm	2005	475,314
Flood	2008	180,000
Drought	2001	113,596
Storm	1998	105,700
Flood	2002	98,740
Drought	1987	73,000
Epidemic	1991	26,800
Earthquake*	1991	23,890
Flood	1982	20,256
Flood	1995	7,435

Economic Damages

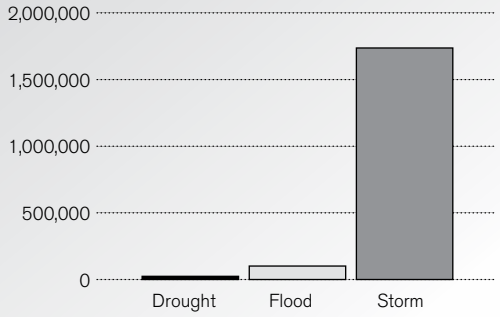
Disaster	Date	Cost (US$ x 1,000)
Storm	2005	988,300
Storm	1998	748,000
Flood	1982	100,000
Drought	2001	14,000
Drought	1994	10,000
Earthquake*	1982	5,000
Flood	1999	1,000
Storm	1996	500
Storm	2001	100
Storm	2002	100

Statistics by Disaster Type[b]

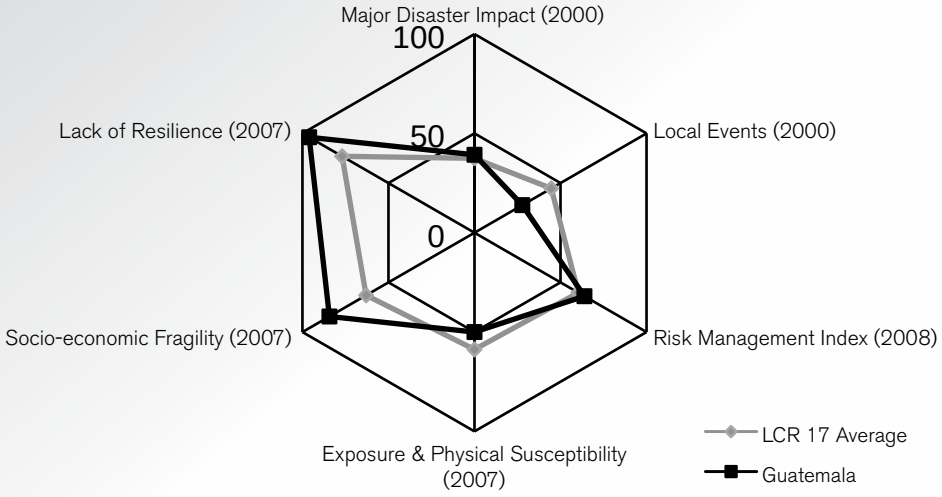
Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



Relative Vulnerability and Risk Indicators[c]



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=70. Source data from EM-DAT. Data displayed does not imply national endorsement.

[c] Relative Vulnerability and risk Indicators are adapted from IADB-IDEA-ERN (2009). Values are normalized on scale of 0 – 100 and presented against the average for 17 LCR countries. Major disaster Impact taken from disaster deficit Index: the ratio of economic losses which a country could suffer during a Maximum Considered event and its economic resilience. Local events taken from Local disaster Index: the propensity of a country to experience recurrent, small-scale disasters and their cumulative impact on local development. risk Management Index is presented as the negative (i.e. 0 = optimal, 100 = incipient) of IADB's risk Management Index: measures a country's risk management capability in (i) risk identification, (ii) risk reduction, (iii) disaster management, and (iv) financial protection. resilience, Fragility and exposure are taken from the component indices of Prevalent Vulnerability Index. Date for local event data depends on information available for each country. Data, and the respective LCR 17 average, from 2000 is used for Dominican Republic, El Salvador, Guatemala, Jamaica and Nicaragua. Data, and the respective LCR 17 average, from 2006-08 is used for Bolivia, Colombia, Costa Rica, Ecuador, Panama and Peru. All LCR 17 averages are calculated based on available data.

DISASTER RISK PROFILE

According to the World Bank's Natural Disaster Hotspot study[2], Guatemala ranks 5th among countries with the highest economic risk exposure to three or more hazards. Guatemala is ranked as a high-risk country due to the vulnerability of its gross domestic product (GDP) to multiple hazards, with 83.3% of Guatemala's GDP located in areas at risk. As one of the most densely populated countries in Latin America, with approximately 13 million inhabitants in a territory of 108,890 square kilometers, the country is also one of the poorest in the region. Between 1902 and 2005, Guatemala experienced 62 natural disaster events, which affected approximately 6 million people.[3]

Exposure in Guatemala is to both low-frequency and high-impact events, such as earthquakes, volcano eruptions and hurricanes, and to high-frequency and low-impact events, such as floods and landslides. It is this combination of high population density, poverty, and exposure to natural hazards in Guatemala that constitutes a high risk to adverse natural events.

Geological Hazards

Guatemala is situated in a zone of high seismic risk due to the conjuncture of three tectonic plates: the North American plate, the Caribbean plate, and the Cocos plate. The most catastrophic adverse natural event in Guatemala would be an earthquake in Guatemala City, in the case of a 500-year event.

There are approximately 288 volcanoes in the country, 8 had been active in historic times, and 4 continue to pose a threat at present. The volcanoes of concern are: Fuego, Pacaya, Cerro Quemado, and Santiaguito.[4] Volcanism in Guatemala exists as a result of the subduction of the Cocos plate beneath the Caribbean plate.

Hurricanes and Drought

Guatemala is exposed to two coasts, with the Pacific Coast more vulnerable to hurricanes, and the floods associated with them, especially at river mouths. The interior of Guatemala is greatly affected by drought; while the agricultural sector suffers the most, other important sectors such as water, energy, and health are also impacted.

In recent years, storms and droughts have had the highest human and economic impact in Guatemala. Losses during 1997-2010 averaged at 0.51 % of GDP, with storms (five events) affecting 749,991 people (around 5.8% of the country's population) with damage costs reaching US$2 billion, and 113,596 people (around 1% of the population) affected by drought (1 event) with the costs of damages reaching US$14 million.[5]

Floods and Landslides

Guatemala is continually affected by low-impact, high-frequency disasters, such as landslides and flooding. These disasters occur at local levels, largely due to the topography of the river basins and

[2] Dilley et al. (2005). Table 1.2.
[3] See the hotspot study's Annex 6 for details on Guatemala's exposure to natural hazards and the number of reported disasters in Guatemala.
[4] USGS (2002).
[5] World Bank (2008a) and CEPAL-IADB-UNDP-WB-GFDRR (2010).

slopes and the exposure of the country to two coasts. Nearly 1,733 communities and 210,000 inhabitants are vulnerable to flooding with a total of 30% of the territory at high risk of flooding.

Determinants of Vulnerability to Adverse Natural Events

Vulnerability in Guatemala is due to a large extent to increased urbanization and insufficient planning. Guatemala is one of the most densely populated countries in Central America and unplanned urban growth has greatly increased population and infrastructure vulnerability. Given the high vulnerability of the country, natural hazard events result in disasters that have a high human cost and negative impact on productivity, which in turn delays developmental progress.

Guatemala is characterized by inadequate application and enforcement of building codes. With increases in urban population and a lack of building code, both the population and infrastructure are increasingly at risk to natural hazards. This is compounded further by environmental degradation.

Informal settlements are also considered high-risk areas given the poor quality of housing construction and absence of building codes. These risks must be addressed to decrease vulnerability and mitigate disaster risk in Guatemala.

DISASTER RISK MANAGEMENT FRAMEWORK

The Government of Guatemala has placed disaster risk management (DRM) firmly in its development agenda. This is evident with the inclusion of DRM in the National Development Plan (Plan de la Esperanza), and the National Program for Disaster Prevention and Reduction 2009-2011, approved in January 2009. The institutional coordinating mechanism that provides a legal framework for disaster prevention in the country and inter-ministerial coordination in cases of emergency is the National Coordinator for Disaster Reduction (CONRED in Spanish) and its Secretariat (SE-CONRED).

Over the last decade, the Government of Guatemala has moved towards a more proactive disaster risk management approach. The Government has passed two laws that demonstrate this commitment: the Social Development Law (Decree 42-2001) and the Law of Housing and Human Settlements (Decree 120-96). Both of these laws include the concept of disaster vulnerability reduction in development planning.

Guatemala has made substantial progress towards addressing vulnerability. The Social Development Law (Decree 42-2001) establishes that there is a reciprocal relationship between the advancement of development planning and reducing disaster risks. In Articles 37 and 38, the Ministry of Planning (SEGEPLAN in Spanish), in coordination with other government institutions, is charged with the strategy for disaster risk prevention and protection of vulnerable populations. In 2004, Project GUA 04/021 sought to strengthen capacities for reducing risk in development processes. The principal objective was to create an inter-institutional program with a vision to incorporate disaster risk management in development planning.

In addition, the Government has a National Program for Disaster Prevention and Reduction 2009-2011 (PNPMD in Spanish). This program focuses on enhancing risk monitoring and assessment, reducing risk, strengthening institutions, and developing risk financing strategies. It ensures a comprehensive disaster risk management strategy in the country.

Despite great progress the country has made in addressing disaster risk, Guatemala remains

vulnerable to disasters triggered by adverse natural events and continued attention by the Government of Guatemala is needed. Guatemala's economic and social development is regularly interrupted by earthquakes, volcanic eruptions, hurricanes, floods, and forest fires. Major disasters in Guatemala, such as the 1976 Earthquake, which resulted in more than 23,000 deaths and damages estimated at 17.9% of GDP, and Hurricane Mitch in 1998, which caused estimated damages of 4.7% of GDP, have crippling effects on the country's sustainable development and long-term growth.

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

The current Government in Guatemala has placed disaster risk management firmly among its development priorities. The *Plan de la Esperanza* 2008–2012, the policy program of the administration, focuses on increasing growth and reducing poverty and inequality. It articulates disaster risk management as a self-standing policy issue in the context of securing productivity. This demonstrates significant political commitment. The government is aware of the economic consequences of business interruptions associated with the transfer of funds to address a disaster caused by adverse natural events and acknowledges the importance of continuing efforts to reduce poverty and inequality.

Learning from recent disasters, Guatemala has made progress towards a more proactive disaster risk management system. The establishment of the Social Development Law (Decree 42-2001) includes the concept of disaster vulnerability reduction and notions of demographics and development planning as contributors to risk scenarios. The Law of Housing and Human Settlements (Decree 120-96) mandates that all territorial entities take disaster risk into account in development planning.

The creation of the National Coordinator for Disaster Reduction (CONRED in Spanish) introduced disaster prevention in the disaster management system in Guatemala for the first time. CONRED works as a coordinating mechanism to provide a platform and legal framework for inter-ministerial coordination in the case of emergency, while also handling disaster prevention. It is supported by an Executive Secretariat (SE-CONRED) which is organized around seven work areas: coordination, financial management, comprehensive disaster risk management, response, preparedness, mitigation, and logistics. During a disaster, CONRED has the power to enlist the cooperation of all public institutions and any private bodies within their areas of competence.

Guatemala's National Program for Disaster Prevention and Reduction (PNPMD in Spanish) aims to articulate institutional and private-sector efforts to achieve sustainable development through initiatives that incorporate disaster risk management in development planning. The PNPMD is a program that addresses disaster risk reduction in a comprehensive manner. Designed with support from the United Nations Development Program (UNDP), the PNPMD includes four lines of action: (i) improving risk identification and monitoring; (ii) investing to reduce risk; (iii) strengthening institutional and planning capacity for risk management; and (iv) developing risk-financing strategies.

The PNPMD aims to significantly strengthen institutions and planning between 2009 and 2011. Programs include: (i) the formulation of the National Policy for Disaster Risk Management, which

involves all sectors and the development of a National Strategy for Disaster Risk Management, coordinated by SE-CONRED and involving both public and private institutions; (ii) the strengthening of SEGEPLAN's planning systems to incorporate risk concepts in public investments; (iii) the implementation of territorial planning in 12 municipalities by an inter-institutional committee involving SEGEPLAN, Ministry of Environment (MARN in Spanish), and Municipal Development Institute (INFOM in Spanish); and (iv) the establishment of a roundtable with private, academic, and international cooperation. Supported by UNDP and the World Bank, the Vice President's Office and SE-CONRED will coordinate these efforts and will convene at least twice a year.

HFA Priority #2: Disaster risk assessment and monitoring

Guatemala has strengthened risk identification and monitoring systems through the development of methodologies to analyze and evaluate hazards and vulnerabilities. The National Institute of Seismology, Volcanology, Meteorology and Hydrology (INSIVUMEH in Spanish) has developed an inventory of historical landslide event maps, implemented an early warning alert system for flooding in six water basins, and conducted hydrological studies in six basins. Various educational facilities have also been prepared for the technical study of monitoring and prognostic elements of the systems.

The PNPMD in Guatemala aims to significantly augment the effort to improve risk identification and monitoring over the next two years. This program includes projects that will advance the methodology to identify hazards, vulnerability, and risks, while strengthening national capacity to identify and monitor such risks. Key components of the sub-programs include: (i) a space to exchange existing methodologies on the analysis of risk and vulnerability, while creating new methodologies in a participatory manner; (ii) the production of hazard risk studies on landslides and flooding, and vulnerability risk studies, especially analyzing the vulnerability of the most important water basins to determine population, infrastructure, and economic vulnerability; and (iii) the construction or strengthening of existing observation networks, particularly the technical and scientific capabilities of the INSIVUMEH.

In recent years, the Ministry of Agriculture (MAGA in Spanish) has made efforts to identify risk using Geographic Information System (GIS) tools on a very large scale. This has complemented the more traditional monitoring of natural hazards carried out by the INSIVUMEH, and the geographic and cartographic information produced by the National Geographic Institute of Guatemala (IGN in Spanish). MAGA has produced hazard maps for volcanic eruptions, developed at a scale of 1:50,000 with the support of Japan's International Cooperation Agency.

Risk evaluations of 250 geographic areas earmarked for relocation of families affected by Hurricane Stan were developed by the Secretariat of Agrarian Matters (*Secretaría de Asuntos Agrarios*, SAA) in 2006. The Gerencia de Riesgo, a professional risk evaluation group, worked with SAA in evaluating 50 additional geographic areas that continue to be affected by landslides and mudslides.

The Government has requested support for various technical assistance projects related to disaster risk management. Guatemala's Vice-President's Office, in coordination with the National Committee for Risk Management, is implementing a Technical and Scientific Information for Municipal Planning project, with financing from the Global Facility for Disaster Reduction and Recovery (GFDRR). This project was designed over a two-year period in a participatory process with institutions including INSIVUMEH, MAGA, SE-CONRED, SEGEPLAN, and the relevant municipalities.

Guatemala is working to strengthen risk identification at the municipal level in order to integrate this knowledge into territorial development planning. This activity, funded by a GFDRR grant, will help hazard-prone municipal governments to include risk considerations in their territorial development process. The project will: (i) develop scientific information on hazards, vulnerability, and risk; ii) provide specific risk information for land use and urban zoning; and (iii) provide scientific information for emergency plans. The information provided will help local authorities place appropriate controls to avoid future generation of risks and will also aid in the design of risk mitigation programs. The project, supported by the GFDRR, includes the seismic building codes updated by the Guatemalan Association of Seismic Engineers (AGIES in Spanish) that could be adopted by different municipalities.

Currently, the Inter-Institutional Committee for Risk Reduction led by the Vice-Presidency of Guatemala, has finished strategic studies with the support of the Global Facility for Disaster Reduction and Recovery (GFDRR). This is a new effort in four basins focused on natural hazard maps for floods and landslides at a 1:25,000 scale, with an action plan for risk reduction in the basins of the rivers Coyolate, Nahualate, Madre Vieja, and Suchiate.

SEGEPLAN is working on Spatial Data Infrastructure for Guatemala to support disaster risk management and the national planning. This is an initiative designed by SEGEPLAN in order to share the spatial data generated by different institutions with the concept of information updated by each institution according to its role. This initiative will save time and cost for planners, and is named SINIT (Spanish for the National System Information for Territorial Planning).[6]

SE-CONRED has developed an early warning alert system for the Fuego Volcano. This is aimed at reducing risk in the Escuintla, Sacatepequez and Chimaltenango Departments. The initiative was supported by Japan's International Cooperation Agency.

The Government of Guatemala is not yet in a position to identify or monitor needs for investments in risk reduction across sectors. The Government of Guatemala also lacks capacity to provide a strategic overview of hazard exposure or contingent risk for the country as a whole or for different sectors. To address this challenge, the Government has drafted a new regulation to strengthen the mandates of CONRED, SE-CONRED, CORRED[7], COMRED[8], and COLRED[9] to document and monitor disaster risk, as well as to promote prevention and mitigation activities. In addition, the new regulation for the Law of CONRED has been prepared and requires that all public infrastructure investments comply with seismic building codes. The regulation is ready for the President's signature and, if approved, could have a significant positive impact on risk reduction in future investments.

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

Guatemala has taken steps to include disaster risk reduction concepts in the educational sector. This is demonstrated by the scientific knowledge program to identify high-risk areas, the introduction of the subject disaster reduction in primary and secondary schools, the strengthening of the disaster documentation center, the national campaign "We Can Act", the raising of awareness by the media, and finally, the consolidation of the CONRED website.[10]

[6] http://ide.segeplan.gob.gt.
[7] Regional Coordinator for Disaster Reduction.
[8] Municipal Coordinator for Disaster Reduction.
[9] Local Coordinator for Disaster Reduction.
[10] http://conred.gob.gt.

Guatemala City

Guatemala is working with CEPREDENAC, the UN ISDR, IADB, and the World Bank to develop the Central American Probabilistic Risk Assessment (CAPRA) platform[11], an innovative initiative with a strong educational element. CAPRA helps facilitate a comprehensive understanding of risk and risk management. The platform enables governments and scientific communities to identify and evaluate the sources of potential losses (both geographically and by sector) from disasters, risk reduction investment opportunities, and government capacity to finance and manage recovery operations. This knowledge provides the basis to formulate strategies and policies to strengthen the national risk prevention and emergency management system, and to develop a comprehensive risk financing strategy. It is anticipated that CAPRA software will be included in university curricula.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

The PNPMD aims to significantly augment investments in risk reduction over the next two years. The main components of the program include: (i) developing national standards for including disaster risk assessment in construction planning; (ii) elaborating National Regulation for the Construction of Schools and guidelines for its application; (iii) the implementation of a public infrastructure auditing

[11] http://ecapra.org.

program through the National General Auditing Agency (*Controloría General de Cuentas*); (iv) two pilot programs in Guatemala City to transform high-risk zones into secure zones; and (v) identification of mitigation works in river basins managed through the Water Cabinet.

A series of risk reduction activities that incorporate mitigation and guarantee safe construction, especially in the health and education sectors, have been earmarked. These initiatives include the development of building codes; national regulations for hospitals and schools combined with municipal disclosure of these codes; infrastructure auditing; works to prevent landslides (retaining walls, slope reinforcements); rehabilitation and maintenance of road infrastructure; and integrated management of river basins. The Vulnerability Reduction and Environmental Degradation Regional Project (PREVDA in Spanish) has already been initiated.

SE-CONRED developed and disseminated better-construction standards according to risk assessment methodologies post-Hurricane Stan. The methodology was developed in coordination with line ministries responsible for reconstruction as well as the rehabilitation and retrofitting of public buildings. The aim is to introduce construction standards that result in better and safer buildings on the basis of risk assessment methodologies. Although SE-CONRED does not have the capacity to supervise the processes nor to monitor to what extent the methodology is being followed, the methodology has been passed on to implementing agencies that have been encouraged to use this for construction and rehabilitation activities.

COVIAL (*Unidad de Conservación Vial,* or the Road Conservation Unit)is overseeing the implementation of investments in river dredging and the strengthening of river banks to prevent significant adverse impacts of natural events on road infrastructure. These investment decisions are made on the basis of documented cost for road maintenance. In areas where COVIAL experiences significant recurrent costs of rehabilitation of the road network due to the impacts of floods, the agency invests in flood prevention as a cost-minimizing strategy. Over the last five years, COVIAL has dredged more than 150,000 cubic meters of rivers and canals per annum.

INSIVUMEH has developed landslide event maps to improve land use planning. As a result of the development of these maps, there has been substantial investment in the upgrading and expansion of monitoring networks.

Disaster risk management is not yet explicitly part of the land use planning processes, but authorities are working towards a screening process for both public and private investment. SEGEPLAN has developed a methodology that will help territorial entities integrate disaster reduction and recovery into land use planning. This is a significant first step for developing the instruments and capacities that will allow the territorial entities to effectively manage their development planning in a way that reduces the construction of new risk.

Despite progress, Guatemala does not have a systematic investment program for risk reduction. Interventions in risk reduction have generally been done in an ad hoc manner. The Government of Guatemala does not track or monitor investments in risk reduction across sectors.[12] This means that there is little understanding of the significance or effectiveness of these investments in reducing the disaster risk exposure of the country or even of specific geographic areas in the country; this makes it difficult to demonstrate results in terms of risk reduction activities. Nevertheless, some of the ad hoc activities represent significant investments and have been good starting points to reduce the country's disaster risk.

[12] Recently, the Ministry of Finance has developed the budgetary classification for monitoring public investments in risk reduction, which is currently in implementation phase.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

The institutional structure for disaster risk management in Guatemala is organized around CONRED and is replicated in regional (Regional Coordinator for Disaster Reduction – CORRED), municipal (Municipal Coordinator for Disaster Reduction – COMRED), and local (Local Coordinator for Disaster Reduction – COLRED) committees. These committees include representatives from public agencies, private sector and civil society organizations, and are convened by the most senior government representative in the relevant locality. Delegates of SE-CONRED support the committees, whose main functions are to (i) coordinate disaster prevention and response activities; (ii) relay information to the next level of the system; and (iii) implement actions relating to alerts, evacuation, security, and emergency shelter.

Until recently, Guatemala has relied on ex-post budget allocations to respond to disasters caused by adverse natural events. In the past, financing for disaster response and reconstruction was almost entirely allocated after the disaster event through two mechanisms: (i) the National Fund for the Reduction of Disasters, coordinated by CONRED and financed according to the guidelines provided by the National Plan for Disaster Prevention and Response (each year the fund receives US$2 million from the national budget, the *Presupuesto General de Ingresos y Egresos del Estado*); and (ii) on an event-by-event basis. CONRED coordinates the implementation of reconstruction with additional funding via budget reallocations by the Ministry of Finance. The funds are generally channeled to three entities that are responsible for implementing and managing rehabilitation and reconstruction projects after disasters: the *Unidad de Conservación Vial* (COVIAL), which manages the funds allocated to the maintenance of the road network; the *Fondo Nacional para la Paz* (the National Fund for Peace, or FONAPAZ), which develops and implements projects to eradicate poverty and extreme poverty (communal buildings, halls, sport fields, and recreation, education, and nutritional programs); and the *Secretaría Coordinadora Ejecutiva de la Presidencia* (SCEP)/ *Unidad de Convoyes Regionales*, a unit specializing in the implementation and management of construction and maintenance projects of rural roads.

Guatemala's Ministry of Finance is preparing a comprehensive strategy to cover contingent liabilities that will include adverse effects of natural events. The Catastrophe Deferred Drawdown Option (CAT DDO) is included as one of the elements in this strategy. The National Program for Disaster Prevention and Reduction in Guatemala outlines three specific areas where the Government will advance towards this strategy over the next two years. The objective of these activities is to improve the government's capacity to mobilize and efficiently execute resources in case of disasters. The three specific areas are: (i) viability studies for a tag system in the budget by the Ministry of Finance, identifying resources in the budget that may be dedicated to disaster risk management; (ii) an analysis of the fiscal exposure to adverse natural events, which will also determine in which way investments lost after a disaster may be recovered; and (iii) a feasibility study to determine the Ministry of Finance's ability to maintain a contingency fund for disasters.

Despite great progress, local community capacity to prepare for, and respond to, disasters caused by adverse natural events should be improved and strengthened. During the last 10 years, the response and preparation capabilities in Guatemala have improved; however, Hurricane Stan, the 2008 floods, and recently Tropical Storm Agatha and the Pacaya Volcano eruption in May 2010, revealed that despite good response capabilities at the municipal level, CONRED response skills remain weak at the local level and require additional support to be adequately prepared in the future.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Modernization and updating of the meteorological system in Guatemala	Central American Development Bank (BCIE)	12.5 million	2
Program for the Reduction of Vulnerability and Environmental Degradation Guatemala (PREVDA)	European Commission	3.34 million 2007-2011	2, 3
Development of scientific information to promote municipal planning to reduce disaster risks	World Bank (GFDRR)	730,000 2008-2010	1, 2, 3, 4
Disaster risk management development policy loan with a Catastrophe Deferred Drawdown option (CAT DDO)	World Bank	85 million 2009-2011	1, 2, 3, 4, 5
Strengthening of Information and Communication for CEPREDENAC and National Commissions	World Bank	446,000 2007-2009	1, 2
Development and application of a Risk Assessment Platform for Guatemala (CAPRA)	IADB	350,000 2009-2010	2, 3
Community Risk Management and risk mapping with local actors	GTZ	not available	2, 3, 4
National Policy for Risk Reduction in Guatemala	IADB	750,000 2009-2010	1
Institutional support to technical groups related with risk reduction	UNDP	90,000 2009	1, 3
National program for risk reduction on the reconstruction process PROREC	UNDP, Sweden, Norway, USAID	13 million 2007-2010	
Regional Program of Environment in Central America (PREMACA)	Danish Cooperation (DANIDA)	not available	2, 4
Earthquake Risk Reduction In Guatemala, El Salvador and Nicaragua With regional cooperation to Honduras, Costa Rica and Panama (RESIS II)	Norway	2.4 million 2007-2010	2
Strengthening of CEPREDENAC and National Commissions for disaster vulnerability reduction in Central America	Spanish International Cooperation Agency	130,000 2005-2009	1
Regional Plan for Disaster Reduction (PRRD)	Norway, Spanish International Cooperation Agency	400,000 2006-2011	1
Development of disaster risk management capacity at the local level	Japan International Cooperation Agency	300,000 2008-2011	2, 4
Mesoamerican coordination system for territorial information	IADB	800,000 2009-2011	2
Strengthening of communication systems at national and regional levels (Regional program)	China (Taiwan)	1,130,000 2009-2011	3
Capacity Building for Risk Management in Central America (BOSAI)	JICA	2,500,000 2007-2012	1, 2
Urban Risk Reduction (Guatemala, Costa Rica, El Salvador, Honduras)	UNDP	300,000 2009-2010	3, 4
Action Plan AECID-CEPREDENAC (Regional level)	Spanish Cooperation for International Development (AECID in Spanish)	763,750 2009-2010	1, 2
Strengthening of CAPRA Implementation (Regional Level)	CEPREDENAC	50,000 2010	1, 2

GLOBAL FACILITY FOR DISASTER REDUCTION AND RECOVERY (GFDRR): ACTION PLAN

Given Guatemala's disaster risk profile and its existing framework for disaster risk management, the key priority is to implement the recently approved national program for disaster risk management. Strategic actions are needed in the following areas in Guatemala: (i) strengthen institutional capacity for strategic planning and coordination, (ii) mainstream disaster risk reduction in specific sectors, and (iii) develop a comprehensive risk assessment and monitoring capacity.

The following activities have been identified in consultation with local authorities and international donor agencies. These activities are built on the PNPMD and the current GFDRR grants for Guatemala, which are coordinated by the same agencies (CONRED, Vice-Presidency) that would coordinate the proposed activities. These actions support Guatemala's disaster risk management program and reflect HFA priority action areas.

Indicative Program for GFDRR Funding (Projects and engagement areas being considered for GFDRR funding)	Implementing Agency / International Partners	Indicative Budget and Period (US$)	HFA Activity Area(s)[2]
Support for the development of territorial planning that integrates disaster risk considerations at the municipal level	INSIVUMEH, Municipalities	1.4 million 2009-2012	1, 2, 4, 5
Technical assistance to support the national program for disaster risk reduction and mainstreaming disaster risk reduction in other sectors	Vice-Presidency, CONRED, Ministry of Finance	800,000 2009-2011	1, 2, 3, 4
Studies and designs for mitigation measures for critical infrastructure	CONRED	1.2 million 2009-2010	1, 3, 4
Mitigation works in key sectors that will be identified during implementation of the PNPMD	Sectoral Ministries, Municipalities	980,000 2009-2011	1, 4
Support for the development a Risk Assessment Platform for Guatemala	Vice-Presidency, CONRED, Universities, Sectoral Ministries, INSIVUMEH	564,000 2009-2010	1, 2
Initial Budget Proposal:		**US$4.944 million**	

In addition to the above-mentioned activities, ongoing dialogue with national and local officials will continue to identify disaster risk management measures that consider climate change as part of their adaptation strategies.

[2] HFA Priority Action Areas: 1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation; 2. Identify, assess, and monitor disaster risks—and enhance early warning; 3. Use knowledge, innovation, and education to build a culture of safety and resilience at all levels; 4. Reduce the underlying risk factors; 5. Strengthen disaster preparedness for effective response at all levels.

Lima, Peru

Other Latin American and Caribbean Countries

Antigua and Barbuda
Belize
Bolivia
Dominica
Dominican Republic
El Salvador
Grenada
Honduras
Jamaica
Nicaragua
Peru
St. Kitts and Nevis
St. Lucia
St. Vincent and the Grenadines

COUNTRIES AT HIGH ECONOMIC RISK FROM MULTIPLE HAZARDS
(Top 33 based on GDP with 3 or more hazards)[a]

1. Taiwan, China
2. Dominican Republic
3. Jamaica
4. El Salvador
5. Guatemala
6. **ANTIGUA AND BARBUDA**
8. Costa Rica
10. Colombia
21. St. Kitts and Nevis
24. Honduras
27. Mexico
28. Hong Kong, China
30. Mozambique
32. Bolivia
33. United States

[a] Dilley et al. (2005). Table 7.2.

The tourism sector, a major contributor to the Antigua and Barbuda's economy, is largely insured by commercial underwriters.

ANTIGUA AND BARBUDA

Natural Disasters from 1983-1999[b]

Affected People

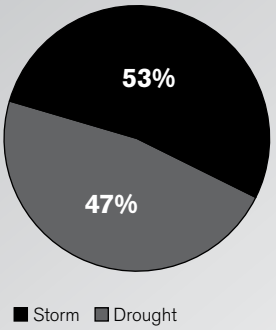
Disaster	Date	Affected (Number of People)
Drought	1983	75,000
Storm	1995	68,702
Storm	2008	25,800
Storm	1989	8,030
Storm	1999	3,423
Storm	1999	2,534
Storm	1998	2,025
Storm	1990	0

Economic Damages

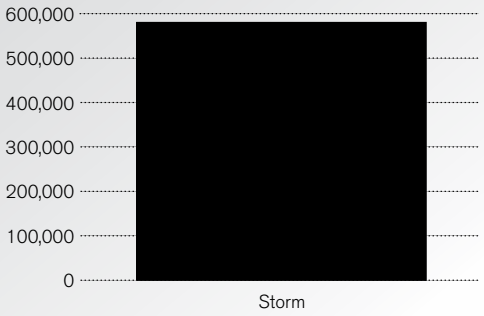
Disaster	Date	Cost (US$ x 1,000)
Storm	1995	400,000
Storm	1998	100,000
Storm	1989	80,000
Drought	1983	0
Storm	1990	0
Storm	1999	0
Storm	1999	0
Storm	2008	0

Statistics by Disaster Type[b]

Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=6. Source data from EM-DAT. Data displayed does not imply national endorsement.

DISASTER RISK PROFILE

Antigua and Barbuda is among the top five countries most exposed to multiple hazards. 100% of the land area and 100% of the population is exposed to 2 or more hazards. In terms of risk to GDP, Antigua and Barbuda is among the top 20 countries with an estimated 80.4% of GDP at risk from two or more hazards.[1]

Antigua and Barbuda are located in the northern end of the Leeward Islands of the Caribbean, at approximately 17º 03' north latitude by 61o 48' west longitude. The two islands occupy approximately some 442 km^2 with Antigua, the larger of the two, covering approximately 280 km^2, and Barbuda with approximately 161 km^2 of surface area. Antigua is roughly circular in shape, measuring approximately 19 km along the north-south axis and approximately 23 km along the east-west axis. Approximately 40 km to the north of Antigua is the island of Barbuda measuring approximately 22 km along the northwest-southeast axis and approximately 14 km in width at its widest points. The estimated population for Antigua and Barbuda is approximately 90,000 persons.

Elevations on Antigua range from sea level to its highest peak, Boggy Peak, measuring 402 meters above sea level. Barbuda is a low-lying island without significant topography much of which is below 20 meters elevation. Both islands were formed from a combination of remnant volcanic peaks and limestone from ancient reef systems.

Multiple hazards impact Antigua and Barbuda, including storms, earthquakes and drought. The most common threat is the potential for hurricanes and tropical storms. Due to the size of the islands, a single storm has the potential for directly impacting the entire population. High winds and rainfall are the principal risk factors. The islands' lack of significant topographic variability results in open exposures to the effects of wind and rain.

Since 1950, Antigua and Barbuda have been exposed to 11 named storms whose track has passed within 40 km of the two islands. This includes eight hurricanes; three notably intense storms which passed directly over the islands included Donna (1960, Category 4); Luis (1995, Category 4); and Georges (1998, Category 3).[2] Potential storm impacts can be crippling. Damages estimated in the aftermath of Luis, for example, were placed at approximately 2/3 of the country's GDP.

Antigua and Barbuda experience rainy and dry seasons and are particularly vulnerable to drought. This is due to the geology of the islands, which consists largely of limestone plains. As much of the topography is relatively low-lying, these islands lack a significant stream network. Groundwater is the principal source for freshwater which is recharged by direct infiltration of rainwater through the surface. The islands have added desalination systems to augment freshwater supplies.

One seaport serves the islands and is located on Antigua in the capital St. Johns. The islands are also served by a single international airport on Antigua and two smaller airfields on Barbuda.

Economic risks are related to the country's dependence on the services sector (largely tourism) which represents an estimated 74% of GDP. Agriculture is minimal, contributing some 4% to GDP.

Geological Hazards

Antigua and Barbuda are regularly exposed to seismic risk and are located in seismic zone 4

[1] Dilley et al. (2005). Table 1.1b and Table 7.2b.
[2] Saffir-Simpson Scale.

(on a 0-4 scale), a high-risk earthquake zone.[3] The islands are located along the eastern margin of the Caribbean plate and as recently as 1974, were hit with a 7.5-magnitude earthquake which caused structural damages estimated in the millions. No active volcanic centers are located in the island group.

While tsunami is not considered a major recurrent risk for the region, the low-lying nature of the islands would make them particularly vulnerable to storm surge and tsunami. Tsunami risk is generally associated with the potential effects of an eruption of Kick-'em-Jenny located 500 km south of Antigua. Reports on the 1939 eruption indicate that a 2-meter tsunami was generated.

Floods and Landslides

Landslides are not a pressing problem in Antigua and Barbuda, but flooding represents a significant risk to the islands. Internal drainage from development has been implicated in some flooding events; however, the greatest risk is from storm surge and wave action. Low elevations coupled with deeply intrusive bays provide ample opportunity for flood events to occur.

Determinants of Vulnerability to Adverse Natural Events in Antigua and Barbuda

Island constructions are generally exposed with little natural protection from wind forces. Much of the land in Antigua and Barbuda lies below 20 meters in elevation with limited relief. This also contributes to the potential for inland flooding. Additionally, the islands are particularly vulnerable to storm surge and wave action.

Drought is a major concern as most of the drinking water is supplied by well systems or rainwater cisterns. Both islands are predominately karstic in nature as limestone covers much of the islands' area. In this setting, water is maintained in a Ghyben-Herzberg lens.[4] This is a lens of fresh groundwater floating above saltwater and is maintained by rainfall percolating through the ground surface. Among the factors affecting the volume of freshwater stored in this setting are the availability of rainfall and the surface area of impervious surfaces, natural or manmade. Water management is a major concern because of limited natural freshwater resources, and is further hampered by the clearing of trees to increase crop production, causing rainfall to run off quickly. Additionally, systems of this nature are also particularly susceptible to pollution either by sanitary discharge or contaminated infiltration as well as saltwater intrusion from overuse of the system.

Critical infrastructure is particularly at risk and alternative services are limited. Power generation, drinking water, international port and airport services are concentrated in the vicinity of St. Johns, in Antigua. When these facilities are damaged, services are lost until repairs can be completed. The added reliance on desalination facilities for drinking water places water resources at particular risk as loss of power and direct damages to coastal facilities can interrupt service.

Climate Change and Global Warming

Antigua and Barbuda was mentioned by Germanwatch regarding the Global Climate Risk Index 2010 (GCRI) report. The Global Climate Risk Index 2010 is based on figures from 2008 and is also an analysis of the worldwide data collection on losses caused by weather-related events during 1998–2008. While Antigua and Barbuda had no deaths from

[3] SEOC (Structural Engineers Association of California) zone system. Zone 4 corresponds to a Z factor of 0.750 as defined under CUBiC 1985. Values obtained from Gibbs (1999), Appendix 1, Table 3.

[4] Ghyben-Herzberg lenses are formed due to density differences between fresh and salt water. Lighter freshwater floats above the denser saltwater and absent turbulent mixing, remains uncontaminated. Overexploitation of these resources leads to saltwater intrusion contaminating well systems.

storms, floods or heat waves in 2008, it ranked 60th with losses of 2.94% GDP, and ranked 52nd for the decade with GDP losses of 4.51%.[5] Two factors were cited: the impact of global warming on rising sea levels which increase the risk of storm surges, and secondly the increase in the strength of hurricanes.[6]

Climate Change models[7] have predicted that Antigua and Barbuda will undergo a warming and drying trend and is expected to endure more frequent heat waves and droughts, rainfalls with increased intensity, and rising sea levels as predicted for the rest of the Caribbean consistent with the projected global median.[8] It is known that inter-annual climate variability of either the Pacific or Atlantic explains a significant amount of the total variance in rainfall in the Caribbean and Central America.[9] Probable climate change impacts in Antigua and Barbuda include higher temperatures, higher storm intensities and, possibly, more frequent El Niño-Southern Oscillation (ENSO)[10] events, exacerbating existing health, social and economic challenges affecting Antigua and Barbuda.

Changes in sea surface temperature as a result of climate variability could increase the intensity of cyclones and heighten storm surges, which in turn will cause more damaging flood conditions in coastal zones and low-lying areas. According to the World Bank's study, "Sea Level Rise and Storm Surges",[11] the impact of sea level rise and intensified storm surges in Latin America and the Caribbean will be high. While data is not available for Antigua and Barbuda, data for Puerto Rico is showing an increase of 51.84% - with 53.81% of the coastal population exposed and potential losses of coastal GDP projected to exceed 52.71%.

Antigua and Barbuda's first National Communication on Climate Change (NCCC)[12] was released in 2001. It cites the Intergovernmental Panel on Climate Change (IPCC) evidence that the global average sea level has risen by 10 to 25 cm over the past 100 years; and that it is likely that much of this rise is related to an increase in the lower atmosphere's global average temperature since 1860. Moreover, the IPCC's climate change models project that sea levels will rise another 15 to 95 cm by the year 2100. As a small island developing state, Antigua and Barbuda stands to be devastated by sea level rise. Tourism is the dominant economic sector and accounts for over 60 per cent of gross national product (GNP), and will be significantly affected.

DISASTER RISK MANAGEMENT FRAMEWORK

Specific disaster management legislation has been adopted in Antigua and Barbuda. Disaster preparedness and emergency response in Antigua and Barbuda is implemented under the authority of the Emergency Powers Act of 1957[13] and Disaster Management Act of 2002.[14]

The Disaster Management Act established the office of the Director of Disaster Preparedness and Response who reports to the Prime Minister. The Act also established the National Disaster Preparedness and Response Advisory Committee. This committee is chaired by the Prime Minister and is composed of Ministers, key staff from government agencies, corporations, business and non-governmental organizations. The committee

[5] Harmeling (2009). Table 5.
[6] McLymont-Lafayette (2009).
[7] Hadley Centre Coupled Model, Version 2 (HADCM2), as reported in Mulligan (2003). Same modeling data as used by the Intergovernmental Panel on Climate Change (IPCC).
[8] Chen et al. (2008).
[9] Giannini et al. (2002).
[10] El Niño-Southern Oscillation; commonly referred to as simply El Niño, a global coupled ocean-atmosphere phenomenon.
[11] Dasgupta et al. (2009).
[12] Office of the Prime Minister (2001).
[13] OAS-DSD (1957).
[14] OAS-DSD (2002).

functions to coordinate the development of national disaster policy and serves as the interagency focus during disaster events. The National Disaster Preparedness and Response Advisory Committee serves to monitor progress toward national disaster policy implementation and provides the technical implementation supervision on behalf of the national council.

Disaster management in Antigua and Barbuda is executed through the National Office for Disaster Services (NODS). This office is headed by the Director of Disaster Preparedness and Response. Emergency powers are executed through the office of the Prime Minister as provided under the Emergency Powers Act. The Governor-General may, by Proclamation which shall be published in the Official Gazette, declare that a state of public emergency exists.[15]

Preparation of the National Disaster Management Plan is underway and a final plan is expected in 2010. Currently there is no formally adopted National Disaster Management Plan, however, the current draft plan has been in preparation since 2007. While not formally adopted, the draft plan serves to guide disaster management activities.

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

NODS is operational and an Emergency Operations Center has been constructed to house NODS's activities. Currently (2010) NODS maintains a staff of 14, consisting of 4 professional staff and 10 support staff. Warehousing space has been constructed for pre-positioned disaster supplies.

NODS coordinates with international agencies in a variety of activities including shelter management, supply pre-positioning, response exercises and workshops. NODS currently focuses on preparedness and response; risk reduction and mitigation activities have yet to be integrated into the national disaster management framework.

HFA Priority #2: Disaster risk assessment and monitoring

Risk mapping in Antigua and Barbuda is relatively advanced in the region. NODS supports GIS and mapping services and maintains a GIS specialist on staff. Hazard maps include hurricane effects, coastal erosion, inland erosion, flooding and drought. A vulnerability assessment has been conducted of critical facilities and resources including schools. The hazard maps and the Vulnerability Assessment are used by a number of agencies in Antigua, including NODS, Antigua Public Utilities Authority, Development Control Authority (DCA), banks, insurance agencies, the Ministry of Health, Ministry of Public Works, Police and Military. Base maps have been prepared in a GIS format and include contours, agricultural and urban land use, roads, water courses, electricity and telephone lines, population, social and economic facilities, land capability, parcels and a digital elevation model corresponding to a scale of 1:50,000. Maps are maintained and updated periodically at NODS and DCA.[16]

The Meteorological Service is the national monitoring agency for weather-related activity. The office monitors and forecasts weather providing general forecasting services and storm alert warnings. The office coordinates with the U.S. National Oceanic and Atmospheric Administration for forecasting

[15] OAS-DSD (1981a).
[16] CDERA (2003a).


Nelson's Bay, Antigua and Barbuda

support and weather satellite imagery access. NODS assists in coordinating the distribution of these warnings and provides public preparedness advice under a system prescribed under the national plan. Warnings are distributed through radio, television and loudspeaker broadcasts, as well as warning flags displayed at police stations.

Earthquake monitoring is managed through the University of the West Indies (UWI) Seismic Research Centre. Real-time observations are taken from the international system of seismograph stations and analyzed at the institute. The unit analyzes the data and provides event reports and periodic analysis as needed. NODS reviews the information provided by UWI and issues public warnings and bulletins as required.

HFA Priority #3: Use knowledge, innovation and education to build a culture of safety and resilience at all levels.

Disaster risk reduction through development policy and planning is not currently included in the national DRM strategy. A building code is being managed through the Development Control Agency (DCA) but enforcement is variable. National policy currently does not yet mandate DRR as a development objective and has not yet been adopted as an operational principle in the national line ministries.

NODS sponsors occasional workshops dealing with disaster preparedness and response. NODS' functions include promoting preparedness and public awareness. NODS also prepares public information activities and distributes disaster preparedness information. While educational programs in Antigua and Barbuda are limited, a recent program (2009) in earthquake awareness has been developed for public presentation.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

Building code legislation was adopted in Antigua and Barbuda in 1996 and is enforced through the Development Control Authority (DCA).[17]

[17] Status of Building Codes in the Caribbean, USAID/OAS Post-Georges Disaster Mitigation Project, updated 2002.

Enforcement is variable and no retrofitting program has been developed. While new construction for public buildings is monitored for code compliance, private constructions are variously monitored for compliance and eligibility requirements for mortgages and private insurance are likely factors in construction design.

DRM strategies are yet to be integrated in the national development strategy. There is no formal policy for the inclusion of DRM planning in national development programs. Land use planning is currently not a factor for disaster risk reduction in Antigua and Barbuda. While some land use planning occurs, its translation into actual land use constraints is limited.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

Antigua and Barbuda is a member of the regional Caribbean Disaster Emergency Management Agency (CDEMA).

Antigua and Barbuda's capacity to respond to a major disaster without major outside support will remain limited for the foreseeable future. Risk reduction and improved insurance coverage will be key factors supporting reconstruction capacity. As for public sector risks, Antigua and Barbuda is a subscriber to the Caribbean Catastrophic Risk Insurance Facility.[18] This offers some relief in the event that the policy is triggered.

The tourism sector, a major contributor to the Antigua and Barbuda's economy, is largely insured by commercial underwriters. An estimated 80% of tourism enterprises is insured. Other sectors, such as agriculture, transport, housing and public infrastructure remain relatively vulnerable. Mortgaged properties are generally insured pursuant to investor requirements.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Caribbean Risk Management Initiative	UNDP	2.1 million 2004-2010	1, 2, 3
Enhancing Resilience to Reduce Vulnerability in the Caribbean	Government of Italy	4.5 million 2009-2011	1, 2, 3, 4, 5
Mainstreaming DRM in the OECS countries	IDB	400,000 2008-2011	
Regional DRM Strategy for the Caribbean Tourism sector	IDB	800,000 2007-2009	
Regional Monitoring and Evaluation Framework for DRM in the Caribbean Tourism Sector	IDB	750,000 2009-2012	

[18] The CCRIF is the first multi-country risk pool in the world, and is also the first insurance instrument to successfully develop a parametric policy backed by both traditional and capital markets. It is a regional insurance fund for Caribbean governments designed to limit the financial impact of catastrophic hurricanes and earthquakes to Caribbean governments by quickly providing financial liquidity when a policy is triggered.

COUNTRIES AT HIGH ECONOMIC RISK FROM MULTIPLE HAZARDS
(Top 33 based on GDP with 3 or more hazards)[a]

1. Bangladesh
3. Dominican Republic
5. Haiti
8. El Salvador
9. Honduras
10. Guatemala
12. Costa Rica
17. Nicaragua
26. Ecuador
28. Colombia
37. Peru
47. Montserrat
55. Mexico
61. BELIZE
63. United States
96. Thailand

[a] Dilley et al. (2005). Table 1.2.

Belize City is especially vulnerable to flood damage due to its very low-lying land and exposed position on the coast.

BELIZE

Natural Disasters from 1990 - 2008[b]

Affected People

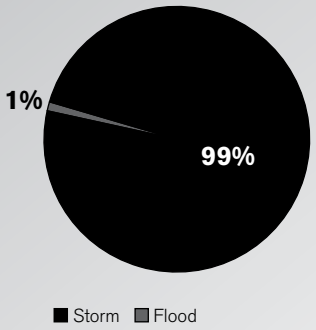
Disaster	Date	Affected (Number of People)
Storm	2000	62,570
Storm	1998	60,000
Flood	2008	38,000
Storm	2001	20,000
Storm	2007	20,954
Storm	2008	10,000
Flood	1995	2,600
Extreme Temp.	1990	0
Flood	1990	0
Storm	2001	0

Economic Damages

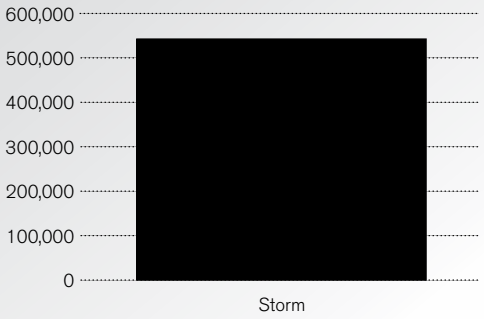
Disaster	Date	Cost (US$ x 1,000)
Storm	2000	277,460
Storm	2001	250,000
Storm	2007	14,847
Flood	2008	9,697
Extreme Temp.	1990	2,250
Flood	1990	2,200
Flood	1995	500
Storm	1998	50
Storm	2001	0
Storm	2005	0

Statistics by Disaster Type[b]

Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=18. Source data from EM-DAT. Data displayed does not imply national endorsement.

DISASTER RISK PROFILE

Belize is the 61st highest exposed country to relative mortality risk from multiple hazards in the world, according to the Natural Disaster Hotspot study by the World Bank[1], and 8th ranked country from 167 for climate risk.[2] Located in one of the most active hurricane areas of the world, Belize's population of only 300,000 is hit by a major storm on average every three years, over 50 times since records began in 1871. Between 1935 and 2005, 11 hurricanes killed an average of 168 people per event, injuring 52 and causing an average annual loss of US$5.5 million (in constant US$ of 2000) to its economy of approximately US$1 billion GDP.

Hurricanes and tropical storms are the principal hazards affecting Belize, causing severe losses from wind damage and flooding due to storm surge and heavy rainfall. Recently, hurricanes Keith (2000), and Iris (2001) caused some of the worst damage ever, reaching 45% (US$280 million) and 25% of GDP, respectively.[3] Government expenditures associated with increased costs for emergency reconstruction due to these events were approximately US$50 million, covering three fiscal cycles. The government of Belize has argued that these spending increases for reconstruction led to large fiscal deficits and debt accumulations that in 2006 required a restructuring operation for public debt.

Belize City is especially vulnerable to flood damage due to its very low-lying land and exposed position on the coast. The city has been frequently affected by hurricanes. In 1931, Belize City was devastated by an unnamed hurricane reaching Category 3, which resulted in 2,000 deaths from among the town's population of 16,000. The city was again impacted in 1961 when Hurricane Hattie caused the greatest financial cost (US$413 million (USD 2007)) from a natural disaster in Belize to date. This spurred the Government to build a new capital at Belmopan, 50 miles inland, and to encourage the relocation of the main population center. This move, although widely commended, remains incomplete. The risk in Belize City therefore remains and it is estimated that the city faces a 10% chance of hurricane storm wind speeds between 178km/h-209 km/h during a ten-year period.

The country faces some minor seismic and tsunami risk as Belize is close to the boundary of three tectonic plates with earthquake risk concentrated in the southern part of the country. There are no records of very major earthquake activity; however, there are minor earth tremors and a significant seismic event is not impossible. There are no active volcanoes in Belize, however, the submarine volcano Kick-'em-Jenny, located 8 km north of Grenada has demonstrated frequent eruptions that breach the surface and generate tsunamis around 2 m high that can affect the coast of Belize. Kick-'em-Jenny first erupted in 1939 and there have been eleven subsequent eruptions since, the most recent in 2001.

The population across the country is vulnerable because of the relative lack of transport and flood protection infrastructure; high levels of poverty; concentration of urban centers in low-lying coastal areas; high levels of linguistic and cultural diversity; and poor access to information and health care. Productive sectors are also vulnerable, especially agriculture in the north and the south, which is affected by flooding; and tourism, based in coastal areas and affected by wind hazards. Belize's long, low-lying coastline accommodates approximately 45% of its total population in densely populated urban areas such as Belize City (approximately 20.5% of total population). These coastal urban centers represent some of the country's most vulnerable to storm events as they lie approximately one to two feet below sea level.

[1] Dilley et al. (2005). Table 1.2.

[2] Belize's annual average losses from weather events during 1990-2008 equal 3.94% of GDP/year (Harmeling 2009).

[3] Economic impact of disaster usually includes direct costs, such as infrastructure damage, crops, housing and indirect losses, such as reduced tax revenues, increased state expenditures and market instability. See EM-DAT (2009).

Climate Change and Global Warming

Climate change is also a significant threat to Belize as it is expected to alter the hazard dynamics that affect competitiveness of productive sectors. The United Nations Framework Convention on Climate Change (UNFCCC) recognizes that Belize is one of those countries most vulnerable to the adverse impacts of climate change due to: (i) its long, low-lying coastline; (ii) its over 1,060 small islands; (iii) its second-longest barrier reef in the world and 17,276 km^2 of forest cover, each of which support fragile ecosystems; and (iv) the fact that it is very prone to natural disasters, especially hurricanes.

Storm hazards are expected to become stronger and develop more rapidly, greater variations in precipitation are predicted to affect droughts and floods, and rising sea levels to threaten much of Belize's low-lying territories. The past events of coral bleaching and mortality are symptomatic of the impacts of climatic events on biodiversity and ecosystem function. Most infrastructure and settlements are located on the coastal plains and on low-lying Cayes of the country. Projected sea level rises and extreme weather events are expected to jeopardize the country's coastal tourism, fisheries and aquaculture industries, and agriculture base, as well as undermine availability of water resources.

Belize was cited in the Germanwatch 2010 Global Climate Change Risk Index. The 2010 Climate Risk Index is based on figures from 2008 and is also an analysis of the worldwide data collection on losses caused by weather-related events during 1998–2008. In 2008 Belize was ranked 9th with losses of 4.86% GDP, and 38th for the decade with GDP losses of 3.94%.[4] Two factors were cited: the impact of global warming on rising sea levels which increase the risk of storm surges, and secondly the increase in the strength of hurricanes.[5]

Climate Change models[6] have predicted that Belize will undergo a warming and drying trend and is expected to endure more frequent heat waves and droughts, rainfalls with increased intensity, and rising sea levels as predicted for the rest of the Caribbean consistent with the projected global median.[7] It is known that inter-annual climate variability of either the Pacific or Atlantic explains a significant amount of the total variance in rainfall in the Caribbean and Central America.[8] Probable climate change impacts in Belize include higher temperatures, higher storm intensities and, possibly, more frequent El Niño-Southern Oscillation (ENSO)[9] events, exacerbating existing health, social and economic challenges affecting Belize.

Changes in sea surface temperature as a result of climate variability could increase the intensity of cyclones and heighten storm surges, which in turn will cause more damaging flood conditions in coastal zones and low-lying areas. According to the World Bank's study, "Sea Level Rise and Storm Surges",[10] the impact of sea level rise and intensified storm surges in Latin America and the Caribbean will be high. Data available for Belize shows an increase of 26.93% - with 56.15% of the coastal population exposed and potential losses of coastal GDP projected to exceed 61.14%.

[4] Harmeling (2009). Table 5.
[5] McLymont-Lafayette (2009).
[6] Hadley Centre Coupled Model, Version 2 (HADCM2), as reported in Mulligan (2003). Same modeling data as used by the Intergovernmental Panel on Climate Change (IPCC).
[7] Chen et al. (2008).
[8] Giannini et al. (2002).
[9] El Niño-Southern Oscillation; commonly referred to as simply El Niño, a global coupled ocean-atmosphere phenomenon.
[10] Dasgupta et al. (2009).

Belize's first National Communication on Climate Change (NCCC)[11] was released in 2002. It comments that coastline erosion is already considered a major concern, noting that it is inevitable that accelerated sea level rise would exacerbate the rate of erosion and possibly destroy all existing beaches within this new century. Research undertaken under a US Country Studies Program vulnerability assessment reveals that a 4 cm rise in sea level over the next 25 years would have a low impact. A 50 cm rise would claim over half the existing beaches, while a 100 cm rise in 100 years would destroy over 90% of these beaches. Regarding inundation, approximately 60% of coastal areas are already inundated. Considering that most of the mainland coastline between the existing communities is wetland-dominated, a one-meter rise in sea level would transform the wetlands to lakes. Dry land within a few meters of high tide levels would provide potential areas for new wetland formation.

DISASTER RISK MANAGEMENT FRAMEWORK

The Disaster Preparedness and Response Act (2000[12], revised in 2003)[13] is the primary legislation governing DRM in Belize. The Act established the National Emergency Management Organization (NEMO) as a Department of Government, headed by a National Emergency Coordinator. It assigns broad responsibilities for "coordinating the general policy of the government related to the mitigation of, preparedness for, response to and recovery from emergencies and disasters". The Act is skewed toward preparedness and response and is silent on risk transfer. The Governor-General may, by Proclamation which shall be published in the Official Gazette, declare that a state of public emergency exists.[14]

The Belize Building Act of 2003 (amended in 2005) provides for the regulation of building operations, including building standards in the country.[15]

The Land Utilization Act (revised in 2000) provides for the subdivision and utilization of land; and for the National Emergency Coordinator (NEC) to be a member of the Land Subdivision and Utilization Authority.

The Environmental Protection Act assigns to the Department of the Environment the authority to conduct its own environmental impact assessment where deemed necessary, and to approve environmental impact assessments subject to consultation with the NEC. This provision enables the NEC to incorporate disaster risk considerations into the project cycle.

The Coastal Zone Management Act of 1999 mandates the Coastal Zone Management Authority and Institute to address cross-sectoral sustainable development of coastal resources.

The Insurance Act (No. 11 of 2004) makes provisions for domestic insurers and to strengthen the regulatory framework for the insurance industry. The Act provides for risk coverage for government and private sector-financed infrastructure, up to the duration of the mortgage.

The Reconstruction and Development Corporation Act facilitated the relocation in 1970 of the Government's main administrative center from Belize City to Belmopan, following damage from Hurricane Hattie in 1961. The Act has not

[11] Ministry of Natural Resources, the Environment, Commerce and Industry, Belize (2002).
[12] OAS-DSD (2000a).
[13] OAS-DSD (2003).
[14] OAS-DSD (1981b).
[15] The Belize Building Act supersedes the Housing and Town Planning Act, which regulated development in Belize City and Belmopan only.

been applied since, and has no current functioning administering unit.

The National Emergency Management Organisation is the recognized national coordinating and implementing entity for DRM. NEMO comprises the Cabinet, with the Prime Minister as the Chairperson, the Cabinet Secretary, as Secretary, the NEMO Secretariat and the 13 Operational Committees and nine District and Special Committees.

The policy framework relating to disaster risk management in Belize is fragmented, with several sectoral policies but no overarching policy in place as a more comprehensive measure. The most comprehensive attempt to date is Belize's National Hazard Mitigation Policy (2004), prepared through a concerted effort by the Government of Belize, the Caribbean Disaster Emergency Response Agency (CDERA) and the Caribbean Development Bank (CDB) to provide an integrated approach to hazard risk management and sustainable development, at national, sectoral and community levels. The policy is seen as an important benchmark for stakeholder cooperation and forms the national platform for addressing hazard reduction issues within a broader national development framework. The 2004 policy aims to integrate hazard risk reduction into national development processes and national institutional strengthening for disaster risk reduction.

Public sector agency organization and legislative frameworks mainly support the emergency management cycle, and suffer disparities in addressing comprehensive risk management. While advances have been made in managing disasters, including adoption of policy on hazard mitigation, a greater focus is now required in mainstreaming risk management into sector planning and building a culture of ex ante prevention through risk reduction.

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

A 10-year National Hazard Mitigation Plan to implement the Policy was adopted in 2007. The Plan emphasizes a multi-sectoral, integrated and coordinated approach to hazard mitigation. Several other key national policy documents explicitly promote the integration of DRM into the planning process. For example, the National Coastal Zone Management strategy emphasizes cross-sectoral coastal area planning and development; and includes confronting coastal vulnerability as a component of a strategic objective to support planned development. Few other national or sectoral policies or strategies explicitly integrate either hazard mitigation or DRM.

The government is working with UNDP on the Strengthening of Disaster Preparedness and Emergency Response Capacity project, intended to: "assist the country of Belize in the strengthening of its framework for disaster co-ordination as well as the strengthening of national capacities allowing for effective disaster preparedness, risk reduction and emergency response." The project focuses on strengthening both human resources and government structures, and technical instruments for proper disaster planning and management in the country. In response to the national need for holistic planning the project firstly proposes the collation, revision, updating and possible consolidation of existing sectoral disaster management plans into a comprehensive National Disaster Management Plan.

NEMO is improving its information management with UNDP financing for an information manager

Ambergris Caye Island, Belize

position and to support effective planning and response with the establishment of the DevInfo and DesInventar databases. These contribute to the identification, assessment and monitoring of disaster risk and enhancement of early warning.

HFA Priority #2: Disaster risk assessment and monitoring

The Global Risk Identification Programme's (GRIP) Risk Assessment Package is being supported in Belize by UNDP. The GRIP Risk Assessment Package allows national entities to improve their capacities for disaster risk reduction by facilitating access to improved risk information. As part of this activity the La Red methodology and software for recording disaster events DesInventar is being rolled out in Belize during 2010. This activity includes software packages, training and data entry to establish a geo-referenced record of subnational disaster events that can support the identification of risk areas and guide a more specific assessment under GRIP.

Belize is participating in the Central American Probabilistic Risk Assessment (CAPRA) platform.[16] CAPRA, supported by CEPREDENAC, UN ISDR, IADB, and the World Bank, will establish a reference methodology for probabilistic risk assessment in Belize as well as a risk information platform. The initiative also seeks to train local users in use of open-source risk models and to facilitate a comprehensive understanding of risk and risk management. Such models will build on the databases and IT infrastructure being built in NEMO through the UNDP project and can use the historical information in DesInventar. The outputs of CAPRA represent high-quality quantitative risk metrics and risk maps for various hazards at the return periods of interest. The

[16] http://ecapra.org.

platform architecture is modular and open-source, intended to adjust to national systems, complement related project and data sources, and bring a common language to prior risk estimates in Belize. Applications of the platform are tailored to the institution and sector of interest and can include scenarios of modeled damage for emergency planning or estimates of annual loss in infrastructure for specific hazards to risk estimates resulting from climate change scenario analysis. CAPRA has set in motion a process of risk evaluation and understanding in Belize across sectors and is guided by a National CAPRA Committee established within the national Disaster Council and chaired by NEMO. The national committee meets regularly to discuss standards, data needs, synergies with related projects and to express their training and application needs as they adopt increasingly more modules of the platform. To date the CAPRA initiative remains modest in Belize, focused on addressing existing needs and capacities; however, the underlying foundation in IT, data and staff capacity being established by the government of Belize opens great potential to build ever more powerful risk evaluations and monitoring systems.

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

An innovative system of Indicators of Risk and Risk Management is being developed for Belize, financed by the Inter-American Development Bank as part of the CAPRA project. These indicators are already established in 16 Latin American and Caribbean countries and are useful for both national policy formulation and country comparisons as well as subnational awareness raising, monitoring of progress and risk management resource allocation. They cover the consequences of major disaster impacts (Disaster Deficit index), local small-scale and frequent events (Local disaster index), community's vulnerability (Prevalent Vulnerability index) and risk management (Risk Management index). The local disaster index will be developed from and complement the data established by the DesInventar historical disaster losses record.

International Federation of Red Cross (IFRC) is assisting vulnerable communities with a methodology for community Vulnerability and Capacity Assessments (VCA). This tool is expected to be employed in the community contingency planning exercises and with UNDP/GEF Small Grant support will allow for contingency planning utilizing this methodology in three Northern villages.

The government of Greece and UNDP are supporting the transfer of LIDAR technology to be used in addressing a long-standing sub-regional concern of the Small Island Developing States of the Caribbean of inadequate available maps for coastal development, hazard and mitigation planning. At present, Belize, like most of its Caribbean counterparts, utilizes maps of 10-meter contours rather than the required 0.5- or 1-meter interval contour maps required for true determination of storm surge and coastal vulnerabilities. This action will be undertaken in conjunction with the regional Caribbean Community Climate Change Center (CCCCC) headquartered in Belmopan city. Present funding only covers construction of the LiDAR instrument by the CCCCC but not the aerial campaigns to acquire the baseline data or the processing and analysis work required to use the information to derive improved risk and climate impact models. Such high-quality high-resolution datasets, when established, present a valuable opportunity for technological leapfrogging in many sectors as the most sophisticated models can be used to generate very detailed and accurate risk information for application in environmental management, marine conservation, coastal erosion, reef assessment, storm surge modelling, hurricane planning and cost benefit analysis of coastal hazard mitigation.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

A Central Building Authority was recently established to administer the Belize Building Act of 2003 and provide for the regulation of building operations, including building standards in the country. The provisions in the Act for monitoring and enforcement are limited.[17]

The Caribbean Disaster Emergency Management Agency (CDEMA), through its piloted Caribbean Hazard Mitigation Capacity Building Programme (CHAMP), is assisting Belize in the development of national capacities allowing for the reduction of national vulnerabilities to the effects of natural hazards. Under this project the national and local governments will work with engineers and local contractors in the development of adequate building codes and will provide training in hurricane-resistant buildings.

A watershed floods management project is supported by the Japan International Cooperation Agency to improve management of the Belize River Watershed. The initiative is the first step in the establishment of an early warning system for communities along the Mopan and Belize Rivers.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

NEMO is focused on improving capacity for preparedness, emergency management and response. The 2009 work program activities for NEMO focus on: i) improved communication and alerting system; ii) improved preparedness, mitigation and response capabilities; iii) emergency plans being tested and updated; iv) strengthened district offices; v) shelter management; and vi) capacity building and support.

Belize is a member of the regional Caribbean Disaster Emergency Management Agency (CDEMA).

Belize is currently benefiting from the USAID OFDA regional preparedness programme. The initiative focuses on the training of trainers as a means of transferring knowledge to local instructors, ensuring a multiplication of project impact. Training areas offered to Belizean stakeholders include introductory damage assessment and shelter management. USAID is also teaming with the Ministry of Education in the developing of a school safety program.

Risk transfer and financial protection is in its initial stages in Belize. The country has not articulated a national strategy for financing of disaster risk and there is no requirement of insurance of public or private sector infrastructure and property beyond the financing period. Approximately 50% of the housing stock is underinsured, and the vast majority of low-income housing is either uninsured or uninsurable. The Caribbean Catastrophe Risk Insurance Facility (CCRIF) is a regional parametric insurance scheme with an annual premium of US$500,000 for Belize. This instrument is not well understood by the public or within the government. At its inception it covered only windstorm hazards and had only one national trigger point (Belize City). Thus, in 2007 when Hurricane Dean struck north of Corozal, it failed to trigger a payout. Subsequently the CCRIF has explored additional attachment points and the possibility of flood insurance for Belize.

Vulnerability assessments of the health sector infrastructure have been carried out recently. The Karl Heusner Memorial Hospital in Belize City

[17] National Hazard Mitigation Plan of Belize, 2006.

was assessed in November 2000. More recently in February 2010, this same hospital along with Orange Walk Regional Hospital were assessed using the PAHO/WHO hospital safety index.[18] The assessment provided an estimate of the hospital's capacity to continue providing services during and after a large-scale disaster or emergency and guided necessary intervention actions to increase the hospital's safety in case of disasters. The recommendations addressed structural, non-structural and functional aspects of the facility. Two other regional hospitals are scheduled to be assessed in 2010.

Belize Electricity Company Limited (BECOL) has developed a sister initiative to the JICA project in which it will support the improvement of the early warning system along the Macal River. The Macal River plays host to BECOL's three hydroelectric generating facilities and is a tributary of the Belize River.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	UN, Donor, IFI Cooperation (where possible)	Allocated Budget and Period (US$)	HFA Activity Area(s)
Strengthening National Capacity for Disaster Risk Management BCPR	UNDP	1 million 2009-2012	1, 2, 3, 4, 5
Central American Probabilistic Risk Assessment in Belize	IDB	330,000 2006-2011	1, 2, 3
Update of DesInventar Database	UNDP	N/A 2009-2012	2
Watersheds Floods Management Project	JICA	N/A 2003-2009	3, 4
Indicators of Risk and Risk Management	IDB	60,000 2009	1,2
Caribbean Risk Initiative	UNDP	2.1million 2004-2010	1, 2, 3
Support for the Implementation of an Integrated DRM Plan	IDB	400,000 2009-2011	
Regional DRM Strategy for the Caribbean Tourism sector	IDB	800,000, 2007-2009	
Regional Monitoring and Evaluation Framework for DRM in the Caribbean Tourism Sector	IDB	750,000 2009-2012	
Risk Evaluation and Indicators of Disaster Risk and Risk Management for Belize, El Salvador and Guatemala	IDB, WB	1 million 2008-2010	
Feasibility Study, Expansion of Water and Sewerage Facilities	CDB	250,000 2007	4
Natural Disaster Management – Emergency Relief Hurricane Dean	CDB	100,000 2007	5
Feasibility Study and Detailed Designs for River Valley Water Supply Systems	CDB	149,000 2007	4
NDM Bridge Rehabilitation –Tropical Storm Arthur	CDB	4,300,000 2008	4
NDM Immediate Response Loan – Tropical Storm Arthur	CDB	500,000 2008	4
NDM Emergency Relief – Tropical Storm Arthur	CDB	20,000 2008	5

[18] http://new.paho.org/disasters/index.php?option=com_content&task=view&id=964&Itemid=911.

COUNTRIES AT HIGH ECONOMIC RISK FROM MULTIPLE HAZARDS
(Top 33 based on GDP with 3 or more hazards)[a]

1. Taiwan, China
2. Dominican Republic
3. Jamaica
4. El Salvador
5. Guatemala
8. Costa Rica
10. Colombia
12. Chile
15. Barbados
18. Ecuador
20. Peru
24. Honduras
27. Mexico
32. BOLIVIA
33. United States

[a] Dilley et al. (2005). Table 7.2.

Bolivia is exposed to a particular set of climatological characteristics that include specific rain, hail, frost, humidity, wind, and pressure patterns.

BOLIVIA

Natural Disasters from 1980 - 2008[b]

Affected People

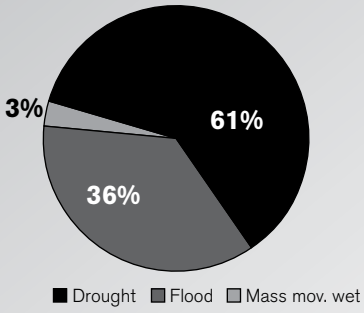
Disaster	Date	Affected (Number of People)
Drought	1983	1,583,049
Drought	1983	1,500,000
Flood	2007	485,000
Flood	2001	357,250
Flood	2007	339,495
Flood	1986	310,000
Drought	1990	283,160
Flood	1997	190,000
Mass mov. wet	1994	165,000
Flood	2006	126,096

Economic Damages

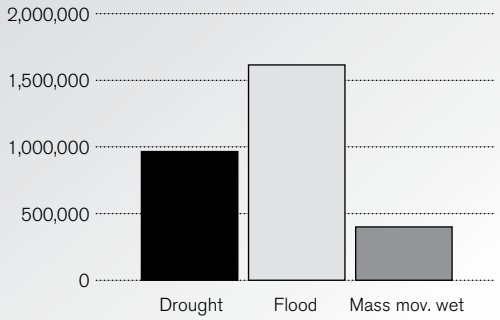
Disaster	Date	Cost (US$ x 1,000)
Drought	1983	500,000
Flood	2007	500,000
Drought	1983	417,200
Flood	1982	400,000
Mass mov. wet	1992	400,000
Flood	2001	121,000
Flood	1992	100,000
Flood	1992	100,000
Flood	2002	100,000
Flood	2007	90,000

Statistics by Disaster Type[b]

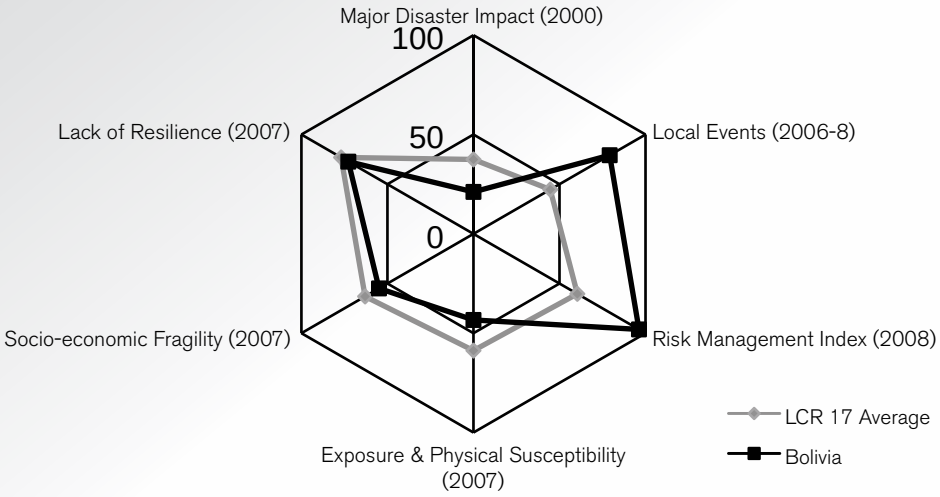
Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



Relative Vulnerability and Risk Indicators[c]



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=21. Source data from EM-DAT. Data displayed does not imply national endorsement.

[c] Relative Vulnerability and risk Indicators are adapted from IADB-IDEA-ERN (2009). Values are normalized on scale of 0 – 100 and presented against the average for 17 LCR countries. Major disaster Impact taken from disaster deficit Index: the ratio of economic losses which a country could suffer during a Maximum Considered event and its economic resilience. Local events taken from Local disaster Index: the propensity of a country to experience recurrent, small-scale disasters and their cumulative impact on local development. risk Management Index is presented as the negative (i.e. 0 = optimal, 100 = incipient) of IADB's risk Management Index: measures a country's risk management capability in (i) risk identification, (ii) risk reduction, (iii) disaster management, and (iv) financial protection. resilience, Fragility and exposure are taken from the component indices of Prevalent Vulnerability Index. Date for local event data depends on information available for each country. Data, and the respective LCR 17 average, from 2000 is used for Dominican Republic, El Salvador, Guatemala, Jamaica and Nicaragua. Data, and the respective LCR 17 average, from 2006-08 is used for Bolivia, Colombia, Costa Rica, Ecuador, Panama and Peru. All LCR 17 averages are calculated based on available data.

DISASTER RISK PROFILE

Bolivia has the 32nd highest economic risk exposure to three or more hazards, according to the Natural Disaster Hotspot study[2] by the World Bank. Bolivia is exposed to significant hazards due to its geographic and hydrometeorological characteristics combined with the vulnerability of its population and infrastructure. During the past three years, the country has experienced a series of emergencies caused by floods, frosts, hail storms, droughts, landslides, and mudslides.

Geological Hazards

Bolivia is geographically diverse, with high plateau (altiplano) zones of altitudes reaching more than 3,000 meters above sea level, middle-elevation valleys, and tropical plains. These geological conditions offer a diversity of temperatures and microclimates throughout the country's 1,158,742 square kilometers. This geographic mix has given rise to the formation of basins that cover most of Bolivia's territory, with some of the basins shaping and feeding into important regional basins.

Major Natural Hazards

Bolivia is exposed to a particular set of climatological characteristics that include specific rain, hail, frost, humidity, wind, and pressure patterns. This is because Bolivia is located in the inter-tropical zone, influenced by warm and cold winds coming from the west and the cold masses from the altiplano and the Andes range.

Extreme rainfall in certain parts of Bolivia causes the consistent overflow of river basins while other regions of the country experience scarcity of rain that causes prolonged drought. Due to the mountainous nature of these high areas in Bolivia, intense rains are associated with mass movements, including landslides and river floods. During the dry season, controlled burning is done; however, due to the lack of appropriate measures and protocols and because of climatic conditions, controlled burning often creates forest fires that reach large areas and pose a risk to local populations. Regional events like El Niño and La Niña also contribute to such floods and droughts in Bolivia. In recent years, the intensified frequency and impact of these events have shown signs of climate change and longer-term repercussions.

The geographic configuration of the territory shows a long history of seismic movements associated with major faults and the consequences of important events in other countries, such as Chile and Peru. The geomorphologic configuration of certain areas increases the risk conditions for liquefactions[3] due to possible seismic movements.

Exposure and Vulnerability

The levels of vulnerability in Bolivia have substantially increased as a result of deepening poverty factors combined with the repeated succession of adverse natural events in the same regions. Estimated losses in these lower-income regions range between 4-6% of the country's gross domestic product. Due to the level of poverty, the associated vulnerability of the population, and inadequate basic infrastructure, Bolivia is highly vulnerable to potential hazards. According to an Inter-American Development Bank (IADB) study, "Bolivia presents a high risk,

[2] Dilley et al. (2005). Table 7.2.

[3] Liquefaction: "The behavior of soils that, when loaded, suddenly go from a solid state to a liquefied state, or having the consistency of a heavy liquid. Liquefaction is more likely to occur in loose to moderate saturated granular soils with poor drainage." (Wikipedia 2010).

particularly in cases of events of low probability and high consequences."[4]

Industries and the general population are deeply affected by adverse natural events, with 40% of the population working in agriculture, 12% in industry, and 49% in the service sector.[5] The estimated population of Bolivia in 2009 was 10,227,299, of which 66% lived in urban areas and 34% lived in rural areas. 62% of the indigenous population lives in urban areas and 38% lives in rural areas. In 2006, the extreme poverty rate was 23% in urban areas and 62% in rural areas.[6]

The rural sector remains the most vulnerable, especially in its productive activities (agriculture and livestock) and transportation. Subsistence agricultural activities are most exposed to risk, endangering food security and nutritional levels of most of the rural population (ECLAC 2008[7]). Due to the high rates of extreme poverty in rural areas, the capacity of resilience among the rural population is minimal, increasing the possibility that each emergency will deepen poverty levels and migration to urban areas will continue to increase. It is important to note that urban areas also lack regulations related to the quality of construction and formal mechanisms to enforce building codes, especially in housing and infrastructure for basic services.

The consequences of climate variability and climate change are evident in events such as rainfall and droughts, which have significantly increased in frequency and intensity. Combined with high levels of vulnerability, these occurrences cause costly damage and losses. These new parameters, such as the amount of precipitation and the duration of the rainy or dry seasons, are not being included in planning processes in Bolivia, resulting in increased limitations of the population's food security, health conditions, and access to basic services.

Recent Disasters and Tendencies

In the past few years, Bolivia has suffered the consequences of adverse natural events such as El Niño and La Niña and has consequently experienced significant losses. As calculated by the Economic Commission for Latin America and the Caribbean (ECLAC), the losses amounted to US$379.9 million in 2006–2007 (3.28% of GDP for 2006) and US$757.5 million for the events registered in 2007–08 (5.72% of GDP for 2007). ECLAC also maintains that the La Niña event of 2007–08 deepened residential vulnerability, especially in families with income sources dependent on natural conditions (such as agriculture).[7]

The events of 2005, 2006, and 2007 affected an average of 45 municipalities, approximately 14% of the country, and a total of 34 municipalities were affected repeatedly during the same three consecutive years. The average number of people affected repeatedly by adverse natural events was close to 500,000. Because of the magnitude of these events, the national government sought international assistance that mobilized around US$40 million in cash, in addition to in-kind support and humanitarian aid. From October 2009 to July 2010, the government had to declare a national emergency due to floods, drought and river contaminations five times.

[4] Cardona (2008:34).
[5] Ibid.
[6] Ibid.
[7] ECLAC (2008).

DISASTER RISK MANAGEMENT FRAMEWORK

Progress in the implementation of the Hyogo Framework for Action in Bolivia is generally limited, with scant coordination and action toward comprehensive disaster risk management.[8] As indicated in the conclusions of a regional study by the IADB that calculated the evolution of the Risk Management Indicators in different countries in the region between 1980 and 2000, "Bolivia shows very little progress on the topic of risk management, which is illustrated in the IGR [Risk Management Index]". Bolivia was described as the lowest among the 12 countries of Central and South America; in 2008, there was a small shift to the 11th position.

The government structures at the national and subnational levels do not have risk reduction policies, strategies, or the institutional capacity to implement them. While there is a participatory and concurrent system of planning, the lack of guidelines, methodologies, and supervision for the inclusion of items associated with disaster risk limits the possibility for prevention and mitigation actions. The levels of exposure to risk are deepened by factors such as the lack of territorial planning and urban settlement policies, manifested through inappropriate land use and overexploitation of environmental resources.

The specific legal framework provided by the Law for Risk Reduction and Response to Disasters or Emergencies enacted in 2000 (Law No. 2140, 2000) has implementation and coordination problems among the different executive branch agencies responsible for DRM activities (that is, the presidency and ministries), creating conflicts of responsibility and function between the Ministries of Development Planning and of Defense. The Ministry of Planning is responsible for prevention, mitigation, and reconstruction, while the Ministry of Defense is responsible for response and rehabilitation. This situation has limited the possibility of comprehensive action at the national level.

The entry into effect of the new National Political Constitution presents an opportunity to improve upon the legal framework and mainstream DRM into the development planning process by clarifying requirements and enforcing additional rules. By incorporating DRM into the sectoral and territorial planning processes, Bolivia can greatly advance DRM efforts and long-term development impact. Although there has been some progress at the departmental and municipal levels, this progress was achieved through technical assistance projects supported by non-governmental organizations in response to recent emergencies. Efforts need to be made to overcome the coordination and communication issues among the national government's agencies responsible for DRM and the central government and its subnational counterparts. The Autonomies Law (No. 031, July 2010) defines risk management responsibilities at the Departmental and Municipal level (including the Native Indigenous Autonomies). It assigns responsibilities to authorities and the allocation of resources. This framework will contribute to reducing the vulnerability and impact of disasters.

Climate change has not been considered in the current planning models in Bolivia, although some climate change initiatives and relevant funding mechanisms could be applied to maximize synergies with DRM activities. Climatic factors and subsequent consequences must be considered in the context of DRM and Bolivia's sustainable development.

[8] National Report about the Progress in the Implementation of the Hyogo Framework for Action, Bolivia, 2008.

International donor organizations and other non-governmental organizations continue to play a critical role in DRM and emergency response in Bolivia. This set of experts and resources has been instrumental in reducing the loss of human life due to natural catastrophes and man-made disasters; however, it is a fundamental role of the government to provide strong leadership within its legal and institutional framework and to commit the necessary human and financial resources to remove the causes of risk, minimize exposure of the population as a whole, and protect vulnerable groups. Since October 2009, the donors and international cooperation started organizing the DRM Subgroup under the group of Environment, depending on the Group of Partners for Development of Bolivia (GruS or *Grupo de Socios para el Desarrollo de Bolivia*).

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

The National System of Risk Reduction and Disaster Response (SISRADE) was created based on the Law for Risk Reduction and Response to Disasters or Emergencies enacted in 2000 (Law No. 2140, 2000). The SISRADE is composed of the National Council of Risk Reduction and Disaster Response (CONARADE), headed by the President of the Republic. Over the years, different sectoral ministries have joined the system and, at present, 11 ministries are represented.[9] The Technical Secretariat of CONARADE is run by the Vice-Ministry of Civil Defense (VIDECI), under the Ministry of Defense.

The current rules state that the Ministry of Development Planning is responsible for the tasks of risk reduction (prevention, mitigation, and reconstruction), and the Ministry of Defense is responsible for the response (response and recovery). The different rules for these executive powers and the definition of the functions and responsibilities among the two ministries have created confusion and contradictions that have substantially complicated compliance with the rules and have thereby hindered DRM activities.

The new regulatory framework strengthens the disaster risk management at the national level. The organization of the Executive Power (Decreto Supremo 29894, February 2009) defines risk management responsibilities for five ministries: Development Planning, Environment and Water, Rural Development and Land, Health, and Public Services, besides the Ministry of Defense in coordination with the Vice-Ministry of Civil Defense (VIDECI). This new regulation will support institutional development with a sectoral vision.

To date, the country has lacked policy and specific risk management strategies at the national, subnational, and sectoral levels. In specific circumstances and in response to the possibility of the impact of El Niño and La Niña, the government approved contingency plans with specific protocols for each emergency. Although the current government presented the National Development Plan in 2006, "To Live Well 2006–2010," which included specific guidelines for risk reduction and emergency response, much work remains to be done to effectively implement DRM activities in Bolivia. Because of the need to update the legal framework, several initiatives were carried out within the executive and legislative powers in 2008. The Defense Committee of the Congress conducted a study of municipalities and prefectures affected by disasters to identify the strengths and weaknesses of the current rules. This

[9] Ministries of Agriculture and Rural Development; Finance; Interior (Ministerio de Gobierno); Development Planning; National Defense; Water; Education and Culture; the Presidency; Ministry of Works, Services and Housing; Health and Sports; and Production and Micro-Enterprise.

Titicaca Lake, Bolivia

committee then presented a proposal for consideration to the executive authorities that needs to be acted upon.

At the subnational (departmental and municipal) levels, the responsibility for risk reduction and response are the responsibility of the gubernators (formerly prefectos) and mayors, respectively. At these levels, the implementation of some actions and strengthening of programs have been possible; however, the coordination among these three levels continues to be very limited and inadequate resources minimize the possibility of effectively managing DRM activities. International cooperation has strengthened programs by providing equipment and building capacity at various national-, departmental-, and municipal-level institutions. The intended impact has not yet been achieved due to high staff turnover in public institutions and a lack of compliance to organizational responsibilities for risk management activities.

A Fund for Risk Reduction and Disaster and Emergency Services was created to complement the rules established by Law No. 2140, but the Fund has not yet been implemented. This has limited risk reduction efforts and disaster response at the national, departmental, and municipal levels. The lack of capitalization has forced the government to assign special, and generally limited, amounts to the financing of disaster response, while creating ad hoc recovery funds that have had limited implementation.

In the Andean region, the implementation of an initiative called 'Disaster Prevention in the Andean Community', referred to as PREDECAN[10], has made important strides in the development of coordination mechanisms and platforms of agreement on the definition of national risk management policies and strategies. This initiative also includes the creation of the virtual disaster library (BiVa-Pad) that compiles the institutional memory of

[10] http://www.comunidadandina.org/predecan/.

documents on specific topics and the implementation of DesInventar as a historical registry of minor and medium disasters.

HFA Priority #2: Disaster risk assessment and monitoring

The monitoring and tracking of seismic, meteorological, and hydrometeorological hazards have been strengthened in the past year, as has the implementation of the early warning systems for local and regional floods. Important efforts have been made in the implementation of the National Information System for Risk Management (SINAGER). These initial efforts resulted in the creation of a virtual library and event database, DesInventar.[11]

The identification and monitoring of the different hazards in Bolivia is carried out by national agencies. The National Meteorology and Hydrology Service (SENAMHI)[12] is responsible for monitoring meteorological and hydrological conditions throughout the country. SENAMHI, with its network of monitoring stations, is the agency responsible for collecting and analyzing information, forecasting, and issuing warnings. Starting in 2008, SENAMHI has received funding to expand its network and improve its technical capacity for analysis and dissemination of hydrometeorological information. SENAMHI is part of a network of agencies that provide information to the International Center for Research on the El Niño Phenomenon (CIIFEN)[13] in Ecuador.

Based on departmental initiatives, systems have been formed to monitor watersheds and rivers, primarily in the country's eastern region. Examples of services that stand out include the Piraí River Water Channeling and Regulation Service (SEARPI) and the Amazon Navigation Improvement Service (SEMENA) in Santa Cruz de la Sierra and Beni, respectively. These systems provide information about the water levels of major rivers and issue relevant warnings.

The Municipality of La Paz is currently implementing an early warning system for floods and landslides for three river basins. Using state-of-the-art technology (telemetry), the municipality is trying to establish a monitoring system of the major rivers in the city and any changes in the conditions of the landslide-prone areas. The project is still in its infancy.

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

The initiatives to create risk management information systems in Bolivia have been promoted by programs and projects since the enactment of Law No. 2140. Currently, PREDECAN is strengthening the National Information System for Risk Management (SINAGER) through VIDECI. The most important initiative and information source is the Andean virtual library for disaster prevention and response[14] that forms a nationwide network of information centers and libraries in each of the five Andean countries. Also, the San Calixto Observatory monitors and disseminates reports on seismic activity in Bolivia.

The inclusion of risk management topics in school curricula at the national level is in its infancy. However, at the local level, and in light of the different hazards, some education systems have included topics such as contingency plans and preventive measures. These initiatives are partly projects and programs implemented by NGOs or programs with international financing. At the post-

[11] http://www.desinventar.org/.
[12] http://www.senamhi.gov.bo/.
[13] http://www.ciifen-int.org/.
[14] http://www.bivapad.org.bo/.

secondary level, disaster risk management topics have not been included as part of graduate-level training. At the post-graduate level, the *Universidad Andina Simón Bolívar* has been implementing an academic program in Management for Risk Reduction and Disaster Response since 2002.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

Little progress has been noted in the structural, comprehensive, and sustainable reduction of the existing vulnerabilities. Most of the actions were developed in response to actual emergencies, and in some cases for the recovery or reconstruction of damaged infrastructure. In the absence of a national policy and strategy for risk management, in some instances, key sectors have taken isolated, unsustainable actions to reduce existing vulnerability.

Public investment related to risk and disasters is oriented toward mitigation of events like floods or droughts. Resources are directed to containment or diversion of river elevations and the drilling or rehabilitation of wells in case of droughts. In relation to protection and retrofitting of civil works, the investment has been minimal and insufficient to confront the level of vulnerability and exposure.

Following from emergency response, some projects have been implemented to compile cultural knowledge of risk reduction. In this way, a number of ancient practices were recovered, such as those of the Suka-Kollus around Lake Titicaca, and the combination of community practices with technical knowledge on hydrological risk management at the headwaters of the Río Grande basin in northern Potosí. These initiatives have helped reduce vulnerability by protecting watersheds and by managing water resources, while improving agricultural and livestock production.

Given the continuous emergencies occurring in the eastern region, early warning systems and contingency plans have been strengthened and improved. These systems are located around the basins of the main tributaries of the Amazon. The development of contingency plans has an institutional perspective, loosely integrated among the different sectors and even less so among the national, departmental, and municipal levels.

Although the legislation mandates the inclusion of budget line items for risk reduction and emergency response activities, the Bolivian Government has no policy in place for the management of financial resources designated for risk management. Compliance is not monitored by the responsible agency even though directives established that national resources shall be used to support departmental, local, and sectoral initiatives. Diversification strategies or the transfer of contingent liabilities have not yet been considered.

In Bolivia, municipalities lack the capacity to enforce urban development regulations, hindering effective and sound land use management. The norms concerning planning and land use management have been in place for several years, but only few departments and municipalities have completed their zoning plans. As a result, in rural areas, settlements and productive activities are being developed near river banks; meanwhile, in the cities, unplanned settlements become legalized over time when municipalities start providing utility services. With regard to specific norms for risk reduction, the country does not have building codes aimed to increase resistance to earthquakes or any other hazards. Such efforts have proven very effective in DRM and need to be applied and adequately enforced in Bolivia.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

The VIDECI is the agency responsible for national-level preparedness and response actions. As a result of the controversy created between the Ministries of Defense and Planning over the distribution of respective responsibilities for recovery and reconstruction activities, there are still a number of programs and allocated resources that need to be activated in response to emergencies that occurred more than two years ago.

According to the principle of subsidiarity established in the legal framework, mayors and gubernators are responsible for the initial response actions, to the extent of their capabilities. Given the prevalence of limited local capacity, intervention by the national level is frequently required, resulting in the slow coordination process for the distribution of humanitarian assistance and duplicated coordination mechanisms. Bolivia's "existing capabilities, in terms of equipment and supplies needed for response to a disaster, are highly inadequate and in urgent need of being strengthened," as indicated by the United Nations Disaster Assessment and Coordination/ Office of Coordination of Humanitarian Affairs (UNDAC/ OCHA)[15] team, which conducted an evaluation of the country's capacity for disaster response in March 2007. The limited availability of resources allocated by the government to disaster response leads to dependency on international cooperation agencies for resources and technical support. That being said, Law No. 2140 stipulates the implementation of financial mechanisms (FORADE) that will allow for reversing this situation, and that must be activated as soon as possible.[16]

Emergency response is repeatedly faced with the lack of protocols and standards for sectoral actions and for territorial coordination (at the national, departmental, and municipal levels). This results in problems of information management and slow identification of effective and efficient humanitarian response actions. The mere establishment of Emergency Operation Centers does not effectively contribute to the development of information exchange and circulation mechanisms, nor does this ensure the coordination of actions. However, the coordination mechanisms for international cooperation have been strengthened through the United Nations System in recent years, in particular through the expanded United Nations Emergency Team. At the national level, there have been efforts to implement sectoral coordination with the establishment of coordination commissions and information management to provide humanitarian assistance.

Although the legislation mandates the inclusion of budget line items for risk reduction and emergency response activities, the Bolivian Government has no policy in place for the management of financial resources designated for risk management.

[15] Coordination and Evaluation Team of the Office of Coordination of Humanitarian Matters.
[16] Report of the UNDAC Mission to Bolivia, p. 6.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Emergency Recovery and Disaster Management Project (including additional financing of US$4.4 million that is yet to become effective)	World Bank	16.9 million 2008-2012	1, 4
Technical assistance to strengthen Bolivia's Disaster Risk Reduction Framework	World Bank	360,000 2007-2011	1, 3, 4, 5
Mainstreaming Adaptive River Defense for Huayhuasi & El Palomar Settlements	World Bank	427,000 2007-2010	1, 2, 4
Hazard Risk Management	CAF	75 million	1, 2, 3, 4, 5
Technical assistance to the Ministry of Development Planning for the formulation of policies and strategies for risk reduction and post-disaster recovery	UNDP (Crisis Prevention Recovery Disaster Reduction Unit) Spanish Agency for International Cooperation	1,388,923 2007-2011	1, 2, 3, 4
Assistance to the food security	Italian Cooperation	2.6 million 2009-2010	5
Program of Risk Reduction (PRRD) - Phase III	COSUDE	5 million 2010-2014	1, 2, 3, 4, 5
Program of Agriculture Development Sustainable (PROAGR)	GTZ	3.3 million 2008-2010	4
Food Assistance	WFP	12 million 2009-2011	5
Disaster Preparedness Program (DIPECHO), Version #6 – Support to prepare disaster response	European Commission	not available	5

The Bolivia Emergency Recovery and Disaster Management Project (ERDM) includes a rehabilitation, reconstruction, and small mitigation works component. In support of the implementation of the National Plan for Sustainable Rehabilitation and Reconstruction (PRRES), the A Credit (P106449, 4377BO) for the Bolivia Emergency Recovery and Disaster Management Project (ERDM) project will contribute to restoring access to basic infrastructure for a portion of the affected population in five target regions, and to strengthening the Government's ability at the national, sectoral, and municipal levels throughout the country to respond to future disasters. As of May 2010, 110 subprojects have been completed with the estimated number of beneficiaries at 121,008.

Given Bolivia's disaster risk profile and its existing framework for disaster risk management, the key priority in Bolivia is to institutionalize disaster risk management at the sectoral and territorial levels. Strategic actions are needed in the following areas to enhance disaster risk management in Bolivia: (i) strengthen institutional capacity for strategic planning and coordination at sectoral and territorial levels, (ii)

reduce vulnerability to adverse natural events at the local level, and (iii) develop a comprehensive risk assessment and monitoring capacity. The GFDRR is strengthening the SISRADE according to the current norm and supports them to fulfill their roles and responsibilities, supporting the country Strategic Agenda and institutional coordination. The support is provided to SENAMHI, OSC and the Ministries of Rural Development and Land, Health and Sports, Environment and Water, and Civil Defense in order to improve their knowledge of natural hazards and prepare the National Program of DRM for the next ten years.

Under the leadership of VIDECI, the GFDRR and ECLAC have provided support to prepare the Damage and Loss Assessment of El Niño 2009/2010 and the Reconstruction and Recovery Program. The assistance included training of around 40 people in the ECLAC's methodology and validated the national version for future use.

The opportunity to develop a Risk Assessment Platform will be revisited with the Bolivian authorities. This approach will be similar to the ongoing effort in Central America under the Probabilistic Risk Assessment initiative referred to as CAPRA.[17] This initiative to help countries identify and assess risk in a comprehensive manner would raise disaster risk awareness and contribute to increased resilience in Bolivia.

[17] http://ecapra.org.

COUNTRIES AT RELATIVELY HIGH MORTALITY RISK FROM MULTIPLE HAZARDS (Top 35 based on population with 3 or more hazards)[a]
1. Taiwan, China
2. El Salvador
3. Costa Rica
5. Dominica
6. Antigua and Barbuda
7. Guatemala
9. DOMINICA
11. Nicaragua
14. Honduras
17. Colombia
20. Trinidad and Tobago
23. Chile
26. Mexico
33. Venezuela
35. Panama

[a] Dilley et al. (2005). Table 1.2.

The combination of rainfall, geology and topography in Dominica is particularly favorable to the development of landslides of various types.

Dominica

DOMINICA

Natural Disasters from 1980 - 2007[b]

Affected People

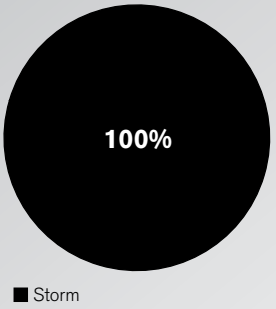
Disaster	Date	Affected (Number of People)
Storm	1984	10,000
Storm	2007	7,530
Storm	1995	5,001
Storm	1999	715
Storm	1989	710
Storm	2001	175
Earthquake*	2004	100
Storm	1980	0
Storm	1995	0

Economic Damages

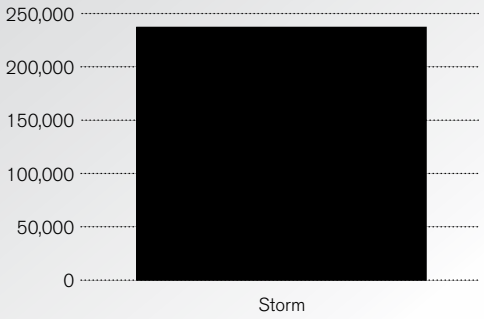
Disaster	Date	Cost (US$ x 1,000)
Storm	1995	175,000
Storm	1989	20,000
Storm	1995	20,286
Storm	2007	20,000
Storm	1984	2,000
Storm	1980	0
Storm	1999	0
Storm	2001	0
Earthquake*	2004	0

Statistics by Disaster Type[b]

Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=51. Source data from EM-DAT. Data displayed does not imply national endorsement.

DISASTER RISK PROFILE

Dominica is the northernmost member of the Windward Island group of the Caribbean. It is north of Martinique located at 15 o 25' north latitude by 61 o 20' west longitude. The island occupies approximately 751 km^2 and is approximately 48 km on the north-south axis and approximately 24 km in the east-west direction. The country supports an estimated population of 110,000 persons.

Dominica is a mountainous volcanic island with steep terrain features. The highest point on the island is Morne Diablotin which rises to approximately 1,447 m and is located in the northern area of the island. Morne Trois Piton rises to approximately 1,424 m and is located in the southern section of the island. Much of Dominica's center is dominated by steeply dissected terrain. As a result, population centers tend to be located along mountain tops and stream valleys with the majority of the population, nearly 90%, located in settlements along the coastal fringe of the island.

Dominica experiences some of the highest annual rainfall amounts in the region which are heavily influenced by orographic effects. As a result, annual rainfall totals vary across the island depending on the topographic setting. There is some seasonality to the rainfall distribution but amounts typically range from 500 cm along the coast to over 900 cm annually. This rainfall coupled with the island's steep topography contributes to the increased risk of landslide and floods.

Since 1950, Dominica has been exposed to 13 named tropical storm systems passing within 40 km of the island. Since 1979, the island has been impacted by 15 tropical systems including 11 hurricanes. The most notable recent storm was hurricane David, a Category 4 storm whose eye crossed the southern portion of the island. This storm produced 250mm of rainfall over a 24-hour period and produced sustained winds of 240 km/h. Damage to the island was severe with major agricultural losses and the damage or destruction of some 80% of the island's housing stock. In August 2007, Dominica was impacted by Hurricane Dean with gusts up to 170 km/h and about 200mm rainfall over an 18-hour period. The hurricane resulted in flooding and landslides in parts of the island and strong waves affected coastal areas. The agricultural sector (crop, livestock, fisheries) was hardest hit.

Geological Hazards

Dominica is considered the most geologically active island in the Caribbean. It lies close to the eastern margin of the Caribbean plate and is the only island with more than one volcano. Dominica has eight volcanoes. Earthquake activity originates from two sources, tectonic activity associated with plate movement and magma displacement associated with volcanic activity. The severe topography of the island favors landslide potential and flooding from the island's many streams; this is a significant recurrent event. Dominica is considered by the scientific community to be at significant risk from volcanic eruption within the next 100 years.

Seismic Activity

Most of the seismic activity on Dominica is associated with the island's volcanic activity which produces shallow small-magnitude earthquakes. Earthquake swarms are not uncommon and appear to be tending toward stronger and shallower events. This suggests an increase in the risk of magmatic eruption. The region is tectonically active and Dominica is exposed to potential earthquake impacts associated with plate activity. In 2004, an earthquake of magnitude 6.3 was located some 10 km north of the island. The quake coincided with a three-day period of rainfall and triggered numerous landslides throughout the island. Damages

to structures were significant but no deaths were reported on the island. In 2007, an earthquake of 7.4 magnitude located off the coast of Martinique was felt throughout the entire region. While no major damage was reported in Dominica, the earthquake did trigger a payment to Dominica under the recently created Caribbean Catastrophic Risk Insurance Facility (CCRIF). This was the first payout ever to be made under the CCRIF.

While tsunamis are not considered a major recurrent risk for the region, the low-lying nature of the coastal developments would make them particularly vulnerable to tsunami activity. Particularly vulnerable is the island's tourism infrastructure. Recent studies have evaluated the potential for earthquakes in the vicinity of Dominica to create tsunami.

Floods and Landslides

The combination of rainfall, geology and topography in Dominica is particularly favorable to the development of landslides of various types. Steep cliffs present a constant threat to roads and villages from rock fall and debris slides. Landslides along river courses are not uncommon and the temporary pooling of water behind landslides is a significant contributor to flood risk on the island. One such location is an active slide located at the confluence of the Matthieu and Layou rivers some 6 km northeast from the mouth of the Layou. The landslide formed in 1997 effectively blocked the discharge of the Matthieu river to the Layou. Subsequent failure of the slide dam resulted in the flooding of the downstream portions of the Layou river and major damage along the Layou Valley to the coast. Over the years, the landslide stabilized flooding watershed of the Matthieu River, creating a lake known as Miracle Lake. The relatively large volume of water compounded in this system presents a continuing threat to the Layou Valley.

Flash floods are also a constant threat in Dominica.

Determinants of Vulnerability to Adverse Natural Events in Dominica

An estimated 90% of the population lives within 5 km of a live volcano.[1] Dominica is a highly active volcanic island and while major eruptions are not a regular event, Dominica is currently considered overdue for an eruption event.

Dominica's steep topography is a major factor contributing to the island's vulnerability to landslides. Landslides are a recurrent threat and the tendency for development in coastal areas places infrastructure frequently at the base of landslip-prone slopes. The limited area available for construction is generally found along rivers that have cut through the mountainous terrain, which exposes these areas to potential flooding.

Limitations on land suitable for construction have forced an expanding population to construct homes on vulnerable slopes, increasing their risk potential. Terrain also determines where transportation routes can be constructed. In the case of Dominica, mountain roads are circuitous and have limited capacity. For many areas there are limited access options should the principal access route be impeded.

Dominica has a single port with container-handling capacity and two ports that can accommodate smaller inter-island traffic. There are two airports: Canefield's, used largely for inter-island traffic, and Melville Hall, Dominica's

[1] CDERA (2003b).

principal international airport facility. Electric power generation is provided by both diesel and hydropower generation. Two diesel-generating facilities are located at Fond Cole and Portsmouth. Three hydro-power facilities are located at Laudat, Trafalgar and Padu. Diesel facilities are entirely dependent on imported fuel to sustain operations, and hydro facilities are vulnerable to seismic and extreme rainfall events. Distribution is by above-ground transmission lines which are subject to impacts from high winds and landslip activity.

The health infrastructure is comprised of 51 health centers/clinics and 3 hospitals.[2] The Princess Margaret Hospital (PMH), in Roseau, is the main healthcare facility in Dominica.

Climate Change and Global Warming

Dominica has recently been cited as one of six Caribbean countries in the world's top 40 climate "hot spots" by the Germanwatch Global Climate Change 2009 Risk Index.[3] The country was ranked 25th out of 150 countries based on an analysis of weather events between 1998 and 2007. The 2010 Global Climate Risk Index is based on figures from 2008 and is also an analysis of the worldwide data collection on losses caused by weather-related events from the years 1998–2008. Dominica was ranked 55th with losses of 9.62% GDP, and 72nd for the decade with GDP losses of 7.25%.[4] Two factors were cited: the impact of global warming on rising sea levels which increase the risk of storm surges, and secondly the increase in the strength of hurricanes.[5]

Climate Change models[6] have predicted that Dominica will undergo a warming and drying trend and is expected to endure more frequent heat waves and droughts, rainfalls with increased intensity, and rising sea levels as predicted for the rest of the Caribbean consistent with the projected global median.[7] It is known that inter-annual climate variability of either the Pacific or Atlantic explains a significant amount of the total variance in rainfall in the Caribbean and Central America.[8] Probable climate change impacts in Dominica include higher temperatures, higher storm intensities and, possibly, more frequent El Niño-Southern Oscillation (ENSO)[9] events, exacerbating existing health, social and economic challenges affecting Dominica.

Changes in sea surface temperature as a result of climate variability could increase the intensity of cyclones and heighten storm surges, which in turn will cause more damaging flood conditions in coastal zones and low-lying areas. According to the World Bank's study, "Sea Level Rise and Storm Surges",[10] the impact of sea level rise and intensified storm surges in Latin America and the Caribbean will be high. While data is not available for Dominica, data for Puerto Rico is showing an increase of 51.84% - with 53.81% of the

[2] PAHO (2007).
[3] McLymont-Lafayette (2008).
[4] Harmeling et al. (2009). Table 5.
[5] McLymont-Lafayette, I. (2009).
[6] Hadley Centre Coupled Model, Version 2 (HADCM2), as reported in Mulligan (2003). Same modeling data as used by the Intergovernmental Panel on Climate Change (IPCC).
[7] Chen et al. (2008).
[8] Giannini et al. (2002).
[9] El Niño-Southern Oscillation; commonly referred to as simply El Niño, a global coupled ocean-atmosphere phenomenon.
[10] Dasgupta et al. (2009).

coastal population exposed and potential losses of coastal GDP projected to exceed 52.71%.

Dominica's first National Communication on Climate Change (NCCC)[11] was released in 2001. Based on Intergovernmental Panel on Climate Change (IPCC) models, it projects that by 2050 the annual precipitation will decrease by 20 to 30 percent, the sea level will rise by 26 to 39cm, and the temperature will increase by 1.71 to 2.5 degrees Celsius. All of the principal social and economic sectors in Dominica are vulnerable to the potential impacts of climate change.

DISASTER RISK MANAGEMENT FRAMEWORK

Disaster preparedness and emergency response in Dominica is implemented under the authority of the Emergency Powers Act of 1951 (amended in 1973 and 1990).[12] A National Disaster Plan was initially developed in 1988 and subsequently revised. The latest revision is from 2006.[13]

While no national disaster management act has been passed in Dominica, the Office for Disaster Management (ODM) operates under the auspices of the National Emergency Planning Organization. NEPO is chaired by the Prime Minister and is composed of Ministers, key staff from government agencies, corporations, businesses and non-governmental organizations. The committee functions to coordinate the development of national disaster policy and serves as the inter-agency focus during disaster events. Proclamations of an emergency are made by the President.[14]

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

ODM is largely focused on emergency response preparedness and response activities. The office is staffed with 3 technical specialists and 2 support staff. Technical specialists include a Geologist, a Disaster Specialist/Aviation Manager and a Disaster Specialist/Meteorologist.

Disaster management operations are executed in accordance with The National Disaster Plan. This plan was initially prepared in 1996 and subsequently revised in 2006. The 2006 plan was not formally adopted and is being revised. A final plan is expected to be issued in 2010.

ODM is operational and an Emergency Operations Center has been constructed. A national warehouse has been prepared and satellite storage in the form of containers has been located around the island.

Dominica has recently been cited as one of six Caribbean countries in the world's top 40 climate "hot spots" by the Germanwatch Global Climate Change 2009 Risk Index.

[11] Ministry of Agriculture and Environment (2001).
[12] OAS-DSD (1951). See also OAS-DSD (1987a).
[13] The Office for Disaster Management (ODM) is currently operating on a draft plan revised in 2006 but not formally adopted. Efforts are underway (2010) to revise this draft in preparation for the formal adoption of the revised management plan.
[14] OAS-DSD (1978a).

Disaster risk reduction through development policy and planning is currently not included in the national DRM strategy. A building code is being managed through the Development Control Agency (DCA) but enforcement is variable. National policy currently does not yet mandate DRM as a development objective and has not yet been adopted as an operational principle in the national line ministries.

HFA Priority #2: Disaster risk assessment and monitoring

The Meteorological Service is the national monitoring agency for weather-related phenomena. The office monitors forecasts provided by U.S. National Oceanic and Atmospheric Administration and Barbados Meteorological Service. As needed, the Meteorological Service provides public warnings and relays forecasts to the ODM for planning and action. ODM assists in coordinating the distribution of these warnings and provides public preparedness advice under a system prescribed in the national plan. Warnings are distributed through radio, television and loudspeaker broadcasts, as well as storm warning flags displayed at police stations.

Real-time seismic and volcano monitoring is managed through the University of the West Indies Seismic Research Centre. A network of 10 seismographic stations has been installed on Dominica through the UWI program. This is augmented by private contributions of additional stations and ongoing research activity relating to mapping and monitoring of the volcanic systems of Dominica. Periodic deformation surveys are made using precision GPS equipment to assess volcanic activity. Dominica

has been experiencing a swarm of seismic activity that began in May 2009 and continued through January 2010. Warnings and bulletins are issued to ODM by UWI for action. ODM issues public announcements as needed. Additionally, UWI provides public bulletins and information through their website.[15]

Hazard Mapping has been completed in several areas and GIS map datasets have been prepared. Past initiatives have produced several hazard maps including landslide risk, volcanic hazard assessment, multiple hazard map, storm hazard, wind, wave, seismic, structural and human structural. Additionally digital base maps at a scale of 1:25,000 have been prepared and include roads, contours, beaches, rivers, rainfall, electric lines, schools settlements, ports, and quarries.[16] Maps are maintained by the physical planning unit of the Ministry of Housing, Lands, Settlement and Water Resources.

ODM currently lacks GIS mapping resources. ODM currently does not have a GIS mapping capability and lacks equipment, software and trained GIS professional staff. As a result, ODM is unable to use the hazard mapping tools developed under past initiatives.

Dominica ranks 6th in regional benchmarking. A vulnerability risk assessment utilizing the Vulnerability Benchmarking Tool (BTool), was conducted in all six independent Eastern Caribbean States during 2006 to 2007. The report indicated that within the OECS region, Dominica placed sixth in the assessm ents of the risk mitigation, risk transfer, recovery and rehabilitation indices. A second BTool audit commenced in 2008 but has not been completed for Dominica.

HFA Priority #3: Use of knowledge, innovation and education to build a culture of safety and resilience at all levels

Socialization of disaster awareness is not currently a strong component under Dominica's disaster management program. Citizens are generally aware of the geologic and metrological hazards facing the island but an active education and awareness program has yet to be developed. ODM does issue alerts and preparedness advice at the onset of the hurricane season but no formal education programs have been developed for integration into the educational curriculum. Additionally, there currently (2010) is no program for training construction contractors in disaster-resistant construction techniques.

Educational programs in Dominica are limited. A recent advancement was the conduct of the first Hazard Awareness Week (2009), sponsored by ODM. Additional activities are contemplated under this area as resources become available.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

Building-code legislation has not been formally adopted in Dominica.[17] While the Caribbean Building Code (CuBIC) was developed in the 1990's under the OECS (Organization of Eastern Caribbean States) initiative, Dominica has yet to adopt a standard building code that carries force of law.

Land use planning currently does not fully incorporate disaster risk reduction considerations in Dominica. While some land use

[15] http://www.uwiseismic.com.
[16] CDERA (2003b).
[17] World Bank (2001).

planning occurs, its translation into actual land use constraints based on disaster risk criteria remains to be fully incorporated into the planning process. Land use planning and approval of construction plans rests with the Ministry of Housing, Lands, Settlement and Water Resources.

DRM strategies are yet to be integrated into the national development program. The disaster management program in Dominica is oriented at response and response planning. The program is in the early stages of considering the integration of risk reduction strategies and enabling legislation is yet to be developed to assign DRM responsibilities and authorities.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

Dominica's capacity to respond to a major disaster without major outside support will remain limited for the foreseeable future. Risk reduction and improved insurance coverage will be key factors supporting reconstruction capacity. As it relates to public sector risks, Dominica is a subscriber to the Caribbean Catastrophic Risk Insurance Facility. This offers some relief in the event that the policy is triggered.

Dominica is a member of the regional Caribbean Disaster Emergency Management Agency (CDEMA).

The tourism sector, a major contributor to the Dominica's economy, is largely insured by commercial underwriters. While insurance is available in Dominica, sectors such as agriculture, transport, and/or housing remain relatively vulnerable.

Vulnerability assessments of the health sector infrastructure have been carried out recently. The Princess Margaret Hospital, the main healthcare facility in the country, was assessed in 2008 using PAHO/WHO hospital safety index. The assessment provided an estimate of the hospital's capacity to continue providing services during and after a large-scale disaster or emergency and guided necessary interventions actions to increase the hospital's safety in case of disasters. The recommendations addressed structural, non-structural and functional aspects of the facility. Some of these recommendations have already been implemented. Using the same methodology adjusted to serve smaller health facilities, all 51 health centers/clinics and 2 district hospitals have also being assessed. At this point the country has clarity about the vulnerability status of its health infrastructure.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Comprehensive Disaster Management Harmonised Implementation Program (CDM HIP) - Community disaster risk reduction component (technical support including the conduct of vulnerability assessments for communities, training, infrastructural works, multi- hazard database development	CDEMA / OECS / CIDA / DFID	125,000 2009-2010	1, 2, 4
Caribbean Risk Initiative	UNDP	2.1 million 2004-2010	1, 2, 3
Enhancing Resilience to Reduce Vulnerability in the Caribbean	Government of Italy	4.5 million 2009-2011	1, 2, 3, 4, 5
Mainstreaming DRM in the OECS countries	IDB	400,000 2008-2011	
Regional DRM Strategy for the Caribbean Tourism Sector	IDB	800,000 2007-2009	
Regional Monitoring and Evaluation Framework for DRM in the Caribbean Tourism Sector	IDB	750,000 2009-2012	
Natural Disaster Management – Emergency Relief Hurricane Dean	CDB	100,000 2007	5
NDM – Rehabilitation of Sea Defences, Hurricane Omar	CDB	4,060,000 5,100,000 2008	4
NDM Immediate Response Consultancy Services – Hurricane Omar	CDB	500,000 20,000 2008	

COUNTRIES AT RELATIVELY HIGH ECONOMIC RISK FROM MULTIPLE HAZARDS
(Top 75 Based on GDP with 2 or more hazards)[a]

1. El Salvador
2. Jamaica
3. DOMINICAN REPUBLIC
4. Guatemala
8. Costa Rica
9. Colombia
13. Trinidad and Tobago
14. Antigua and Barbuda
15. Barbados
17. Ecuador
18. México
19. Dominica
20. Nicaragua
21. Chile
33. Haiti

[a] Dilley et al. (2005). Table 7.2.

Tropical storms and floods join the hurricanes among the disasters that have had the greatest impact in the Dominican Republic.

DOMINICAN REPUBLIC

Natural Disasters from 1980 - 2008[b]

Affected People

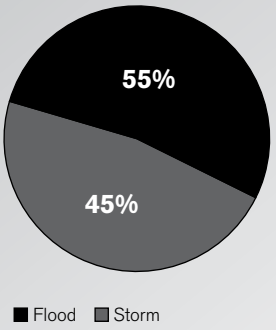
Disaster	Date	Affected (Number of People)
Flood	1988	1,191,150
Storm	1998	975,595
Flood	1981	150,000
Storm	2007	79,728
Flood	2003	65,003
Storm	2007	61,605
Storm	1996	25,000
Flood	1993	20,000
Flood	2007	16,000
Storm	2004	14,009

Economic Damages

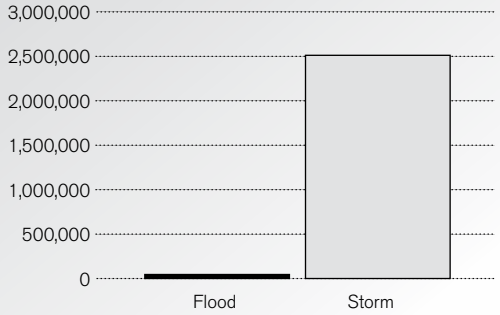
Disaster	Date	Cost (US$ x 1,000)
Storm	1998	1,981,500
Storm	2004	296,000
Storm	2007	77,700
Storm	1980	47,000
Storm	2007	45,000
Flood	2003	42,620
Storm	2007	40,000
Storm	1987	23,700
Flood	2003	2,100
Storm	2004	1,000

Statistics by Disaster Type[b]

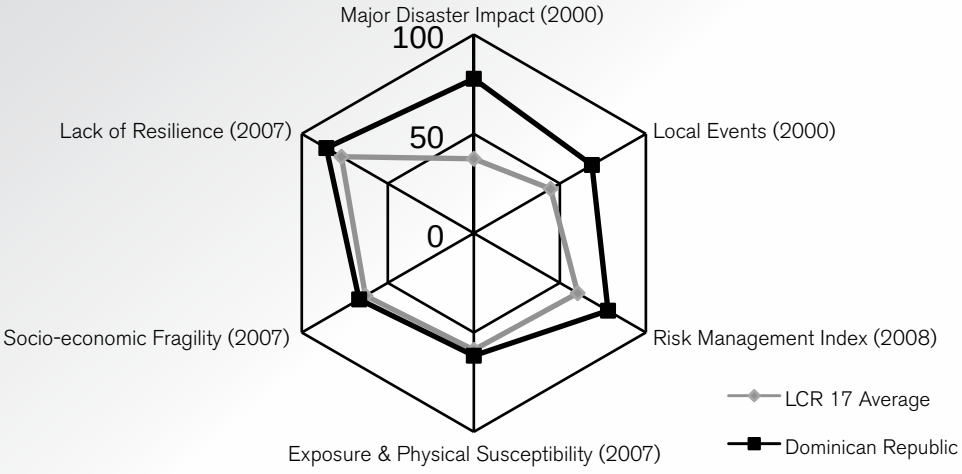
Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



Relative Vulnerability and Risk Indicators[c]



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=52. Source data from EM-DAT. Data displayed does not imply national endorsement.

[c] Relative Vulnerability and risk Indicators are adapted from IADB-IDEA-ERN (2009). Values are normalized on scale of 0 – 100 and presented against the average for 17 LCR countries. Major disaster Impact taken from disaster deficit Index: the ratio of economic losses which a country could suffer during a Maximum Considered event and its economic resilience. Local events taken from Local disaster Index: the propensity of a country to experience recurrent, small-scale disasters and their cumulative impact on local development. risk Management Index is presented as the negative (i.e. 0 = optimal, 100 = incipient) of IADB's risk Management Index: measures a country's risk management capability in (i) risk identification, (ii) risk reduction, (iii) disaster management, and (iv) financial protection. resilience, Fragility and exposure are taken from the component indices of Prevalent Vulnerability Index. Date for local event data depends on information available for each country. Data, and the respective LCR 17 average, from 2000 is used for Dominican Republic, El Salvador, Guatemala, Jamaica and Nicaragua. Data, and the respective LCR 17 average, from 2006-08 is used for Bolivia, Colombia, Costa Rica, Ecuador, Panama and Peru. All LCR 17 averages are calculated based on available data.

DISASTER RISK PROFILE

The Dominican Republic has the third highest economic risk exposure to two or more hazards, according to the 2008 update of the Natural Disaster Hotspot study[2] by the World Bank. In addition to the exposure of 94.7% of the national population, in 87.2% of the national territory and 95.6% of the GDP to two or more hazards, vulnerability in the DR is also influenced by the debt burden, health status, climate change, weak building code enforcement and other factors.

Major Natural Hazards

Due to its geographical location and geotectonic characteristics, the Dominican Republic is exposed to a variety of natural hazards, including hydrometeorological and geophysical. Located in "hurricane alley," the DR, along with Haiti and Jamaica to the West and Puerto Rico and the Antilles to the East, is located in one of the most seismically active regions in the hemisphere, situated on the boundary of the Caribbean Plate, to the South, and the North American Plate to the North. The island nation is further affected by the Gonave Microplate, extending West from the Caymans to a fault near Longitude 71W where the Hispaniola Puerto Rico Microplate begins and continues East to the Mona Passage West of Puerto Rico. Both microplates are limited by the Septentrional Fault to the North and the Enriquillo-Plantain Garden Fault and Muertos Trough to the South[3]. Both faults run on land and pose a direct seismic threat to the island. Two additional seismic faults bound the island to the north (North Hispaniola fault, westward continuation of the Puerto Rico subduction trench) and to the south (Muertos fault)[4].

Natural disaster data from the Dominican Republic published on the PreventionWeb website[5] indicates 40 natural disaster events for the period 1980 to 2008, which affected 2.65 million people with total economic damages estimated at US$2.56 billion. Economic damage by disaster type was reported as follows: storms accounted for US$2.51 billion and floods US$44.2 million. The number of people killed was reported as 1,446, with 42 percent by storms, 55 percent by floods, and the remaining 3 percent caused by epidemics.

Flooding and landslides pose serious risks to the Dominican Republic during the rainy season (June to November). Flooding is common for the following primary watersheds nationwide: Haina, Nizao, Ocoa, San Juan, Yaque del Sur, Yaque del Norte, Yuna,[6] Soco, and the riverbanks of the cities of Santo Domingo and Santiago.[7] Likewise landslides are common due to precipitation and a great hazard in conjunction with seismic events of relevant magnitudes. The primary mountain ranges at risk include the Septentrional, Central, Oriental, Neiba and Bahoruco.[8]

Storms and Floods

Hurricanes that marked the Dominican Republic's history and development include: The hurricane in 1502 that forced the relocation of Santo Domingo, the capital. Other historic hurricanes were Lilis in 1894; San Severo in 1909; and San

[2] GFDRR (2008).
[3] Mann et al. (1995).
[4] Manaker et al. (2008).
[5] Prevention Web (2010c).
[6] Cocco (N. D.a).
[7] Dunn (2009).
[8] Cocco (N. D.b).

Zenon in 1930 – a Category 4 whose eye passed over the city and claimed an estimated 6,000 lives. Hurricanes Flora and Edith in 1963 and Inés in 1966 followed. The first Category 5 hurricane to make a direct hit in the DR was David in 1979. It killed 2,000 people and caused nation-wide flooding. The combined losses from David and Tropical Storm Frederick – 1 week later - were US$2,654,700,000. More recent hurricanes affecting the DR have not been as powerful. Hurricane Georges in 1988 packed winds of 110 mph and left 8 million people without power.[9] Some 595 persons were injured, 64 persons disappeared, and 85,420 persons were dislocated. Georges caused losses estimated at US$3,116,100,000. Hurricane Jeanne in 2004 caused major flooding in the Eastern DR destroying large bridges with losses amounting to US$331,500,000.[10]

Tropical storms and floods join the hurricanes among the disasters that have had the greatest impact in the Dominican Republic. In November 2003 floods the lower watershed of the Yaque del Norte and Yuna rivers forced the Taveras Dam to release 820 cubic meters per second, prompted the evacuation of 47,270 people,[11] and generated US$49,300,000 in damages. On October 29 2007 Noel caused floods from Barahona to Pedernales in the southwest worth US$439,000,000,000 in losses. Noel affected over 6 million people (70 percent of the population). The death toll was 87 persons, 34,172 persons were displaced, 20,000 houses were affected, and 42 persons disappeared. Less than two months later, on December 12 2007, Tropical Storm Olga brought severe flooding to the Eastern DR. CEPAL (2008) estimates this extreme precipitation was equivalent to 170% of normal rainfall, which was attributed to climate change. Olga obliged yet another emergency operation of the Taveras dam and caused losses of US$105 million.[12] In 2008 Fay, Gustav and Hanna caused flooding in the East, South and North before continuing to Haiti.[13]

Earthquakes and Tsunamis

The Dominican Republic has a long history of destructive earthquakes and owes part of its current geology to past volcanic eruptions. The DR has a historic record of strong earthquakes including those of 1551, 1562 (destroying Santiago, Jacagua and La Vega), 1673, 1691, 1751, 1761, 1770, 1842, 1860, 1910, 1911, 1915, 1916, 1918, 1946 and 2003. The event on May 9, 1673 destroyed Santo Domingo and caused 120 aftershocks for 40 days. Another on October 18 1751 affected the entire southern coast with aftershocks and tsunamis. The cities of Azua in the DR and Port Au Prince in Haiti were destroyed. The estimated intensity was IX or X on the Modified Mercalli scale. The country's third most important earthquake was magnitude 7.9 (originally classified as 8.1) on Sunday, August 4th 1946 generating a deadly tsunami in the Bahía Escocesa on the northeast coast. There were numerous landslides and liquefaction sites throughout the Northeast region of the country as well as 1,200 aftershocks during the ensuing year.[14]

The Dominican Republic's ongoing seismic hazard following the tragic and historic magnitude 7 earthquake in Haiti on January 12, 2010. This event only released limited stress on the western portion of the Enriquillo-Plantain Garden Fault, which remains a significant source of hazard. This earthquake and dozens of strong aftershocks were felt strongly as far away as Santo Domingo, the Capital. Both the

[9] Cocco (2001).
[10] Dunn (2009).
[11] Cocco (N. D.c).
[12] Dunn (2009).
[13] Cocco (2009).
[14] Corominas (1998). See also Cocco (2001).

Septentrional and the Enriquillo-Plantain Garden Fault systems are capable of producing a magnitude 7.5 event without prior warning. There is concern in the scientific community that the Septentrional fault in the Cibao valley, which has not experienced a large event in about 1,000 years but is steadily building up stresses, is overdue for a large earthquake. In addition, the offshore subductions to the north and south of the island are capable of magnitude 7,5 or greater earthquakes, such as the 1946 event in the north or the 1751 event that strongly affected the southern part of Hispaniola.[15]

Tsunamis have been reported along the North, East and Southern coasts of the Dominican Republic since 1751. Two reported tsunamis were localized as in 1751, affecting Azua, and 1946. The Sunday, August 4 1946 tsunami resulted from the 7.9 earthquake in the Bahía Escocesa. One week later a 7.8M aftershock and another tsunami affected the same area. Reports frequently do not detail deaths due specifically to tsunamis, especially if associated with a large earthquake. However, documents for the 1946 event which killed the population of Matancitas in Nagua, report deaths from 500 to 1,790 people.[16] The DR has also witnessed tsunamis generated at a distance. This includes the Portugal magnitude 9 earthquake on November 1, 1755.[17]

Volcanoes

The country has over a dozen volcanoes, none of which are active. However, the past volcanic activity yielded fertile lands for agriculture as well as gold and copper mining throughout much of the central Dominican Republic. Additionally there are active traces of past volcanic activity such as sulfuric and thermal wells throughout the country, several are promoted for eco-tourism and health purposes. In Azua there is a natural asphalt field and areas in the deep southwest such as Oviedo have ancient lava fields that stretch for kilometers. Duarte's Peak is an extinct volcano and is also the highest elevation of the Caribbean at 3,110 meters.

Landslides

The landslide on the Haiti-DR border on May 24, 2004 was the result of over 500 mms of precipitation between May 18 and 25th. The La Selle mountain range in Haiti is reported as 90% deforested, reaches 2700 meters in height, and drains into the Soliette River. This event caused a flash flood washing parts of Fonds Verrettes in Haiti 12 kms through the canyon crossing into Jimaní and the Bahoruco mountain range in the Dominican Republic. The Arroyo Blanco stream continued the swath of catastrophic erosion, washing some residents and their belongings into Enriquillo Lake 5 kms downstream. The transnational event killed 237 Haitians, 393 Dominicans and 274 people were reported missing.[18] In addition to landslide hazards above sea level a new oceanography study sponsored by the Spanish government found evidence that off the south coast of the Dominican Republic of an active deformation, the "Muertos Megasplay." The finding means greater vulnerability to large undersea landslides of high seismic danger and, in certain ways, of tsunamis.[19]

[15] Manaker et al. (2008) and edit of this section by Dr. Eric Calais, August 2010.
[16] Fay and Lander (2003). See also Cocco (2001).
[17] Mercado–Irizarry and Liu (2006).
[18] Cocco (2004).
[19] *Diario Libre* (2010). See also abstract of study available in Spanish at http://eprints.ucm.es/5880/1/COMUNIC_BATHY2.pdf.

Exposure and Vulnerability

In addition to the exposure of 94.7% of the national population, in 87.2% of the national territory and 95.6% of the GDP to two or more hazards,[20] the Dominican Republic's vulnerability to disasters is also linked to its debt burden. The public debt is high at approximately 40.6 percent of GDP (2007 est.). This limits the resources available to provide social protection to the poorest and most vulnerable citizens, and to recover from disasters. Poverty is therefore a factor that increases vulnerability and more females than males are poor. The Millennium Development Goal (MDG) Monitor indicates that a significant portion of the population is poor and that the country is unlikely to meet its MDG #1 target to reduce poverty. The analysis in the MDG Monitor is that the country is unlikely to meet most of its MDG targets. The Dominican Republic is currently ranked 94 out of 177 on the 2008 Human Development Index. The population living on less than US$1 per day was 2.8 percent.[21]

The health status of the population influences vulnerability. The major types of infectious diseases affecting the Dominican population were food or waterborne diseases (e.g. bacterial diarrhea, Hepatitis A, and Typhoid Fever); vector borne diseases (Dengue fever and Malaria); and water contact diseases (e.g. Leptospirosis).[22]

Vulnerability to floods, storms, hurricanes and earthquakes – as evidenced following the recent January 12 2010 earthquake in Haiti which damaged hundreds of schools throughout the DR coupled with land degradation, unplanned urban growth in areas unsuitable for development and weak enforcement of building codes and zoning regulations are the main drivers of most of the current vulnerability in the Dominican Republic. Stakeholders across sectors and disciplines have called for the enforcement of existing laws and the application of administrative measures to improve the quality of construction, reduce illegal construction and improve the performance of the engineering community.[23]

Climate Change and Global Warming

The Dominican Republic has recently been cited as one of six Caribbean countries in the world's top 40 climate "hot spots" by the Germanwatch Global Climate Change 2009 Risk Index (CRI). The country was ranked 12 out of 150 countries based on an analysis of weather events between 1998 and 2007. Two factors were cited: the impact of global warming on rising sea levels which increase the risk of storm surges, and secondly the increase in the strength of hurricanes. The 2010 CRI is based on figures from 2008 and is also an analysis of the worldwide data collection on losses caused by weather-related events from 1998 – 2008. In 2008 the Dominican Republic was ranked 72nd for the decade with GDP losses of 7.25%.[24] CEPAL (2008) estimates that 170 percent the normal amount of rain fell during Tropical Storm Olga which was attributed to climate change.[25]

Climate Change models[26] have predicted that the Dominican Republic will undergo a warming and drying trend and is expected to endure more

[20] GFDRR (2008).
[21] Dunn (2009).
[22] Ibid.
[23] FUNGLODE and CODIA (2005).
[24] Harmeling (2009). Table 5.
[25] Dunn (2009).
[26] Hadley Centre Coupled Model, Version 2 (HADCM2), as reported in Mulligan (2003). Same modeling data as used by the Intergovernmental Panel on Climate Change (IPCC).

frequent heat waves and droughts, rainfalls with increased intensity, and rising sea levels as predicted for the rest of the Caribbean consistent with the projected global median.[27] It is known that inter-annual climate variability of either the Pacific or Atlantic explains a significant amount of the total variance in rainfall in the Caribbean and Central America.[28] Probable climate change impacts in the DR include higher temperatures; higher storm intensities and, possibly, more frequent El Niño-Southern Oscillation (ENSO)[29] events, exacerbating existing health, social and economic challenges affecting the Dominican Republic.

Changes in sea surface temperature as a result of climate variability could increase the intensity of cyclones and heighten storm surges, which in turn will cause more damaging flood conditions in coastal zones and low lying areas. According the World Bank's study, "Sea Level Rise and Storm Surges",[30] the impact of sea level rise and intensified storm surges in Latin America and the Caribbean will be relatively higher in the Dominican Republic with 17.98% percent of the coastal population exposed and potential losses of coastal GDP projected to exceed 16.94 percent. Furthermore, the inundation risk in the DR from storm surges will cover 100 percent of the coastal wetland.

The Dominican Republic's first National Communication on Climate Change (NCCC) was released in 2003 after two years of combined efforts between several institutions, local experts and members of the international scientific community, under the coordination of the Dominican Republic Secretariat of the Environment and Natural Resources.[31] The Dominican authorities also corroborate regional and global data with national studies on various scales confirming a projected increase of 2.6° C in temperature and a decrease in pluvial activity on the order of 10% over the next hundred years. For this reason, the values of potential evaporation and real evapotranspiration will increase, and the total volume of available water in the country will decrease by 28% with respect to the baseline. In this climate scenario, there is an increase in temperature of 4.2° C and a decrease in rainfall of approximately 60% over the next 100 years. Consequently, the total volume of runoff will be reduced by 95% for the year 2100.[32]

DISASTER RISK MANAGEMENT FRAMEWORK

The Dominican Republic has developed a comprehensive legal and institutional framework for disaster risk management (DRM). Various laws and decrees establish the relevant framework as well as clarify the mandate and operations of the various agencies as outlined below:

- Law No 257 dated 17 July 1966 established the Office of Civil Defense (Oficina de Defensa Civil), which is the government mechanism responsible for disaster risk management.
- In addition, Decree No. 2045 (GO No 9083 of 5 June 1968) established the Commission of Civil Defense (Comision de la Defensa Civil), which oversees the Office of Civil Defense.
- Decree No 2784 of 6 October 1981 created a National Emergency Plan for the National Commission (G.O. No. 9566 of 15 October 1981).

[27] Chen et al. (2008).
[28] Giannini et al. (2002).
[29] El Niño-Southern Oscillation; commonly referred to as simply El Niño, a global coupled ocean-atmosphere phenomenon.
[30] Dasgupta et al. (2009).
[31] UNDP (2007). See also http://www.eclac.org/mexico/cambioclimatico/dominicana.html.
[32] Dominican Republic Secretariat of the Environment and Natural Resources (2003).

- Decree No 159 of 13 April 2000 modified Article No 3 & 4 of Decree No 2784.
- Decree No. 360 of 14 March 2001 created the Centre for Emergency Operations.
- Decree No 361 of 14 March 2001 named permanent representatives of institutions for the National Emergency Commission.
- Decree 487 of 1 May 2001 established the status of the National Emergency Commission as part of the Civil Defense Agency.
- Decree No. 715 of 5 July 2001 created the National Office for the Evaluation of Seismic Evaluation and Vulnerability of Infrastructure and Buildings.
- Disaster Risk Management Law 147 of 22 September 2002[33] created an Emergency Budget and the National Council of Disaster Prevention, Mitigation and Response.[34]
- Decree No 932 of 13 September 2003 approved the regulations to apply Law No 147-02 for the Emergency Budget
- Decree No 1080 of 24 September 2003 declared 22 September of each year as the day to promote disaster prevention and emergency response.[35]

The Office of Civil Defense, the National Emergency Plan and National System of Prevention, Mitigation and Response of the Dominican Republic. The Office of Civil Defense (*Oficina de Defensa Civil*, OCD) was established in 1966 under Ley No. 257-66 and Decree No 1525. These laws give OCD responsibility for civil protection and it is therefore one of the main agencies responsible for national emergency response initiatives. The Office is directly responsible for managing shelters and the coordination of volunteers during a disaster. It is also the agency mainly responsible for humanitarian assistance during a disaster. The Office in 1981 developed a National Emergency Plan. In 2002 a legal framework was established to integrate the general principles and definitions of risk reduction policy as well as the National System of Prevention, Mitigation and Response (*Sistema Nacional de Prevención, Mitigación y Respuesta*, SNPMR).[36]

The National Council of Disaster Prevention, Mitigation and Response (NCDPMR) was created by Disaster Risk Management Law 147 of 22 September 2002. It serves as the lead of all disaster risk management efforts in the country. The law separates the national institutions subject to the NCDPMR based on each one's nature, be it prevention, mitigation or response.[37] The Congress may declare that a state of national emergency exists. If the Congress were not assembled, the President of the Republic may dictate the same disposition.[38]

The National Emergency Commission (Comisión Nacional de Emergencia, CNE) of the Dominican Republic. The CNE is comprised of the Technical Committee for Disaster Prevention and Mitigation (TCDPM), the Emergency Operations Center (EOC), the regional, provincial and municipal Disaster Prevention, Mitigation and Response Committees, and a Consultation Team. It operates under the Office of the Presidency of the Dominican Republic. It is an institutional coordinating body that operates under Ley 147-02. The CNE speaks on the behalf of the government during disasters and is responsible for planning, coordinating and managing activities related to protection, rescue, and rehabilitation. It also administers in-kind contributions of donors during disasters including

[33] OAS-DSD (2002a).
[34] UN ISDR and partners (2010).
[35] Dunn (2009).
[36] Ibid.
[37] UN ISDR and partners (2010).
[38] OAS-DSD (2002b).

international aid, in coordination with the external relations Secretariat.[39]

The Emergency Operations Center (EOC) is located in the Office of Civil Defense and coordinates humanitarian action as well as prevention, preparedness and rehabilitation programs. It serves as the focal point for the receipt and dissemination of information on emergencies to the public, the media, and other emergency response stakeholders. It operates under Law 257 and its primary aim is to integrate and house key institutions involved in national emergency response and preparedness such as the emergency services. These include the army, police, civil defense, the Red Cross and other public institutions. The EOC also seeks to ensure coordination and coherence prior to during and after a disaster.[40] The EOC is the designated focal point for the Hyogo Framework for Action (HFA).[41]

The National Technical Committee (NTC) was activated in 2008 and recently 6 provincial and 6 municipal committees have been established. The NTC serves as an advisory function and coordinates risk reduction efforts among other responsibilities such as updating the National Disaster Risk Management Plan and the National Emergency Plan. It has played an important role in multi-sector participation beginning with its 22 member institutions. The NTC has identified constitutional elements for the Disaster Risk Management Strategy, secured budget to finance its activities, and established internal controls to ensure proper administration. As an example of the technical contributions, the NTC has assisted several municipalities by creating a guide for municipal emergency planning.[42]

The National Disaster Risk Reduction Platform is in process. The platform's development and efforts are guided by the National Technical Committee (National Platform) which is made up of technical personnel from 22 agencies, designated as official and permanent representatives responsible for updating the National Risk Management Plan and the National Emergencies Plan.[43]

The Dominican Republic is active in several regional and international forums for Disaster Risk Management, including participating in the Central American Coordination Center for Natural Disaster Prevention (CEPREDENAC) and the United Nations International Strategy for Risk Reduction (UN ISDR).

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

The Dominican Republic was the first country to be assessed in May 2010 by the United Nations International Strategy for Disaster Reduction (UN ISDR) to examine the country's efforts in implementing the "Hyogo Framework for Action (HFA) 2005-2015: Building the Resilience of Nations and Communities to Disasters". This section includes the reported challenges, accomplishments and next steps provided in the Government of the Dominican Republic's 2009 report: National progress report on the implementation of the Hyogo Framework for Action 2007-2009[44] together with recommendations from the UN ISDR report[45] toward achieving the goals set forth in each of the five HFA priorities.

[39] Dunn (2009).
[40] Ibid.
[41] PreventionWeb (2010d).
[42] UN ISDR and partners (2010).
[43] UN ISDR (2010a).
[44] Luna Paulino (2009).
[45] UN ISDR and partners (2010).

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity, and consensus building for disaster risk management

Challenges:

DRM is not included in the National Development Plan or in the planning of the NEC member institutions. DRM efforts and responsibilities are centralized, underfunded, and understaffed. The National Disaster Prevention, Mitigation and Response Fund does not have an established implementation mechanism that permits the financing of DRM activities at the national, provincial and local levels.

The international and national legal frameworks for DRM are not well known at the national, provincial or municipal levels.

While all provinces and municipalities must establish their Disaster Prevention, Mitigation and Response Committees, only six have done so and these efforts were dependent upon international cooperation. All of them need to develop and implement their own emergency and DRM plans.

Accomplishments:

There is institutional commitment comprised of the Disaster Risk Management Law 147-02 which adopts a National Disaster Risk Management Policy and creates a National System for Disaster Prevention, Mitigation and Response. The law contemplates various levels of coordination such as:

1. The National Council of Disaster Prevention, Mitigation and Response (NCDPMR)
2. The National Emergency Commission (NEC)
   a. The Technical Risk Prevention and Mitigation Committee (TRPMC)
   b. The Emergency Operations Center (EOC)
   c. The National Emergency Operations Committee
   d. Consultation Teams
3. Regional, Provincial and Municipal Disaster Prevention, Mitigation and Response Committees.

Of these, the National Council, the NEC, and the EOC exist along with some of the consultation teams. Likewise, the Technical Committee, 6 Provincial, and 6 Municipal Committees have been established. The National Council meets twice a year and in the event of a significant disaster. The NEC meets on a monthly basis and whenever deemed necessary.

There is limited human and technical capacity within the public institutions to consider risk within the project design and development investment decision-making.

Next steps include:

Seek political, institutional and financial commitment for DRM at all levels.

Promote the establishment of a permanent DRM unit to coordinate the work of the Technical Committee and regularly update the National Disaster Risk Management Plan.

Pursue the financial and technical support to enable the provinces and municipalities to establish their Disaster Prevention, Mitigation and Response Committees as well as develop and implement their own emergency and DRM plans.

Create and enforce a zoning law and integrate DRM criteria into the building codes and regulations.

The UN ISDR report recommendations include:

Integrate the achievements and efforts of the National System for Disaster Prevention, Mitigation and Response into the National Development Strategy (NDS).

Develop a National Disaster Management Plan, guided by the NDS.

Secure technical, financial and political support to build capacity at all levels to integrate DRM.

Provide DRM policy guidelines, instruments and tools at the unique region, provincial and municipal levels within development plans and policies. The primary tools to apply are the Environmental Impact Evaluations (EIEs) and the Risk Assessments (RAs).

Re-launch the process of the Dominican Republic National Disaster Risk Reduction Platform.

HFA Priority #2: Disaster risk assessment and monitoring

Challenges:

There are few indications of advancement at the planning or policy level.

Stakeholders are either unaware of or unaccustomed to using the information available.

Idiomatic and cultural differences inhibit regional cooperation.

Accomplishments:

Information is available regarding evaluations of the National Disaster Prevention, Mitigation and Response system. Hazard and risk maps for some areas of the country are available.

All information systems in the country have been identified. There is a hydrometeorological early warning system technical committee. Inter-institutional agreements exist for the use of new tools and information as well as efforts with companies to install early warning systems using telecommunications networks.

International organizations have supported some cross-border programs and training workshops have been conducted to build the capacity of local institutions.

Next steps include:

Seek political support to promote and strengthen the National Integrated Information system as established in Article 19 of Law 147-02. Strengthen inter-institutional connections to develop a joint vision and enable an efficient use of risk data at all levels.

Promote investment for the systematic generation, interpretation, management, and dissemination of technical data.

The UN ISDR report recommendations include:

Prepare and prioritize a list in terms of information gathering; studies to be developed; hazard, risk and vulnerability assessments for city governments in high-risk areas in order to integrate them into the strategic planning process.

Articulate DRM in the development of the National Disaster Risk Management Information System. This includes the initiatives and projects related to the generation of disaster risk cartography (such as hazard, vulnerability, risk, and capacity maps).

Address the equipment, technology, communication and technical needs to improve poor service regions, and ensure

the maintenance and sustainability of the monitoring networks and systems. This includes improvements needed to enable the local, most vulnerable populations to have access to early alerts related to flash floods, floods, and landslides.

Establish a high-level Haitian-Dominican bi-national risk identification working group from an island-wide perspective.

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

Challenges:

There is little institutional commitment and systematic policies are lacking.

Governmental institutions have not arrived at a consensus regarding the systematic use of indicators.

Specific information is scant at the local level.

Communication efforts are fragmented.

Accomplishments:

The Public Information Consultation Team was established and ascribed to the NEC to develop strategies.

DRM laws, regulations, national and local evaluations, results from completed projects, case studies, risk maps, and other efforts have been documented and disseminated.

Generic disaster information is available, particularly for hurricanes. Emergency institutions have materials about the disaster response phase. Some informal didactic materials are available and didactic manuals under development include DRM concepts.

The Autonomous University of Santo Domingo has a DRM unit and plans to do research. This unit participates in regional exercises to identify a system of DRM indicators.

Next steps include:

Seek support and commitment for the development and implementation of the NEC's communication strategy and annual activities including public outreach and awareness-raising as well as the development and dissemination of orientation and educational materials.

Integrate DRM as an overarching theme in education. Modify university curricula to introduce disaster risk reduction.

Promote the development of multi-hazard assessments and cost-benefit analyses.

Develop a simple and unique system of indicators, building on the work and experiences in the Dominican Republic.

The UN ISDR report recommendations include:

Prepare an inventory of the available disaster risk management information and materials among the various ministries, governmental and non-governmental partners, and others. Promote events to exchange and disseminate information.

Define a National Communication Strategy (NCS) and information to address DRM. Include key messaging for the population through radio and television spots among other media. Integrate the communication networks and mass media to achieve a wide dissemination of the topic to the general public.

Systematize successful experiences that can be replicated at the regional, provincial, municipal, and community levels.

Develop, adapt, and promote the use of a system of vulnerability and risk indicators, building on the successful experiences of some of the country's academic institutions.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

Challenges:

There is little institutional commitment for plans and policies.

The integration of climate change in policy development to contribute to risk reduction is a challenging effort.

Accomplishments:

Some procedures for conducting damage assessments have been adopted.

Next steps include:

Promote the adoption of policies for post-disaster recovery and rehabilitation, integrating criteria for DRM and vulnerability reduction.

Create tools to integrate DRM as a cross-cutting component of planning as well as to implement development with a DRM approach.

Update and enforce existing building codes and regulations integrating DRM.

Promote the development and application of a land use policy as well as the relocation of vulnerable communities out of high-risk areas. Develop and implement pilot projects to demonstrate the validity of land use planning at the municipal level.

The UN ISDR report recommendations include:

Integrate disaster risk management into the environmental plans and policies in a way that permits the adequate management of ecosystems and natural resources. An example would be to include DRM in the reforestation plan, contributing to flood control, management of sedimentation processes and ecosystem degradation due to hillside agriculture.

Develop a National Land Zoning Plan which integrates the risk variable to guide land use and the development of criteria for relocating high-risk communities. Provide the municipalities with the necessary human, financial, and technical resources, as well as appropriate tools, in order to implement the zoning and urban planning ordinances.

Foster the development of DRM policies, financing, and mechanisms for sectors that are particularly relevant to social and productive development, such as environment, public works, tourism, agriculture and others. This will require the creation and capacity-building of sector-specific DRM committees, each with its roles and responsibilities.

Develop strategies, policies and plans for environmental and natural resource management with an island-wide focus (DR and Haiti).

Improve the codes and technical standards for public infrastructure, procedures for siting and design studies, the evaluation of construction quality and maintenance, and instruments to guarantee the legal responsibility of contractors.

HFA Priority #5: Disaster preparedness, recovery, and reconstruction at national, regional, and local levels

Challenges:

There is little technical and human capacity for disaster response and recovery at the local level.

There is no procedure to structure access to the National Disaster Prevention, Mitigation and Response Fund.

Information exchange during emergency and disaster situations is limited.

Accomplishments:

There is institutional commitment to disaster risk management.

There are some national structures that implement DRM policies.

Some training has been completed to prepare personnel.

Plans of various types are prepared, but not at all levels. Likewise, drills and other activities have been carried out in some communities.

A National Disaster Prevention, Mitigation and Response Fund was established (by Law 147-02) to support risk reduction measures and to provide recovery assistance to populations affected by disasters.

There are procedures for the EOC to manage information exchange during emergency and disaster situations, as well as to conduct ex-post assessments.

Next steps include:

Provide equipment and training to response institutions.

Promote the establishment of provincial and municipal disaster prevention, mitigation, and response committees.

Integrate communities into the development of their own plans and DRM drills and exercises.

Develop mechanisms to structure access to the National Disaster Prevention, Mitigation and Response Fund.

Strengthen the mechanisms as well as the technical and institutional capacities to improve the exchange of relevant information during emergency and disaster situations.

The UN ISDR report recommendations include:

Articulate and improve, in practice, the roles and areas of coordination between the NEC and the EOC for disaster preparedness and response.

Decentralize and strengthen disaster preparedness processes at the provincial, municipal and local levels to comply with the objectives of the law through feasible and concrete efforts.

Design and apply a national system of indicators of disaster preparedness in order to measure the progress during the implementation of related work.

Train decision-makers and political leaders regarding their duties in terms of preparedness and response under the current legislation.

Facilitate opportunities, and improve articulation, for the participation of the civil society, private sector, NGOs, communities, and international cooperation in disaster preparedness and response activities.

Identify resources within the national budget to allocate to the National Disaster Prevention, Mitigation and Response Fund.

Develop mechanisms that guarantee the sustainability and continuity of preparedness and response projects at all levels through sector-specific plans.

ADDITIONAL OBSERVATIONS

The Dominican Government is very interested in financing risk management cooperation projects.

International cooperation for DRM in the DR is financed with support from the Delegation of the European Commission, ECHO, AECID, IADB, and the World Bank. This includes the recent establishment of the DRM Cooperation Platform, training members of the National Technical Committee, and initiatives related to the HFA priorities.

AECID is financing the Dominican Government's actions according to the National DRM Plan through the National Disaster Prevention, Mitigation and Response Fund (NDPMRF). The related financed initiatives include:

- Formulation of the National DRM Plan;
- Establishment and launch of the NDPMRF;
- Creation of DRM units in institutions and municipalities, and implementation of coordination mechanisms for members of the National System;
- Establishment, support and preparedness of regional, provincial, municipal, and local networks and Prevention, Mitigation and Response Committees;
- Integration of DRM into public investments; and
- DRM methodology creation and approval.

The IADB is financing a project through the General Directorate for Land Use Planning and Development (DGODT) that has established DRM units in five pilot municipalities, integrated the zoning and land use perspective in the work of the DRM committees and education sector, and created a unit responsible for integrating DRM criteria into public investment processes and development planning. The IADB has financed an analysis of how to fund, and insure, DRM in a coordinated and structured manner in spite of the projected national budget deficit increase. In light of the projected average annual emergency expenses of approximately US$400 million, the IADB has created a US$100 million Contingency Credit Facility (CCF) for Natural Disaster Emergencies in the Dominican Republic (GN-2502).[46] The CCF is innovative in that the government can access the funds in advance of a natural disaster for DRM purposes.

The UN ISDR report emphasized the crucial role of the international cooperation in enabling DRM efforts and initiatives in the DR. It states that while, for example, the AECID has financed the startup of the NDPMRF, the GoDR has not yet specified how budget will be allocated to ensure its sustainability. The report further observes that the National Calamity Fund was established by Law 147-02 and is funded with 1% of the Government's national net income. However, the mission could not document its recent use in order to determine eligibility requirements for the new Fund.

Conclusions and Expected Tangible Outputs and Outcomes in DRM

The Dominican Republic is confronted with the challenge of strengthening its existing institutional capacities for disaster risk

[46] Collich et al. (2010).

management (DRM) mandated by Disaster Risk Management Law 147 of September 22, 2002 and its regulations, and recommended best practices within the Hyogo Framework for Action.

It is expected that the Dominican Republic will continue enhancing its role within regional DRM organizations, developing synergies that can strengthen the country's natural disaster preparedness and resilience.

International cooperation has played a major role during natural catastrophes in the Dominican Republic. The same holds true for DRM efforts, especially at the provincial, municipal, local, and community levels. The Dominican Republic is developing mechanisms both for risk management and reduction, to complement those available for response. The country has been advised to prioritize efforts to develop risk transfer mechanisms to protect the country's public infrastructure and the nation's social and economic networks.

The World Bank should continue supporting the Dominican government's efforts to develop an effective legal and institutional framework that incorporates DRM as a cross-cutting theme into the national planning process and within critical sectors and various levels of government administration.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Contingency Credit Facility (CCF)	IADB	100 million	4, 5
National DRM Plan and National Disaster Prevention, Mitigation and Response Fund	Government of Spain (AECID)	4 million Euros 2008-2012	4, 5
Disaster Prevention and Preparedness (Prevención y preparación a desastres, PPD)[47]	UNDP, through the Civil Defense, the Ministry of Environment and Natural Resources (SEMARN), the Ministry of Public Health and Social Assistance, and the Dominican Red Cross	2,979,706.16 2006-2010	1, 2, 3, 4, 5
DRM in land use planning	IADB with Dept. for Land Use Planning and Development (DGODT), and the Ministries of the Economy, Planning and Development	5 million (IADB) and RD$680,000 (DGODT) 2008-2011	1, 4
Resiliencia – Strengthening Disaster Management Capacity of Vulnerable Communities in Azua Province, DR	USAID through Plan International[48]	447,953 2009-2011	3, 5
Disaster Risk Reduction in Sabana Yegua Project, DR	USAID through Catholic Relief Services (CRS)[49]	225,415 2009-2011	3, 5
Strengthening community-based disaster risk reduction in south-western rural Barahona and Pedernales, DR	ECHO through Plan International	975,032 2009-2011	1, 2, 3, 5
DRM in the San Juan and Elías Piña Provinces, DR	AECID through Plan International	839,744 2009-2011	2, 3, 4, 5
Strengthening the implementation of the disaster management strategy of *Plan Internacional,* DR	MOFA (Government of Finland)	81,077 2010	5

* Amount unavailable

[47] UNDP (2009a).
[48] USAID/OFDA (2009).
[49] Ibid.

COUNTRIES AT RELATIVELY HIGH ECONOMIC RISK FROM MULTIPLE HAZARDS
(Top 75 Based on GDP with 2 or more hazards)[a]

1.	Taiwan, China
2.	**EL SALVADOR**
3.	Jamaica
4.	Dominican Republic
5.	Guatemala
10.	Costa Rica
11.	Colombia
15.	Trinidad and Tobago
18.	Antigua and Barbuda
21.	Ecuador
23.	Mexico
24.	United States
26.	Nicaragua
38.	Cuba
75.	Bulgaria

[a] Dilley et al. (2005). Table 7.2.

Natural disaster data from El Salvador published on the PreventionWeb website reported 41 natural disaster events for the period 1982 to 2007, with total economic damages estimated at US$4.57 billion.

EL SALVADOR

Natural Disasters from 1982 - 2007[b]

Affected People

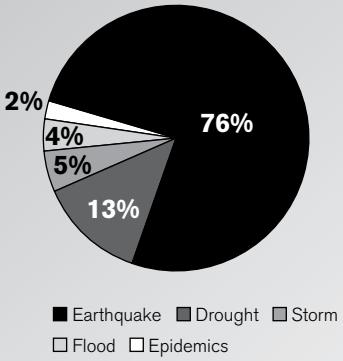
Disaster	Date	Affected (Number of People)
Earthquake*	2001	1,334,529
Earthquake*	1986	770,000
Drought	2001	400,000
Earthquake*	2001	256,021
Storm	1998	84,000
Storm	2005	72,141
Flood	1982	68,000
Epidemic	2003	50,000
Flood	1988	39,060
Earthquake*	1982	32,500

Economic Damages

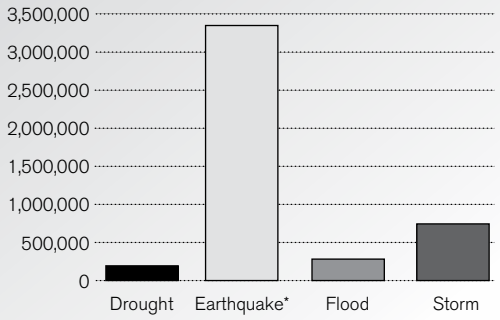
Disaster	Date	Cost (US$ x 1,000)
Earthquake*	1986	1,500,000
Earthquake*	2001	1,500,000
Storm	1998	388,100
Storm	2005	355,700
Earthquake*	2001	348,500
Flood	1982	280,000
Drought	1998	170,000
Drought	2001	22,400
Flood	1999	1,500
Drought	1994	1,000

Statistics by Disaster Type[b]

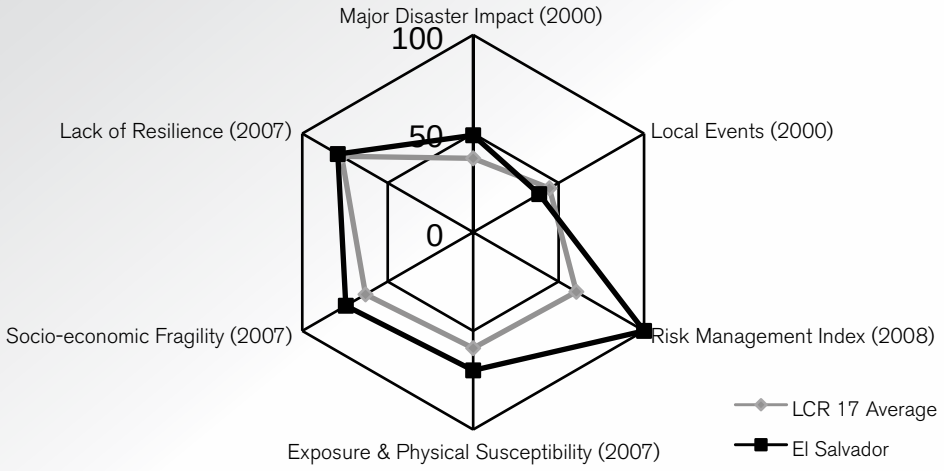
Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



Relative Vulnerability and Risk Indicators[c]



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=55. Source data from EM-DAT. Data displayed does not imply national endorsement.

[c] Relative Vulnerability and risk Indicators are adapted from IADB-IDEA-ERN (2009). Values are normalized on scale of 0 – 100 and presented against the average for 17 LCR countries. Major disaster Impact taken from disaster deficit Index: the ratio of economic losses which a country could suffer during a Maximum Considered event and its economic resilience. Local events taken from Local disaster Index: the propensity of a country to experience recurrent, small-scale disasters and their cumulative impact on local development. risk Management Index is presented as the negative (i.e. 0 = optimal, 100 = incipient) of IADB's risk Management Index: measures a country's risk management capability in (i) risk identification, (ii) risk reduction, (iii) disaster management, and (iv) financial protection. resilience, Fragility and exposure are taken from the component indices of Prevalent Vulnerability Index. Date for local event data depends on information available for each country. Data, and the respective LCR 17 average, from 2000 is used for Dominican Republic, El Salvador, Guatemala, Jamaica and Nicaragua. Data, and the respective LCR 17 average, from 2006-08 is used for Bolivia, Colombia, Costa Rica, Ecuador, Panama and Peru. All LCR 17 averages are calculated based on available data.

DISASTER RISK PROFILE

El Salvador has the second highest economic risk exposure to two or more hazards, according to the Natural Disaster Hotspot study[2] by the World Bank.

The same study also ranks El Salvador second among countries with the highest percentage of total population considered at a "Relatively High Mortality Risk from Multiple Hazards".

Major Natural Hazards

Due to its geographical location and geotectonic characteristics, El Salvador is exposed to a variety of natural hazards, including hydrometeorological and geophysical. El Salvador, along with the rest of Mesoamerica, is one of the most seismically active regions on earth, situated on three tectonic plates. The subduction of the Cocos Tectonic Plate under the Caribbean Plate created the deep Middle America Trench that lies off the coast of El Salvador and generates frequent earthquakes near the coast. The friction of the westward-moving North American Plate against the northern edge of the Caribbean Plate in southern Guatemala is the source of earthquakes in northernmost El Salvador.[3]

The number of natural disasters in El Salvador dramatically increased during the period of 1997-2007. A total of 21 events were recorded, representing 53 percent of all natural disasters of the last 100 years. Five events (23 percent) had a geophysical origin, while the remaining 16 (76 percent) were hydrometeorological. According to the Ministry of the Environment and Natural Resources (MARN)'s Division of the National Service of Territorial Studies (D-SNET), economic losses directly linked to catastrophic events during the last 30 years amounted to almost $US4 billion (equivalent to the total cost of building 33,000 new primary schools, or 298 regional hospitals, or 25 Cutuco-like seaports).[4]

Similarly, natural disaster data from El Salvador published on the PreventionWeb website[5] reported 41 natural disaster events for the period 1982 to 2007, with total economic damages estimated at US$4.57 billion. Earthquakes accounted for US$3.35 billion, storms US$744 million, floods US$281.5 million and droughts US$193.4 million of reported economic damages, respectively. The number of people killed was reported as 3,995, with 58 percent of the deaths caused by earthquakes, 14 percent by storms, 16 percent by floods, and the remaining 12 percent caused by epidemics.

About 41 percent of the Salvadoran population resides in municipalities exposed to high risk of natural disasters (i.e. those municipalities that were affected during the period of 1980 to 2007 by three or more natural hazards: earthquakes, floods, storms, and droughts). These municipalities also concentrate 74 percent of disaster-related fatalities. During this period there was an average of 1.5 disasters per year. This highlights the continuous impact that natural events have on the national development process and their impact on society and the Salvadoran economy.[6]

Based on the Disaster Risk Index[7] it can be inferred that 23 percent of the exposed population to floods, earthquakes or storms has

[2] Dilley et al. (2005). Table 7.2.
[3] Library of Congress (1988).
[4] Ministry of Environment and Natural Services (2009).
[5] PreventionWeb (2009b).
[6] INER (2009).
[7] Cardona (2008).

a high probability of death in El Salvador. Four percent of the exposed population have their lives threatened by floods and 14.5 percent by earthquakes.

It is worth noting that El Salvador is the second most deforested country in Latin America after Haiti.[8] Almost 85 percent of its forested cover has disappeared since the 1960s. According to the UN Food and Agriculture Organization's "Global Forest Resources Assessment 2005"[9], El Salvador's total forest cover was estimated as 14.2 percent of total land area. About two percent of the remaining forests (less than 6,000 hectares) are classified as primary forest.

Flooding and landslides pose serious risks to El Salvador during the rainy season (June to November) as much of the natural land-cover of the country has been removed, increasing its vulnerability to these natural hazards. The Government of El Salvador data indicates that as of 2005, 65 percent of the country was threatened by landslides.

Storms and Floods

In 1998, Hurricane Mitch caused great damage throughout Central America.[10] Over a decade since Hurricane Mitch struck Central America, its impact in the social and economic fabric of the region was still visible.[11] In El Salvador, Mitch produced huge amounts of precipitation, resulting in flash flooding and mudslides throughout the country. More than 10,000 homes were flooded, leaving 59,000 people homeless and forcing 500,000 more to evacuate. Some 1,000 square kilometers of pasture and cropland were flooded, and 10,000 heads of cattle were lost. Total agricultural and livestock damage amounted to US$154 million. Flood damage to infrastructure was also severe, with two bridges destroyed and 1,200 miles of unpaved roads damaged. In total, Mitch caused nearly US$400 million in damage and 240 deaths.[12]
In 2005, tropical storm Stan struck El Salvador at the same time that the Santa Ana volcano erupted near San Salvador[13], leading to destructive floods and mudslides. According to Salvadoran authorities, 300 communities were affected by the floods, with over 54,000 people evacuated from their homes.[14]

In November 2009, during the passing of Tropical Storm Ida, some 355 mm of rainfall fell in a five-hour period, triggering floods and lahars. Even though this was a localized event that affected five out of the 14 Departamentos of El Salvador, 199 people lost their lives; an estimated 5,000 homes were damaged or destroyed, damage to transport infrastructure amounted to US$106.2 million; for a total economic impact estimated at US$315 million.

As recently as late May-early June of 2010, Tropical Storm Agatha - the first storm of the 2010 Pacific hurricane season- struck El Salvador. More than 400 mm of rainfall fell in just a few hours, triggering flashfloods and landslides that killed 12 people. Some 120,000 individuals were affected across 116 municipalities. Due to the widespread damage caused by the storm, the President declared a national state of emergency to facilitate the relief efforts. The events left behind an economic impact estimated at US$112 million[15], equivalent to more than 0.5% of the country's GDP.

[8] Mongabay.com (2004).
[9] Food and Agriculture Organization (2005a).
[10] BBC News (1998).
[11] CATHALAC (2008).
[12] Wikipedia (2009a).
[13] USAID (2005).
[14] Wikipedia (2009b).
[15] http://www.presidencia.gob.sv/tecnica/.

The economic impact of Agatha had a cumulative negative effect on the El Salvadoran economy; and exacerbated the environmental, social and economic impacts caused by tropical storm Ida in late 2009. This observed increase in the frequency of hydrometeorological events that have catastrophic effects reveals an increased vulnerability and loss of the population's resilience capacity.

Earthquakes and Tsunamis

El Salvador has a long history of destructive earthquakes and volcanic eruptions. San Salvador was destroyed in 1756 and 1854, and it suffered heavy damage in 1919, 1982, 1986, and twice in 2001[3], when the country was hit by two major earthquakes within one month of each other. The first earthquake in 2001 struck on January 13, with a magnitude of 7.7 on the Richter scale. The epicenter was 60 miles southwest of San Miguel.[16] Official reports indicated at least 844 people killed, 4,723 injured, 108,226 homes destroyed and more than 150,000 buildings damaged.[17] The second earthquake shook the country on February 13 with a magnitude of 6.6. The epicenter was 15 miles east of San Salvador. At least 315 people were killed, 3,400 were injured, and extensive damage to public infrastructure was reported. Landslides occurred in many areas of El Salvador[16] while clean water and sanitation became a matter of great concern in many areas due to the earthquakes' damage to municipal drinking water systems.

Fernandez, Ortiz-Figueroa, and Mora (2004)[18] indicated that eleven historical tsunamis have been reported along the coast of El Salvador since 1859. Four of these tsunamis flooded villages and killed at least 185 people. This article also reported that the most dangerous tsunami-generating earthquakes are those having magnitudes of 7.0 or higher, with epicenters offshore. With a growing population and urban expansion occurring along the Salvadoran coastline, the potential losses of human life and property as a result of tsunamis are increasing at an alarming rate.

Volcanoes

The country has over twenty volcanoes, although only San Miguel, Izalco, and Santa Ana have been active in recent years. The southern range of mountains is a discontinuous chain of about 20 volcanoes, clustered into five groups. Between the volcanic cones lie rich alluvial basins and rolling hills eroded from ash deposits where much of El Salvador's coffee plantations are located.[3] In October 2005, the Santa Ana volcano erupted for the first time in 100 years. As many as 20,000 people were forced to evacuate from their homes. The volcano spewed hot rocks and plumes of ash into the air across a one-mile radius from the crater[19], killing at least two people and injuring seven. About 10,500 hectares of land mainly planted with coffee trees were covered in ash from the eruption.[20]

Landslides

Nearly one thousand people were reported dead in the aftermath of the 7.7 earthquake in January 2001. Approximately 585 deaths were caused by a single mudslide in Las Colinas in the Santa Tecla district of Greater San Salvador. Nearly 108,000 homes were damaged or destroyed.[21] Utilities and roads

[16] Wikipedia (2009c).
[17] USGS (2004).
[18] Fernandez et al. (2004).
[19] Wikipedia (2009d).
[20] Taylor (2005).
[21] Konagai et al. (2002).

were damaged by more than 16,000 landslides. The subsequent 6.6 earthquake in February also triggered a large number of landslides across the country.

During 2008, 618 sites throughout the country were identified as prone to landslides. In 2009, the number of critical locations increased to 723, representing an additional 105 sites over the previous year. An estimated 773[22] areas are currently identified as prone to flooding.

During the heavy rainfall of November 2009, three deadly lahars fell off from the San Vicente volcano, as a result of the collapse and movement of mud, rocks and water detached from the saturated cone walls. The lahars flowed away from the volcano, on three separate 6-km long pathways, depositing an estimated 1.5 million m^3 of debris over farmland and river courses, killing people and destroying hundreds of homes in several cities near the San Vicente volcano. According to the Ministry of the Environment and Natural Resources (MARN), the amount of debris from the lahar that reached the city of Verapaz was calculated at 240,000 m^3, reaching a height of 2 meters upon entering the city. Concurrently, several lahars converged in the city of Guadalupe, destroying homes and bridges along the way. MARN estimated the amount of debris at 370,000 m^3. The communities of El Refugio and Barrio San Jose near the city of Tetetipán - both located along the pathway of the lahars - suffered the loss of human lives, and the destruction of homes and farmland. The debris transported by the lahars created a heightened vulnerability condition for the affected communities, as riverbeds that drained the region became clogged with rocks and rock-hard mud.

Exposure and Vulnerability

El Salvador is one of the Western Hemisphere's poorest countries. Rural residents depend largely on natural resources for their survival. Deforestation-induced erosion and soil degradation has left much of the country unsuitable for agriculture and has put many people at risk during periods of tropical storms that regularly strike the region.

Vulnerability to floods and landslides (resulting from excessive water accumulation in the soil during periods of heavy rains over deforested slopes, sometimes exacerbated by the mechanical action of high-intensity earthquakes) resulted in the most devastating disasters in El Salvador in recent years. Severe land degradation, unplanned urban growth in areas unsuitable for development and weak enforcement of building codes and zoning regulations are the main drivers of most of the current vulnerability in El Salvador.

The table below shows estimates of the economic impact of recent disasters in El Salvador, based on assessments made using the Economic Commission for Latin America and the Caribbean (ECLAC)'s Post-Disaster Needs Assessments methodology.

Estimated Impact of Recent Disasters in El Salvador

		US$ millions adjusted for inflation		
Disaster	**Year**	**Damages**	**Losses**	**Total**
Floods	1982	218.1	67.6	285.7
San Salvador Earthquake	1986	1,351.3	429.8	1,781.1
Hurricane Mitch	1998	219.9	283.8	503.7
Earthquakes	2001	1,137.6	805.8	1,943.4
Drought	2001	-	38.1	38.1
Hurricane Stan	2005	177.4	217.4	394.8
Tropical Storm Ida	2009	210.7	104.12	314.82

Source: Government of El Salvador (2009).

[22] ElSalvador.com (2009).

The following table, also based on ECLAC's Post-Disaster Needs Assessments methodology, shows the economic cost of several disasters in relation to the GDP.

Economic Cost of Recent Natural Disasters as Percentage of GDP

Disaster	Economic Cost (as percentage of GDP)
El Niño (1997–1998)	1.6
Hurricane Mitch (1998)	3.0
Earthquakes (2001)	12.0
Drought (2001)	1.2

Source: Government of El Salvador (2009).

Climate Change and Global Warming

Climate Change models[23] have predicted that El Salvador will undergo a warming and drying trend and is expected to endure more frequent heat waves and droughts, rainfalls with increased intensity, and rising sea levels as predicted for the rest of Mesoamerica. It is known that inter-annual climate variability of either the Pacific or Atlantic explains a significant amount of the total variance in rainfall in the Caribbean and Central America.[24] Probable climate change impacts in Central America and El Salvador include higher temperatures, higher storm intensities, and possibly, more frequent El Niño-Southern Oscillation (ENSO)[25] events, exacerbating existing health, social and economic challenges affecting El Salvador.

Changes in sea surface temperature as a result of climate variability could increase the intensity of cyclones and heighten storm surges, which in turn will cause more damaging flood conditions in coastal zones and low-lying areas. According to the World Bank study "Sea Level Rise and Storm Surges"[26], the impact of sea level rise and intensified storm surges in Latin America and the Caribbean will be relatively higher in El Salvador, with 53 percent of the coastal population exposed and potential losses of coastal GDP projected to exceed 50 percent. Furthermore, the inundation risk in El Salvador from storm surges will cover 100 percent of the coastal wetland.

El Salvador's first National Communication on Climate Change (NCCC)[27] was released in February 2000 after two years of combined efforts between several institutions, local experts and members of the international scientific community, under the coordination of the Ministry of Environment and Natural Resources (MARN). According to the guidelines, El Salvador developed its greenhouse gas (GHG) inventory based upon 1994 population data. With 0.1 percent of the world's population, El Salvador accounted for less than 0.1 percent of the world's total carbon dioxide (CO2) emissions in 2004. With an average of 0.9 ton of CO2 per person, El Salvador's emission levels are below those of Latin America and the Caribbean. Additionally, El Salvador signed, and ratified in August 2005, the Kyoto Protocol. As a non-Annex I Party to the Protocol, El Salvador is not bound by specific targets for GHG emissions.[28]

[23] Hadley Centre Coupled Model, Version 2 (HADCM2), as reported in Mulligan (2003). Same modeling data as used by the Intergovernmental Panel on Climate Change (IPCC).
[24] Giannini et al. (2002).
[25] El Niño-Southern Oscillation; commonly referred to as simply El Niño, a global coupled ocean-atmosphere phenomenon.
[26] Dasgupta et al. (2009). In this study, the research team assessed 84 coastal developing countries around the world. They considered the potential impact of a large (1-in-100-year) storm surge by contemporary standards, and then compared it with intensification expected to occur in this century.
[27] UNDP El Salvador (2007).
[28] UNDP (2007).

El Salvador's first NCCC indicated that the nation's energy sector is becoming increasingly dependent on fossil fuels, and reported that, by 2020, 61.8 percent of the country's total electricity production will depend on oil and coal. As mitigating alternatives to such a scenario, the study suggested the development of renewable energy sources, including the construction of small to medium-size hydropower plants, an increase in geothermal power production investments, and increasing the use of biofuels such as sugar-cane bagasse.

DISASTER RISK MANAGEMENT

El Salvador has developed a sound legal and institutional framework for disaster risk management (DRM). The Civil Defense Law, created by Legislative Decree No. 498 of April 8, 1976, called for the creation of the Civil Defense System as an essential part of the National Defense for "the purpose of protecting and helping the population to overcome the consequences of public disasters or catastrophes". The primarily reactive focus of the Civil Defense System in the event of natural disasters turned out to be insufficient for adequate DRM.

For the purpose of improving the country's capacity to manage the natural and man-made risks, the "Civil Protection and Disaster Prevention and Mitigation Law" was enacted by Legislative Decree No. 777 of August 18, 2005 (Law No. 777). This Law mandated the creation of the National System of Civil Protection and Disaster Prevention and Mitigation "as an interrelated, operationally decentralized set of public and private agencies responsible for formulating and executing the respective work plans for Civil Protection, and work plans for disaster risk prevention and the mitigation of their impacts." This law repealed the Civil Defense Law and the Law of Procedures for Declaring a National Emergency (created by Legislative Decree No. 44 of July 29, 1988), also defining a new mechanism for the declaration of a State of Emergency, assigning the National Civil Defense Commission the authority to request the President to declare a State of Emergency. To ensure the sustainability of the Civil Defense System, under Legislative Degree No. 778 (Law 778) of August 31, 2005 (and its regulation, Executive Decree No. 11 of February 6, 2006), the Civil Protection and Disaster Prevention and Mitigation Fund was created. Law 778 mandated the Fund's capitalization through an initial Government's General Budget allocation of US$4 million, and mandated the additional allocation as a budget item in the Government's Ordinary Budget, at an amount appropriate for its purpose. Law 778 also authorized the Ministry of the Interior to request resources from the Fund's administrator (the Minister of Finance), to finance measures to cope with emergencies caused by disasters.

El Salvador's National Civil Protection System (the System) is composed of the National Commission for Civil Protection and Disaster Prevention and Mitigation (the National Commission), and the Departmental, Municipal and Community Commissions for Civil Protection (Law No. 777, Article 10). The System's objectives include: incorporating in development plans the prospective management of disasters; preparing and updating risk maps at each organizational level of the system; preparing and coordinating plans and actions to raise awareness and inform the population about possible catastrophic events; designing and executing Civil Protection plans to respond to catastrophic events; and maintaining cooperative relationships with similar regional and international agencies.

The National Commission is composed of the Minister of the Interior who presides over it; the General Director of the General Bureau of Civil Protection and Disaster Prevention and Mitigation (the General Bureau of Civil Protection); the heads of the Ministries of Foreign Relations, Public Health and Social

Assistance, Agriculture and Livestock, Environment and Natural Resources, Public Works, Transportation, Housing and Urban Development, National Defense, and Education; National Civil Police; two representatives of the National Association of Private Businesses; and three nongovernmental organizations that represent the country's western, central and eastern zones, respectively.

The National Commission's duties include: i) designing the National Policy for Civil Protection and Disaster Prevention and Mitigation; ii) proposing to the President of El Salvador the declaration of a State of Emergency and, in the case of such a declaration, providing immediate response and keeping public order, assisted by civil and military authorities, and humanitarian organizations; iii) supervising the implementation of Civil Protection and Disaster Prevention and Mitigation Plans in the country's most vulnerable areas; iv) coordinating the work of the subnational commissions; and v) submitting to the President, for his/her approval, regulatory instruments considered necessary to ensure compliance with the provision of Law 777, including regulations for human settlements in hazardous or potentially hazardous zones, and safe construction codes.

To ensure compliance with the National Civil Protection and Disaster Prevention and Mitigation Plan (National Plan) and other provisions, the National Commission relies on the General Bureau, which depends hierarchically and operationally on the Ministry of the Interior (Law 777, Article 17). The General Director, with the assistance of the Advisory Council (a permanent inter-institutional scientific and technical body created under the authority of Law 777, Article 19), upon approval by the National Commission, is responsible for preparing the National Plan, in addition to declaring emergency warning levels, based on the monitoring of natural phenomena and the technical information provided by the Ministry of Environment and Natural Resources (MARN)'s General Bureau of the National Service for Territorial Studies (D-SNET).[29]

El Salvador has adopted the recommendations and priority actions of the "Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters" as part of the Government of El Salvador's efforts to improve its DRM capacity. El Salvador actively participates in regional and international DRM forums, including the Central American Coordination Center for the Prevention of Natural Disasters (CEPREDENAC) and the United Nations International Strategy for Disaster Reduction (UN ISDR).

The Government of El Salvador signed the Central American Policy for Comprehensive Disaster Risk Management in June 2010. This legal agreement, adopted at the 35th Central American Integration System (SICA)'s Ordinary Meeting of Heads of State and Government, held in Panama, represents a major step towards mainstreaming DRM into the national development policies of the Central American nations.

[29] Law 777, Article 22 makes reference to the National Territorial Studies Service (SNET), which was created as a decentralized agency, assigned to MARN, by Decree No. 96 of September 14, 2001, for the purpose of developing an understanding of factors constituting risk, hazards and vulnerability as a basis for adopting measures to ensure adequate levels of safety for the population in the case of events and processes of disaster risk. The Government of El Salvador repealed Executive Decree No. 41 of May 2, 2007 and Executive Decree No. 96 which created the SNET. Executive Decree No. 42, published in the Official Gazette on May 18, 2007, transferred to MARN the environmental duties that had been assigned to the Ministry of Agriculture and Livestock (as stipulated by Executive Decree No. 24 on the Issuance of the By-laws of the Executive Agency, on April 18, 1989), together with the duties and responsibilities previously assigned to SNET, which now has the rank of a Directorate within the MARN.

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

The Government of El Salvador's 2008 Interim National Progress Report on the Implementation of the Hyogo Framework for Action[30] highlights the country's accomplishments and challenges toward achieving the goals set forth in the HFA Priority #1, as follows:

There is a national disaster risk management (DRM) platform, which identifies actions and commitments. Some progress has been made; however, there is a lack of a national policy on disaster risk reduction (DRR). The government has defined some sector policies (for example, food security, drought, land management, environment) that address DRM, but they are not properly articulated or widely disseminated. There are many efforts that are not yet coordinated.

El Salvador has a good legal and institutional framework that is still in the process of consolidation. The Government has recently published its Quinquennial National Development Plan in which the Government pledges to integrate environmental sustainability and natural disaster risk reduction into all aspects of the development planning process. The Plan brings disaster risk reduction to the forefront of the Government's agenda as an overarching theme, from which policies, plans, programs, and projects could be derived. The Government recognizes the importance of developing environmental and disaster risk awareness campaigns as a critical component of its DRM strategies.

[30] PreventionWeb (2008a).

There are insufficient resources for DRM considering that additional research and technology are needed, as is the construction of additional public works for mitigation activities. Executive Law No. 778 mandated the creation of the Civil Protection Fund, and defined the mechanism for its capitalization. It is important to ensure that the Fund has an appropriate amount of financial resources to be an effective instrument - among the portfolio of government tools - to prepare and respond to natural and man-made disasters. Even though the Fund was created to support disaster preparedness and response, the focus has been on the response. As a result, it is necessary to prioritize the allocation of adequate financial resources for DRR and mitigation into the planning of national public investments. Better planning and coordination of international disaster relief is also needed.

The Community Commissions for Civil Protection need additional support, both financial and technical, to become effective promoters of DRM at the local level. Local efforts are mostly isolated initiatives, driven by community-specific needs and emergencies. Although some progress has been made in the delegation of DRM responsibilities at the municipal level, the corresponding allocation of financial resources has not occurred. The vast majority of Municipal Commissions is still in the early stages and is constrained by insufficient resources.

The existing legal framework does not properly foster or encourage community participation and decentralization. The modernization of the state should emphasize implementing mechanisms that decentralize risk management and facilitate citizen participation.

HFA Priority #2: Disaster risk assessment and monitoring

The Government of El Salvador's 2008 Interim National Progress Report on the Implementation

of the Hyogo Framework for Action highlights the country's accomplishments and challenges in achieving the goals set forth in the HFA Priority #2, as follows:

Additional hazard and vulnerability assessments are needed in El Salvador. Studies of hazards are often found without the requisite vulnerability components. Such studies are done after an event has already impacted specific areas, exposing the fragility of the territory. Knowledge dissemination among decision-makers and the general public needs to be improved.

There is a need to coordinate efforts to standardize methodologies for risk assessment and its dissemination and for performing risk studies by sector. There are additional needs to strengthen capacities at all levels to assess risks and encourage the use of standardized terminologies.

The General Directorate of Civil Protection has made important efforts to keep the general public informed during potential emergencies. Civil Protection has improved its standing among the government authorities and the general public, making it more effective as the agency responsible for implementing the actions needed to cope with natural and man-made disasters. However, there is room for improvement in the coordination efforts with counterparts at the Department and Community levels. Additional financial and human resources are needed to ensure that all the subnational committees are well trained and well equipped, in addition to having an understanding of the risks within their jurisdictions.

The National Service of Territorial Studies (SNET)[31] monitors El Salvador's five major rivers and active volcanoes and their seismic activity. Since the publication of the 2008 Interim National Progress Report, SNET has expanded its river basin monitoring activities to include 5 additional smaller-sized river basins. However, they are very important because of the flood risk they pose to populations living along these rivers. Significant improvements have been made in terms of disseminating knowledge about risk information. There is still room to make additional efforts to (i) focus on hazards and knowledge dissemination, linking such knowledge to education and awareness; (ii) improve the mechanisms for incorporating community input, to improve the quality and relevance of the information about vulnerabilities; and (iii) strengthen DRR organizational capacities that help communities protect life and property, and develop awareness. Examples of national and regional DRM initiatives include earthquake and volcano information sharing, regional forums on climate, and a project to address tsunami threats in the Gulf of Fonseca (PTWC[32]). In the case of risk information management and dissemination, a recent project was completed in collaboration with the Regional Disaster Information Center for Latin America and the Caribbean (CRID), resulting in the online publication of more than 250 studies and other reports about hazards, vulnerability, and risks. Additionally, there are ongoing efforts to increase the level of user access to related scientific information, including audiences such as students from primary and secondary schools, as well as university students.

Since the second semester of 2000, the Ministry of Environment has started a National Program for Disaster Risk Reduction (PNRDR). Among the topics covered by this Program is the development of a Dynamic Atlas of perceived risks through the implementation of vulnerability assessments using community participatory methodologies, aimed at improving the quality of information on existing vulnerability conditions. It is also important to note that there are specific projects, at the regional and

[31] http://www.snet.gob.sv.
[32] Pacific Tsunami Warning Center.

municipality levels, implemented by NGOs such as GTZ (in San Pedro Masahuat), JICA/BOSAI (four municipalities of the Department of La Libertad), and the DIPECHO Project (San Salvador, Ahuachapán, Peace, Usulutan), among others, which are helping to increase response capabilities toward different natural hazards.

In addition, Civil Protection is currently implementing a national program that includes strengthening departmental and municipal committees in all 262 municipalities, with an emphasis on the most critical areas (including municipal and community organization, and equipment for disaster prevention and emergency management).

Continued efforts are needed to standardize and institutionalize early warning systems (EWSs). Most of the work on such systems has been oriented toward flood, volcano, and drought hazards. Most EWSs are national in scope, issuing general warnings at the departmental and municipal levels. Further work is needed to expand and link efforts and to bring them to vulnerable communities. EWSs for landslides exist only as localized efforts at the municipal level. Many initiatives in the country are called EWSs, but in reality they are no more than loose networks of community radios. Through the PNRDR, the observation and monitoring network is being updated and expanded to monitor landslides, floods (including the acquisition of weather radar), seismic activity, volcanic surveillance, tsunamis, and coastal erosion processes.

A regional DRM framework already exists, supported by the Center for the Coordination of Natural Disaster Prevention in Central America (CEPREDENAC). At the university level, there are also several regional initiatives, e.g. the System of Central American Universities (SUCA), the Inter-University initiative, the United States Army Corps (USAC), the Autonomous University of Mexico (UNAM), and the University of El Salvador (UES). The TRIFINIO project is considered a milestone because it represents an initiative that involves all levels of government and civil society, from the presidency to the local communities. However, the above examples are geared toward the assessment of hazards. Vulnerability is not properly addressed by these initiatives; therefore it is important to incorporate vulnerability components into these efforts.

All international efforts should be elevated to a political level that can ensure adequate follow-up and sustainability of these projects. All regional commitments should be disseminated to the proper audiences and have mechanisms in place to ensure their sustainability. Also, coordination of human and technical resources among international organization initiatives must be improved.

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

The Government of El Salvador's 2008 Interim National Progress Report on the Implementation of the Hyogo Framework for Action highlights the country's accomplishments in and challenges to achieving the goals set forth in the HFA Priority #3, as follows:

There remain significant constraints in accessing information at the national and local levels and information systems at the local level should be strengthened. Some information is available on websites and disseminated by the media (radio, TV broadcasting, newspapers, brochures, posters, fairs, among others) that has been generated by national and municipal government agencies, non-governmental organizations, and media sources. Some educational materials have incorporated risk reduction and have complemented these efforts nationwide, but increased focus should be placed on these activities.

Some progress has been made toward the incorporation of DRM into the formal education

process, including: (a) developing the 2021 National Plan that has incorporated risk reduction as a strategic objective, updating the official curriculums; (b) updating the "School Safety" plans as a tool to support and encourage a culture of prevention; and (c) the development and delivery of new educational materials to "educational advisers" and their multiplying effect through their interactions with local school principals and teachers. Concurrently, other entities are developing training opportunities in disaster risk prevention.

A letter of understanding and cooperation to adopt risk management strategies and incorporate them into their curriculums was signed in 2001 by eight universities in El Salvador, along with the Ministry of Education and the U.S. Agency for International Development/Office of U.S. Foreign Disaster Assistance. A group was formed to plan collaborative work and inter-institutional planning in this area, specifically to encourage the inclusion of risk management subjects in the universities' research and community outreach activities.[33]

There are still limitations on expanding the coverage of school safety plans and a need for creating culture of preparedness which would allow sustainability of risk reduction programs and projects. Higher education curricula should include disaster risk reduction. Although there have been several public and private efforts to develop research and standards on multiple hazards and some progress has been made, they have had little impact on policies or planning.

The weak enforcement of the existing legal framework is a constraining factor. There is a need for effective enforcement of territorial zoning and building codes, along with environmental regulations. Development projects should comply with the technical recommendations, eliminating the short-term vision that has characterized urban development and land use practices, hindering the implementation of long-term, sustainable development alternatives.

Despite the lack of a national awareness strategy, some efforts have been made to help shift current attitudes toward a culture of disaster risk awareness, and toward becoming more resilient through the implementation of several governmental and non-governmental programs and projects. Although the results are still limited, in some areas of the country, where the incidence of disaster events has been higher, the population has begun to identify their own needs and their own potential to confront natural and anthropogenic hazards acting, in some cases, with autonomy.

The launching of the Government's Quinquennial Development Plan 2010-2014 is a major step towards developing a culture of safety and resilience across all sectors of society. The Government pledged to make DRM a cornerstone of its development agenda, with an important component of public awareness campaigns aimed at mainstreaming environmental sustainability and risk prevention and mitigation issues. The effective implementation of this new policy will have a significant positive effect on the country's efforts to reduce the social and economic costs of natural disasters.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

The Government of El Salvador's 2008 Interim National Progress Report on the Implementation of the Hyogo Framework for Action highlights the country's accomplishments and challenges

[33] USAID (2007).

toward achieving the goals set forth in the HFA Priority #4, as follows:

There is a need to expand the types of development projects that are required to perform risk assessments, and also to disseminate information about those projects that are already preparing them for the purpose of enabling transparency and a better understanding of the progress made in this respect.

Municipal Civil Protection Plans are not implemented or included in the development plans. Risk has not been included in environmental management. Current land zoning plans are weak with regard to risk prevention. El Salvador's territory is not being utilized according to its optimal use types. There are land zoning and development plans, but these are restricted to certain areas. Even in those municipalities with these plans, disaster risk has not been included in a substantive way. The development plans and building codes need be updated and enforced to better address relevant threats.

Although disaster risk reduction is set forth in the national and municipal laws and regulations, there remains a need to strengthen and link environmental planning, natural resources, and climate change dimensions. It is expected that the implementation of the policies set forth in the Government's Quinquennial Development Plan 2010-2014 will help eliminate the cultural, organizational and regulatory constraints that precluded the effective integration of environmental, DRM and climate change dimensions into the development planning process at all levels of organization in the country.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

The Government of El Salvador's 2008 Interim National Progress Report on the Implementation of the Hyogo Framework for Action highlights the country's accomplishments and challenges toward achieving the goals set forth in the HFA Priority #5, as follows:

The country has made significant efforts at the institutional, departmental, municipal, and local levels with the objective of reducing disaster risk, although the emphasis has been on disaster response rather than on prevention and mitigation.

Until now, existing mechanisms have not yet provided for effective coordination. Although the legal framework establishes procedures and protocols, these are not always enforced. The development of DRM policies, mechanisms, and capacities aimed at the different levels of government are needed.

Although all levels of the administration are required by law to have contingency and preparedness plans, not all have established such plans. Legally required periodic emergency response drills and training events need to be performed, with proper scope and frequency, to prepare the population by raising its level of awareness, and to fine-tune the government's response capacity.

There is a need for an assessment–at all administrative levels–to gauge the achievements and to better understand outstanding challenges. There is also a need to revise and update current plans through a properly designated coordinating body.

The country has the Civil Protection and Disaster Prevention and Mitigation Fund, created to finance disaster preparedness and response activities. Law 778 mandated the allocation of seed money for the Fund, as well as budget allocation from the Ordinary Budget, to be complemented with an ordinary budget allocation, adequate for the purpose of the Fund. However, recent disasters in El Salvador

have shown the need to develop a better capitalization mechanism to ensure that enough financial resources are readily available to cope with emergencies.

Adequate amounts of international humanitarian aid combined with creative financial instruments to help the country prepare for and during an emergency may help reduce or eliminate the need of having government agencies redirecting funds from their ordinary budgets and core activities toward emergency response. Ensuring that proper disaster mitigation measures are implemented to minimize potential damage will help reduce the need for additional resources for disaster recovery and reconstruction activities.

The Civil Protection Law mandates the compulsory exchange of disaster risk data among relevant bodies and the maintenance of up-to-date emergency response procedures; however, there are still gaps in their implementation. It is necessary to strengthen and improve existing coordinating mechanisms between government agencies and civil society organizations. There is still a need to improve sharing of protocols and procedures among all institutions to ensure better coordination and adequate activity implementation. It is important to identify areas for improvement, building upon the experiences gained through past and recent disaster events.

ADDITIONAL OBSERVATIONS

The National Plan for Territorial Zoning and Development (*Plan Nacional de Ordenamiento y Desarrollo Territorial*, PNODT) is viewed as a critical input for the development and implementation of effective national environmental and DRM policies and strategies. The PNODT organizes El Salvador's territory around five central themes: (1) regional development, (2) expansion of a local business base, (3) municipal association and decentralization, (4) land management, and (5) Central American integration.[34]

Even though in El Salvador compliance with the building code is mandatory by law, there are gaps on its enforcement (particularly in rural areas and in unplanned urban developments in the metropolitan areas). The National Registry of Architects, Engineers, Designers and Builders of El Salvador has the legal mandate to supervise the professional practice of its members, including their performance in design and construction procedures. However, low-income families who build their own homes - unsupervised by a professional - are particularly vulnerable, as they build without the proper building materials, usually in marginal, high-risk areas.

Conclusions and Expected Tangible Outputs and Outcomes in DRM

El Salvador is confronted with the challenge of strengthening its existing institutional capacities for disaster risk management (DRM) under policies of decentralization of authority, financial and human resources as mandated by Law 777 and its regulation and recommended best practices within the Hyogo Framework for Action. These policies make local governments accountable for designing and enforcing building codes and the regulatory framework for zoning and planned urban development. Mainstreaming DRM in El Salvador should be considered a major priority of the Government of El Salvador.

It is expected that El Salvador will continue enhancing its role within regional DRM organizations, developing synergies that can strengthen the country's natural disaster

[34] Millennium Challenge Corporation. Presidential Program. http://www.mca.gob.sv/.

preparedness and resilience. International cooperation has played a major role during natural catastrophes in El Salvador; however, the country should develop innovative mechanisms for capitalizing its funding for emergency response to ensure that it has the capacity to effectively respond to the effects of natural disasters, including developing risk transfer mechanisms to protect the country's public infrastructure and the nation's social and economic networks.

The World Bank and the GFDRR should continue supporting the Government of El Salvador's efforts to develop an effective legal and institutional framework that incorporates DRM as a cross-cutting theme into the national planning process and within critical sectors and levels of government administration.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
The Earthquake Emergency Reconstruction and Health Services Extension Project (RHESSA)	World Bank	169.4 million 2003-2009	3, 4, 5
PREVDA (Allocated Budget reflects amount budgeted for 2009 activities in El Salvador)	European Commission CEPREDENAC	1.24 million 2007-2010	1, 2, 3
Institutional Strengthening for Watershed Management, Protected Area Management, and Natural Disaster Risk Management in El Salvador. Phase I	Spanish International Development Cooperation Agency (AECI)	549,332 2007-2009	1, 2
Institutional Strengthening for Watershed Management, Protected Area Management, and Natural Disaster Risk Management in El Salvador. Phase II	Spanish International Development Cooperation Agency (AECI)	480,000 pending approval	1, 2
Development of Geological and Seismological Studies towards Seismic Risk Mitigation.	Spanish Fund for Retooling Aid/ Spanish Debt Swaps Fund	80,000	2
National and Local Capacity for Risk Prevention and Mitigation. National Reports on Risk and Vulnerability. Phase I	Spanish Trust Fund UNDP	1.27 million 2007-2008	1, 2, 5
Risk Reduction II	Spanish Trust Fund UNDP	1.36 million 2008-2010	1, 5
Study of the Tectonic and Structural Framework: Contribution to the knowledge of the tectonics of active volcanoes in El Salvador; Mapping Volcanic Hazard Scenarios	Secretary of Foreign Relations-National University of Mexico (UNAM)	2007*	2, 5
Seismic Micro-Zoning of San Salvador Metropolitan Area	Japan International Cooperation Agency UCA	2007*	2, 5
Seismic Risks in San Salvador Metropolitan Area	Research Council of Norway (NORSAR) UCA-SNET	2008*	2, 5
Central American Program for Regional Capacity Enhancement for Landslide Mitigation Measures	Norwegian Geotechnical Institute	2008	2, 3, 5
Mitigation of GeoRisk in Central America, Phase II	German Federal Institute of Geosciences and Natural Resources	2005-2009	2, 3, 4
Early Warning System for Central America: SATCA	United Nations' World Food Program	2008	4, 5

KEY DONOR ENGAGEMENTS CONTINUED

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Flood Early Warning System for San Salvador Metropolitan Area	Inter-American Development Bank	pending approval	4, 5
Implementation of Vulnerability and Risk Indicators	Inter-American Development Bank	pending approval	2, 3
Risk Reduction Project	Japan International Cooperation Agency Civil Protection	pending approval	1, 2
Network of Atmospheric and Volcanic Change Monitoring (for the Santa Ana and San Miguel Volcanoes)	European Commission Chalmers University NOVAC	56,965 2007-2009	2
DesInventar	United Nations' World Food Program	2007*	2, 3
Support to Local Risk Management in 10 municipalities of the Department of Sonsonate	COSUDE	2008*	3, 5
Information System, Monitoring and Early Warning for Southern Ahuachapan	European Commission (DIPECHO)	2008*	2, 5
Preparation of the National Report on Risks and Vulnerability Project	United Nations' World Food Program	2007*	1, 3
Flood Risk Management in the Rio Grande de San Miguel and the Rio Paz watersheds	Inter-American Development Bank	1.2 million until 2009	2, 3, 4, 5
El Salvador - Central American Probabilistic Risk Assessment (CAPRA)	World Bank/ Inter-American Development Bank	450,000 (estimated)	1, 3, 4, 5
Flood Risk Prevention through Improved Forest Vocation Land Management in ES	Inter-American Development Bank	150,000 2008-ongoing	1, 2
Model for Water Resources Management	Inter-American Development Bank	720,000 2005-2007	2, 4
Environmental Action Plan at the Municipal Level	Inter-American Development Bank	388,700 2003-2007	1, 2, 4, 5
Sustainable Development Lower Rio Lempa Program	Inter-American Development Bank	298,650 2001-2005	2, 3, 4, 5
Desertification Initiatives	Inter-American Development Bank	110,000 2000-2002	2, 4
Tri-national Lempa Watershed Management Project	Inter-American Development Bank	175,000 1999-2000	2, 4, 5
National Environment Protection Program	Inter-American Development Bank	30.0 million 1997-2007	1, 2, 3, 4, 5
Safe School Program	World Bank/ GFDRR/ Government of Brazil	50,000 2010-2011	3, 4, 5
Central America Mitch + 10 Report and Summit	World Bank/GFDRR	270,000	1, 2, 3, 4, 5
Tropical Storm Ida Post-Disaster Damage, Loss, and Recovery Needs Assessment	World Bank/GFDRR	100,000 2009	1, 2, 3, 4, 5
Tropical Storm Agatha Post-Disaster Damage, Loss, and Recovery Needs Assessment	World Bank/GFDRR	125,000 2010	1, 2, 3, 4, 5
Disaster risk management development policy loan with a Catastrophe Deferred Drawdown Option (CAT DDO)	World Bank	50 million pending approval	1, 4, 5

* Amount unavailable

Given El Salvador's disaster risk profile and its existing framework for disaster risk management, the key priority in El Salvador is to mainstream disaster risk reduction at the sectoral level. Strategic actions are needed in the following areas to enhance disaster risk management in El Salvador: (i) strengthen institutional capacity of members of the National Commission and coordination among them; (ii) strengthen the human and financial resources of the General Directorate of Civil Protection; (iii) reduce vulnerability in urban areas; and (iv) develop a comprehensive risk assessment and monitoring capacity.

The most immediate activity sponsored by the GFDRR in El Salvador is the incorporation of a comprehensive risk assessment platform by joining efforts with other countries in the region that are actively involved with the Central American Probabilistic Risk Assessment (CAPRA).[35] CAPRA is expected to improve the country's capacity to prepare and respond to natural disasters.

The following activity recommendations respond to critical DRM needs in the country:

i) continued support and enhancement of Protección Civil's technical capacity and leadership role in risk prevention and mitigation; ii) capitalization of the Disaster Prevention and Mitigation Fund – incorporating innovative mechanisms to ensure adequate levels of funding; iii) developing strategies for mainstreaming DRM, as a cross-cutting theme, into the budgeting and planning processes of all ministries and other government institutions (e.g. ensuring that new hospitals and educational buildings are not built in areas prone to floods, landslides and other known hazards, and according to international anti-seismic standards; old buildings should be retrofitted to withstand the impact of earthquakes); iv) incorporation of disaster risk reduction and mitigation measures in the government's infrastructure construction and maintenance activities; and v) mainstreaming of DRM among local communities. This is especially important in the case of the Greater Metropolitan Area of San Salvador, where suitable land for urban development is becoming ever more limited, forcing low-income families to build in high-risk areas, without proper building materials or professional supervision.

[35] http://ecapra.org.

COUNTRIES AT RELATIVELY HIGH MORTALITY RISK FROM MULTIPLE HAZARDS
(Top 96 based on population with 2 or more hazards)[a]

1. Bangladesh
3. Dominican Republic
5. Haiti
8. El Salvador
9. Honduras
10. Guatemala
12. Costa Rica
17. Nicaragua
26. Ecuador
28. Colombia
37. Peru
45. GRENADA
55. Mexico
61. Belize
63. United States
96. Thailand

[a] Dilley et al. (2005). Table 1.2.

New construction, particularly in relation to tourism, continues with little formal land use planning or construction code enforcement.

GRENADA

Natural Disasters from 1980 - 2005[b]

Affected People

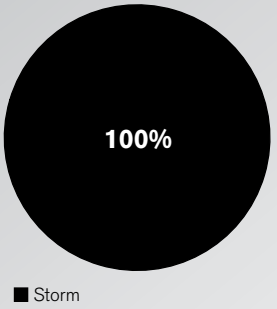
Disaster	Date	Affected (Number of People)
Storm	2004	60,000
Storm	2005	1,650
Storm	1990	1,000
Storm	1999	210
Storm	1980	0

Economic Damages

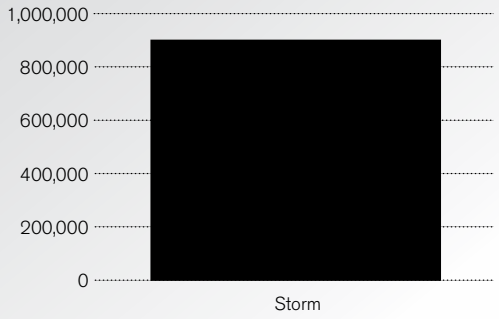
Disaster	Date	Cost (US$ x 1,000)
Storm	1980	889,000
Storm	1999	5,500
Storm	1980	5,300
Storm	1990	0
Storm	2005	0

Statistics by Disaster Type[b]

Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=69. Source data from EM-DAT. Data displayed does not imply national endorsement.

DISASTER RISK PROFILE

Grenada is the southernmost country in the Windward Island chain of the Caribbean and is located at 12º north latitude by 64.47o west longitude. The country comprises three islands, the largest of which is Grenada followed by Carriacou and Petite Martinique. Grenada is approximately 33 km long north to south and approximately 14 km wide, along the east west axis, and occupies approximately 344 km^2 of land area. By contrast, Carriacou and Petit Martinique cover approximately 34 and 2.36 km^2 respectively.

Historically, Grenada was considered relatively safe from hurricanes owing to its location in the southernmost region of the hurricane belt. Prior to 2004, Grenada had seen a total of 3 hurricanes since the beginning of the 20th century.[1] These included one unnamed storm in 1921, Hurricane Janet in 1955 and Hurricane Flora in 1963. While damages associated with Flora and the 1921 storm were relatively minor, Janet passed Grenada as a Category 3 storm[2], causing severe damage to the island and resulting in 110 storm-related deaths.

In September 2004, nearly 50 years after the passage of Janet, Grenada was hit by Hurricane Ivan, a Category 3 storm. The impacts were devastating resulting in an estimated US$800 million (2004) in losses.[3] While deaths attributed to the storm were relatively few (39), damages to infrastructure and agricultural losses were estimated at twice Grenada's GDP, estimated at US$450,000 for 2004. Adding to the economic impacts of the storm, the Government was severely crippled as the capital, St. Georges, sustained major damages and many government employees and officials suffered personal losses. Almost 1 year later, in July 2005, Grenada was hit yet again, by Hurricane Emily. Emily passed the island as a Category 2 storm, further impacting infrastructure already damaged by Hurricane Ivan.

Approximately 52.1% of the population of Grenada is exposed to risk of mortality from 2 or more hazards.[4] Given the islands' size, 100% of the estimated population of 110,000 can be exposed during a single storm event. While infrequent, Hurricanes Ivan and Janet demonstrate Grenada's vulnerability to storm-related risks. Apart from storms, Grenada is regularly exposed to risk of landslides which occur with frequency during the annual rainy season from June to December, caused by tropical waves and upper-level troughs. Storm surge is problematic in exposed coastal areas either through localized flooding in low-lying reaches or through cliff side erosion which has its greatest impact on the island's principal road, linking coastal and interior communities. Additionally, Grenada is exposed to the potential effects of volcanic eruption from Kick-'em-Jenny, an active 1300-meter undersea volcano located 8 km north of Grenada.

Geological Hazards

Grenada is a volcanic island located on the eastern margin of the Caribbean plate. There are two active volcanoes in Grenada, Mount St. Catherine in the center of the island and the submarine volcano Kick-'em-Jenny located 8 km north of the island. Mount St. Catherine rises above the landscape some 846 meters and while the area supports active fumaroles and hot springs there has been no eruption in historical times. Geologic evidence suggests the last eruption could have produced a scoria (cinder) cone that is less than 1000 years old.

[1] NOAA Historical Hurricane Database.
[2] Saffir-Simpson Scale.
[3] World Bank (2005).
[4] Dilley et al. (2005). Table 7.2b and Table 1.2.

Kick-'em-Jenny has erupted 12 times since 1939, with the 1939 eruption recorded as the strongest, producing a tsunami estimated at 2 meters.[5] Kick-'em-Jenny is an under-sea volcano that rises some 1300 meters from the seafloor, reaching a depth below sea surface of approximately 180 meters. Over 2009, the alert level, as defined by the University of the West Indies Seismic Research Center continued as yellow indicating the "volcano is restless: seismicity and/or fumarolic activity are above the historical level or other unusual activity has been observed or can be expected without warning."[6] Given the proximity of the volcano to Grenada's shores, should a tsunami be generated, travel times will be less than 5 minutes, eliminating the possibility of any advance warning.

While earthquake risk is moderate to low, seismic events associated with Kick-'em–Jenny's activity pose a risk of significant earthquake impact. Earthquake risk is relatively low, with Grenada classified in seismic zone 2 under a 4-zone system. Grenada regularly experiences low intensity earthquakes of magnitude 3 or less. These are generally related to shallow earthquakes associated with magmatic displacement. An eruption of Kick-'em-Jenny has the potential for producing a significant earthquake.

Floods and Landslides

Flood risk in Grenada is largely associated with storm surge in low lying coastal areas. Flash flooding from mountain streams coupled with storm surge events are the primary causes of flood events and effects are generally limited to communities located in the coastal margins along stream passages. As much of the island's coast is formed by steep cliff formations, fishing villages are located where access to the sea is open along stream mouths. Among the areas of particular risk to storm surge (or tsunami) is the country capital, St. Georges. This is a harbor town and supports the island's principal port. Impacts to this area are particularly important as the port is the island's principal supply link.

Landslides are a common event in Grenada, with much of the impact experienced along the roadway network. Grenada's mountainous terrain, coupled with its volcanic geomorphology, promotes an increased risk of landslides, particularly where slopes are cut to accommodate construction. With little flat land available for construction, much of Grenada's housing stock is found on steeply sloping hillsides. Structures built without adequate design or quality controls are at greatest risk. Landslides are usually associated with periods of prolonged rainfall which occurs during the rainy season from June to December.

Determinants of Vulnerability to Adverse Natural Events in Grenada

Much of the island's construction occurs on steep slopes often exceeding 45 degrees. There is little protection from the direct impacts of wind forces and prolonged rainfall promotes slope de-stabilization. Informal constructions are at greatest risk as they do not benefit from adequate engineering.

New construction, particularly in relation to tourism, continues with little formal land use planning or construction code enforcement. Construction codes exist but are not evenly applied. Informal settlement continues to occur and vulnerabilities associated with these activities are greatest as settlements tend to be located in areas of increased risk without benefit of engineering support.

[5] http://www.cdera.org/doccentre/fs_tsunami.php.
[6] http://www.uwiseismic.com.

The health infrastructure is comprised of 6 health centers, 30 medical stations and 4 hospitals.[7] The St. George General Hospital is the main healthcare facility on the main island of the country.

CLIMATE CHANGE AND GLOBAL WARMING

Grenada was cited in the Germanwatch 2010 Global Climate Change Risk Index. The 2010 Climate Risk Index is based on figures from 2008 and is also an analysis of the worldwide data collection on losses caused by weather-related events during 1998–2008. Grenada was ranked 32nd for the decade with GDP losses of 12.17%.[8] Two factors were cited: the impact of global warming on rising sea levels which increase the risk of storm surges, and secondly the increase in the strength of hurricanes.[9]

Climate Change models[10] have predicted that Grenada will undergo a warming and drying trend and is expected to endure more frequent heat waves and droughts, rainfalls with increased intensity, and rising sea levels as predicted for the rest of the Caribbean consistent with the projected global median.[11] It is known that inter-annual climate variability of either the Pacific or Atlantic explains a significant amount of the total variance in rainfall in the Caribbean and Central America.[12] Probable climate change impacts in Grenada include higher temperatures, higher storm intensities and, possibly, more frequent El Niño-Southern Oscillation (ENSO)[13] events, exacerbating existing health, social and economic challenges affecting Grenada.

Changes in sea surface temperature as a result of climate variability could increase the intensity of cyclones and heighten storm surges, which in turn will cause more damaging flood conditions in coastal zones and low-lying areas. According to the World Bank's study, "Sea Level Rise and Storm Surges",[14] the impact of sea level rise and intensified storm surges in Latin America and the Caribbean will be high. While data is not available for Grenada, data for Puerto Rico is showing an increase of 51.84% - with 53.81% of the coastal population exposed and potential losses of coastal GDP projected to exceed 52.71%.

Grenada's first National Communication on Climate Change (NCCC)[15] was released in 2000. The National Vulnerability Statement assesses what is currently known about Grenada's vulnerability to the effects of climate change (rising temperatures, sea level rise and increase in extreme events), identifies existing gaps in the available information and makes recommendations on how such information gaps can be addressed. There are no specific climate change scenarios available for Grenada. The scenarios adopted for temperature changes and sea level rise are based on the IPCC (1995) accepted and recommended scenarios, i.e. temperature rise of 1.0°C to 3.5°C and sea level rise of 15cm to 95cm by 2100. In the case of Grenada, a positive or negative variation of 5% to 20% in total precipitation by the year 2100 may be considered. An increase in the frequency of extreme events may also be experienced. It is

[7] PAHO (2007).
[8] Harmeling (2009). Table 5.
[9] McLymont-Lafayette (2009).
[10] Hadley Centre Coupled Model, Version 2 (HADCM2), as reported in Mulligan (2003). Same modeling data as used by the Intergovernmental Panel on Climate Change (IPCC).
[11] Chen et al. (2008).
[12] Giannini et al. (2002).
[13] El Niño-Southern Oscillation; commonly referred to as simply El Niño, a global coupled ocean-atmosphere phenomenon.
[14] Dasgupta et al. (2009).
[15] Ministry of Health and Environment (2000).

predicted that by the year 2100, there will be a 5 to 10 percent increase in the wind speeds of tropical storms worldwide for a sea surface temperature increase of 2.2 °C (Knutson et al. 1998).

DISASTER RISK MANAGEMENT FRAMEWORK

Disaster management in Grenada was formalized in 1985 with the establishment of National Emergency Relief Organization (NERO) and an office for a volunteer disaster coordinator under the office of the Prime Minister. Through a largely volunteer effort, the first National Disaster Plan was developed. In 2004, the name of the organization was changed to NaDMA, the National Disaster Management Agency. In 2005, the National Disaster Plan was revised.

NaDMA operates under the authority of the Office of the Prime Minister. Disaster management in Grenada is a committee-driven program with no specific enabling legislation. Emergency operations are conducted through the authorities established under the Emergency Powers Act of 1987.[16] The Governor-General may, by Proclamation which is then published in the Official Gazette, declare that a state of public emergency exists.[17]

In 2005 the National Disaster Plan was revised in a workshop conducted with the various national agencies and key private sector groups. The plan identifies and assigns responsibilities to various committees and their members for the implementation of a range of activities relating to disaster prevention, public awareness, disaster management, and disaster recovery. Roles for all ministries of Government are included in the plan and their operational authorities are derived from existing legislation relating to their various responsibilities under law. Driving the process is the National Emergency Advisory Council (NEAC), responsible for advising the Prime Minister (and NaDMA) on policy issues relating to disaster management and preparedness. All government ministries are represented along with key private sector businesses, civil and trade groups.

Operations during a disaster occur under the authorities of the Emergency Powers Act with NaDMA serving the office of the Prime Minister as the national coordinating body. Line agencies, such as the national police, government ministries, corporations such as the airport authority and port authority, conduct their activities in accordance with the responsibilities assigned under the plan and under the authorities of their respective enabling legislation. NaDMA coordinates and oversees the operations of 17 District Disaster Management Committees.

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

Under the National Disaster Management Plan[18], Grenada has established NaDMA as the national coordinating body to organize and manage a committee-driven disaster management program. Organizational authorities are established through the Office of the Prime Minister and the

[16] OAS-DSD (1987b).
[17] OAS-DSD (1973).
[18] The National Disaster Management Plan was revised in 2005 after Hurricane Ivan. The plan is currently undergoing revision (2010).

St. George's, Grenada

Emergency Powers Act of 1987. NaDMA currently consists of a staff of 11 persons with offices in the disaster operations center, constructed in 2004.

Disaster management in Grenada is organized through a series of national and local committee structures that are designed to foster consensus building and awareness at all levels of government. The National Disaster Committee is composed of representatives from each of the line ministries as well as the private sector.

Line ministries are responsible for their respective functional areas prior to and during a disaster. Ministries have achieved varying readiness capabilities and work is proceeding in this area. Additionally, disaster response and planning in Grenada is based on the implementation of local activities through the 17 established District Disaster Committees decentralizing various disaster management responsibilities.

Grenada does not currently have specific Disaster Risk Management (DRM) legislation. Much of Grenada's disaster activity is still managed in the preparedness/response context. In 2003, the Caribbean Development Bank (CDB) and the Caribbean Disaster Emergency Management Agency (CDEMA), formerly CDERA, produced the National Hazard Mitigation Policy. National policy currently does not yet mandate DRM as a development objective. Disaster risk reduction through development policy and planning is still in its early development.

After the experience with Hurricane Ivan, efforts in improving public awareness and preparedness were given renewed emphasis. NaDMA maintains a web presence both in its organizational website (http://mypages.spiceisle.com/nadma) and through the national Government of Grenada website (http://www.gov.gd/departments/nadma.html).

Since 2005, NaDMA has sought to improve disaster awareness at the community level. This has been accomplished through a series of initiatives including television presentations, the coordination of disaster awareness in schools with the Ministry of Education, distribution of brochures and various public events including Disaster Awareness Week, to heighten public preparedness and awareness.

HFA Priority #2: Disaster risk assessment and monitoring

Mapping and GIS capability is managed largely through the Ministry of Agriculture with some use in other ministries but progress in this area is limited. Various risk mapping exercises have been completed, including a school construction risk assessment, school landslide vulnerability assessment, shelter vulnerability and a coastal multi-hazard analysis prepared for selected communities. No comprehensive multi-hazard map compilation has been prepared.

Supporting the development of hazard maps, GIS resources in Grenada include national topographic maps, soils, infrastructure, rainfall and other base map elements required to support hazard mapping.[19]

NaDMA lacks basic GIS capacity. NaDMA is in possession of 4 junos but requires licenced GIS programs. All the hurricane shelters in the south of the island are mapped. The Agency needs more training in GIS-based mapping resources as they currently lack equipment and a staff GIS professional.

The ministry of Agriculture maintains a system of stream gauges and meteorological stations on the island. These are not automated systems. Seismic monitoring is managed through a series of 17 networked seismographs located throughout the country and Kick-'em-Jenny is instrumented through UWI with an independent monitoring system.

In accordance with the national disaster plan, the Grenada National Meteorology Office monitors and forecasts weather, providing general forecasting services and disaster alert warnings. The office coordinates with the U.S. National Oceanic and Atmospheric Administration for forecasting support and weather satellite imagery access. NaDMA assists in coordinating the distribution of these warnings and provides public preparedness advice.

Six networked seismic stations are located in Grenada and Carricou. A special monitoring system has been installed to observe Kick-'em-Jenny operated by the University of the West Indies Seismic Research Center. Maintained by the Center, the system is used to measure real-time activity and as a basis for informing the public through a 4-level early warning system.

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

With Hurricane Ivan in recent memory, Grenada's population is acutely aware of disaster-related risks and potential impacts. Efforts on the part of NaDMA have continued to provide information and promote risk awareness through meetings, public campaigns and the introduction of disaster preparedness in the educational curriculum.

As current disaster management efforts are focused on preparedness and response, risk reduction through planning and risk avoidance strategies remains the next advancement to be achieved. While the post-Ivan reconstruction

[19] CDERA (2003c).

theme was "Building Back Better", risk avoidance and resilience are not commonly integrated in development practices. Vulnerability assessments are not commonly completed for individual works projects and local contractors still require training and education in resistant-construction practices.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

Reconstruction from Hurricane Ivan included a priority focus on improving disaster resistance in virtually all reconstruction activities. Additional efforts were realized with the government in the evaluation of existing structural vulnerabilities in strategic facilities such as schools and medical facilities. Disaster risk is currently included in the requirement for environmental assessment as it applies in Grenada.

A building code for Grenada based on CUBiC[20] was most recently revised in the mid 1990's. While new construction for public buildings is monitored for code compliance, private constructions are variously monitored for compliance as the national building code does not have the force of law. Eligibility requirements for mortgages and private insurance are likely factors for building design and construction in the private sector.

Land use planning is currently a factor for disaster risk reduction in Grenada in areas where local area plans have been developed. While some land use planning occurs, its translation into actual land use constraints is limited.

No national system for the reduction of vulnerability is currently in place for the planning or the construction of new facilities. After the passage of Hurricane Ivan, many businesses took stock of their losses and increased structural resilience during the reconstruction process. Development limitation maps were prepared for a part of the parish of St. Andrew through local area planning, however there is need for policy development by the government.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local level

Since Hurricane Ivan, disaster preparedness and awareness have greatly improved at all levels. Citizens react when informed of impending storm events and are more aware of the seriousness of preparing for possible events. The revision of the National Plan has imparted a greater level of organization to the preparedness and response process, and disaster management is a priority at all levels of government.

Grenada is a member of the regional Caribbean Disaster Emergency Management Agency (CDEMA).

With a total population of around 110,000 persons, Grenada's capacity to respond to a major disaster without major outside support will remain limited for the foreseeable future. Risk reduction and improved insurance coverage will be key factors supporting reconstruction capacity. As it relates to public sector risks, Grenada is a subscriber to the Caribbean Catastrophic Risk Insurance Facility.[21] This offers short-term liquidity in the event that the policy is triggered.

[20] Caribbean Uniform Building Code.

[21] The CCRIF is the first multi-country risk pool in the world, and is also the first insurance instrument to successfully develop a parametric policy backed by both traditional and capital markets. It is a regional insurance fund for Caribbean governments designed to limit the financial impact of catastrophic hurricanes and earthquakes to Caribbean governments by quickly providing financial liquidity when a policy is triggered.

Certain critical facilities are protected to a greater degree. The St. Georges port facility, for example, is managed as a government-owned corporation and maintains its own commercial insurance. This was responsible for the rapid repair of facilities damaged during Hurricane Ivan.

The tourism sector, a major contributor to the Grenada economy, is largely insured by commercial underwriters. Other sectors, such as agriculture, transport, and/or housing remain relatively vulnerable.

Vulnerability assessments of the health sector infrastructure have been carried out recently. The St. George General Hospital, main healthcare facility in the country, was assessed in 1996. Some mitigation works were implemented in Duncan ward in 2000. More recently, in 2008, the hospital was assessed using the PAHO/WHO hospital safety index. The assessment provided an estimate of the hospital's capacity to continue providing services during and after a large-scale disaster or emergency and guided necessary interventions actions to increase the hospital's safety in case of disasters. The recommendations addressed structural, non-structural and functional aspects of the facility. Some of these recommendations have already been implemented. The same methodology was used to assess the rest of the health infrastructure which comprises 2 other hospitals on the main island and one in Carriacou, 6 health centers and 30 medical stations (as of late 2009).

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Hurricane Ivan Emergency Recovery Project	World Bank	10 million 2004-2009	1, 2, 3, 4, 5
Post-Hurricane Ivan School Reconstruction Project	European Union, through World Bank	13.4 million 2005-2009	2, 4
Caribbean Risk Management Initiative	UNDP	2.1 million 2004-2010	1, 2, 3
Enhancing Resilience to Reduce Vulnerability in the Caribbean	Government of Italy	4.5 million 2009-2011	1, 2, 3, 4, 5
Grenada Reconstruction, Recovery and Development Program	IADB	10 million 2005-2010	
Regional DRM Strategy for the Caribbean Tourism Sector	IADB	800,000 2007-2009	
Regional Monitoring and Evaluation Framework for DRM in the Caribbean Tourism Sector	IADB	750,000 2009-2012	
Mainstreaming DRM in the OECS Countries	IADB	400,000 2008-2011	
Disaster Mitigation and Restoration – Rockfall and Landslip Project	CDB	5.2 million 2006	4
Disaster Mitigation and Restoration – Rockfall and Landslip (Add Loan)	CDB	3.7 million 2008	4

COUNTRIES AT RELATIVELY HIGH MORTALITY RISK FROM MULTIPLE HAZARDS (Top 96 Based on population with 2 or more hazards)[a]
1. Bangladesh
3. Dominican Republic
5. Haiti
8. El Salvador
9. HONDURAS
10. Guatemala
12. Costa Rica
17. Nicaragua
26. Ecuador
28. Colombia
37. Peru
47. Montserrat
55. Mexico
61. Belize
63. United States
96. Thailand

[a] Dilley et al. (2005). Table 1.2.

Hurricane Fifi struck Honduras in September 1974, killing around 8,000 people – the actual number of people killed is unknown.

HONDURAS

Natural Disasters from 1980 - 2008[b]

Affected People

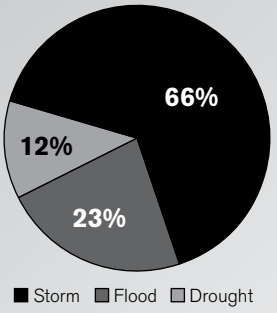
Disaster	Date	Affected (Number of People)
Storm	1998	2,112,000
Flood	1999	503,001
Flood	2008	313,357
Drought	2001	195,000
Drought	2004	137,500
Storm	2005	90,000
Storm	2001	86,321
Drought	2002	82,000
Flood	1996	75,000
Flood	1993	67,447

Economic Damages

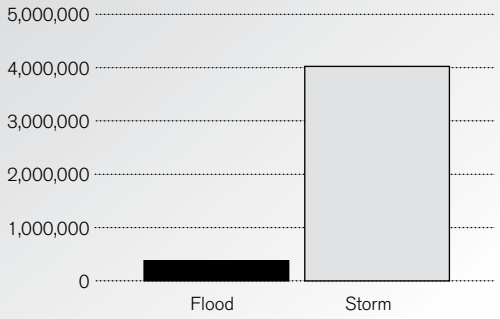
Disaster	Date	Cost (US$ x 1,000)
Storm	1998	3,793,600
Storm	1982	101,000
Flood	1990	100,000
Flood	2002	100,000
Storm	2005	100,000
Flood	1993	57,600
Flood	1993	57,700
Flood	1996	31,000
Flood	2003	20,000
Storm	2005	15,500

Statistics by Disaster Type[b]

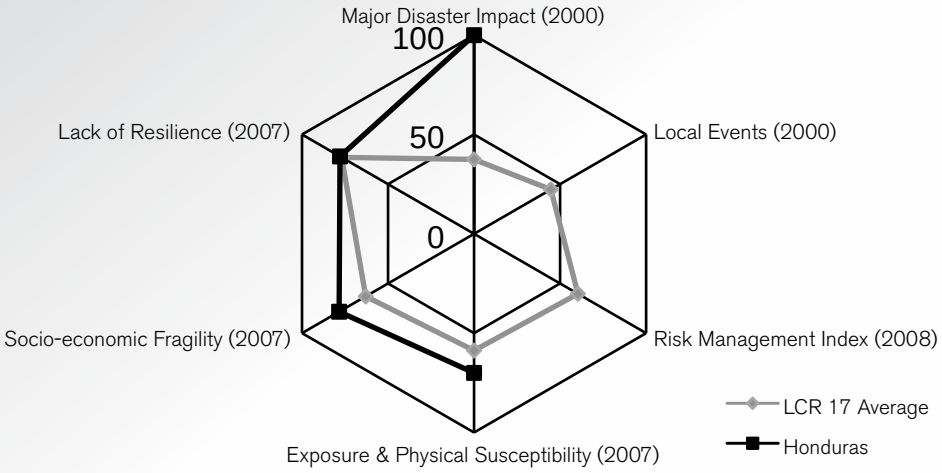
Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



Relative Vulnerability and Risk Indicators[c]



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=76. Source data from EM-DAT. Data displayed does not imply national endorsement.

[c] Relative Vulnerability and risk Indicators are adapted from IADB-IDEA-ERN (2009). Values are normalized on scale of 0 – 100 and presented against the average for 17 LCR countries. Major disaster Impact taken from disaster deficit Index: the ratio of economic losses which a country could suffer during a Maximum Considered event and its economic resilience. Local events taken from Local disaster Index: the propensity of a country to experience recurrent, small-scale disasters and their cumulative impact on local development. risk Management Index is presented as the negative (i.e. 0 = optimal, 100 = incipient) of IADB's risk Management Index: measures a country's risk management capability in (i) risk identification, (ii) risk reduction, (iii) disaster management, and (iv) financial protection. resilience, Fragility and exposure are taken from the component indices of Prevalent Vulnerability Index. Date for local event data depends on information available for each country. Data, and the respective LCR 17 average, from 2000 is used for Dominican Republic, El Salvador, Guatemala, Jamaica and Nicaragua. Data, and the respective LCR 17 average, from 2006-08 is used for Bolivia, Colombia, Costa Rica, Ecuador, Panama and Peru. All LCR 17 averages are calculated based on available data.

DISASTER RISK PROFILE

Honduras ranks 9th among countries at relatively high mortality risk from exposure to two or more hazards, according to the Natural Disaster Hotspot study[1] by the World Bank.

The same study also ranks Honduras 24th among countries with the highest economic risk exposure from two or more hazards.

Honduras is the second largest country of Central America, with an area of 112,088 square kilometers, and the second most populated. Honduras is also the third poorest country in the Western Hemisphere.[2] Two thirds of the Honduran population are poor (with per capita income less than US$1.50 a day); and three out of every four poor people are extremely poor (with per capita income less than US$1 a day). In addition, about half of the population of Honduras is rural, and 80 percent of the rural population lives in hillside areas[3], practicing subsistence agriculture, with the limitations of small-sized holdings, primitive technology, and low productivity that characterize hillside cultivation. Increasing land degradation and low agricultural productivity are major drivers of Honduras' rural poverty.[4]

Honduras' rural economy relies heavily on very few agricultural products, particularly bananas and coffee, making it vulnerable to natural disasters and shifts in commodity prices. Investments in the maquila and non-traditional export sectors are slowly diversifying the economy. Economic growth was expected to decline in 2009 as a result of a reduction in exports to the United States - its main trading partner.[5] Remittances from Hondurans living abroad account for 19.6 percent of GDP.[6] According to the Human Development Report of 2009[7], Honduras exhibits the second lowest score of human development indicators (HDI value of 0,700[8]) in the Central American region. The report also highlights Honduras' GINI inequality index for income distribution of 54.

Geography and Climate

Bordering the Caribbean Sea on the north coast and, through the Gulf of Fonseca, the Pacific Ocean on the south, Honduras has three distinct topographical regions. First, an extensive interior highland area, which encompasses approximately 80 percent of the territory where the majority of the population resides, is characterized by poor soils and low agricultural productivity. Second, a depression runs across the highlands, from the Caribbean Sea to the Gulf of Fonseca, splitting the country's cordilleras and providing a relatively easy transportation route across the isthmus.[9] Third, there are abundant small to large valleys, ranging in elevation between 300 and 900 meters. The floors of the large valleys provide sufficient grasses and weeds to support livestock and, in some cases, enough area for commercial

[1] Dilley et al. (2005).
[2] USAID (2009a).
[3] Jansen et al. (2006a).
[4] Jansen et al. (2006b).
[5] CIA (2009).
[6] CATHALAC (2008).
[7] UNDP (2007).
[8] 2005's Human Development Index (HDI) Ranks for Central American Countries, including Panama: Country, (HDI Rank), HDI value: Costa Rica, (48), 0.846; Panama, (62), 0.812 ; Belize, (80), 0.778 ; El Salvador, (103), 0.735; Nicaragua, (110), 0.710; Honduras, (115), 0.700; Guatemala, (118), 0.689. Source: UNDP 2007.
[9] Wikipedia (2009e).

agriculture. Villages and towns, including the capital, Tegucigalpa, are located in the larger valleys. The climate varies from tropical in the lowlands to temperate in the mountains. The central and southern regions are relatively hotter and less humid than the northern coast. The Caribbean lowlands, especially in the northeast, are the wettest regions in the country. Distinct wet and dry season characterize the Pacific lowlands and interior highlands. May through September are the wettest months.[10]

A major environmental challenge affecting Honduras is the extensive land degradation and deforestation resulting from logging and clearing of land for agricultural and cattle ranching. Uncontrolled development and unsustainable land use practices such as farming of marginal lands and mining activities are also polluting major sources of drinking water for the population.[5] By 1987 it was estimated that about 750,000 hectares of Honduran land had already been seriously eroded as a result of cattle ranching on unsuitable areas and slash-and-burn agriculture.[11] Such unsustainable practices continued and by 1998, when Hurricane Mitch struck Honduras, large tracts of lands were severely degraded, reducing the soil ability to capture excess moisture and exacerbating the damage caused by the extensive flooding.

According to the FAO "Global Forest Resources Assessment 2005"[12], by 1990, forest cover in Honduras was estimated at 65.9 percent of the country's total area. By 2005, extant forest area was estimated at 41.5 percent of the territory. In a period of 15 years 37.1 percent of the country's forest cover (equivalent to 24 percent of the country's total area) was lost.

Major Natural Hazards

Honduras' major natural hazards are the tropical storms and hurricanes that frequently strike the country, generating extensive flooding along the north coast and other regions.[13] Hurricane Fifi in 1974 and Hurricane Mitch in 1998 affected large portions of the country's population, causing major economic damages.

The Honduran geography is prone to large landslides and mudslides set off by torrential rains and hurricanes. In 1998, Hurricane Mitch's torrential rainfall over Honduras flooded extensive regions and triggered thousands of landslides, destroying an estimated 70 percent of the country's crops and 70 percent of the nation's transport infrastructure. Economic damage was estimated at more than US$3 billion.[14]

Honduras has been mostly unaffected by the frequent earthquakes and volcanic activity that characterize other Central American countries. However, the country is not immune to these hazards, as evidenced by the magnitude 7.1 earthquake that struck Honduras on May 28, 2009, killing 7 people and causing more than US$35 million in damages to infrastructure alone. Total estimated losses amounted to US$100 million. Several other lower-intensity aftershocks hit the country (including a 5.7-magnitude quake on June 8, northwest of the Caribbean coastal town of La Ceiba), causing unrest among the local population and unsettling tourists at the Bay Islands, as government officials warned the population of the potential risk of an earthquake-generated tsunami.

[10] Library of Congress (1993).
[11] Ibid.
[12] Food and Agriculture Organization (2005b).
[13] USAID (2009b).
[14] BBC News (2009).

Natural Disaster Data from Honduras published on the Prevention Web site[15] indicate 50 natural disaster events for the period 1980 to 2008. The number of people killed during those events was reported as 15,548, with 96 percent of the deaths caused by storms (an estimated 5,600 deaths caused by Hurricane Mitch alone[16]), and 4 percent by floods. Out of a total 3,601,379 people reported affected, 66 percent were attributed to storms, 23 percent to floods, and 12 percent to droughts. The economic damage caused by storms and floods was estimated at US$4.41 billion.

Storms and Floods

Hurricane Fifi struck Honduras in September 1974, killing around 8,000 people[17] – the actual number of people killed is unknown. Estimates ranged between 3,000 and 10,000 people, as a result of the combined action of the hurricane-force winds, extensive flooding and the large number of landslides that occurred during the passing of the hurricane. Agricultural production was also severely affected, with about 95 percent of the banana production of that year destroyed, and two fifths of the country's livestock drowned. Most of the Honduran fishing fleet and the main Caribbean coast facilities at Puerto Cortes - the country's most important seaport - were also destroyed. Total estimated damage caused by Hurricane Fifi amounted to US$900 million.[18]

Hurricane Mitch struck Central America in October of 1998, leaving a path of devastation and thousands of people killed.[19] In Honduras, Mitch dumped excessive rainfall that overwhelmed the country's natural watersheds' drainage capacity, causing major rivers to overflow, resulting in extensive flooding and thousands of landslides through the country.[20] Honduras' transportation infrastructure was devastated, leaving 90 bridges and nearly all secondary roads severely damaged or destroyed. Some 33,000 homes were destroyed and 50,000 more were damaged. The devastation was so pervasive that many existing maps needed to be redrawn. Widespread flooding was partially caused by Honduras' highly eroded mountainsides and slash-and-burn agricultural practices that rendered the soils unable to absorb excess moisture. About 75 percent of the country's population (4.5 million people) lost access to safe drinking water and sanitation services.[21] Government authorities estimated that in just a week Honduras fell back three decades in its efforts to attain universal access to safe drinking water and sanitation.[22] Economic damage caused by Hurricane Mitch was estimated at about US$3.8 billion.[23]

In 2005 Honduras was hit by another major hurricane. Although Hurricane Stan's staggering human toll was mostly concentrated in Guatemala, in Honduras it also left seven people dead, destroyed 2,475 homes, and forced 7,000 people into shelters.[24] Total economic losses were estimated at US$100 million.

[15] PreventionWeb (2009c).
[16] The actual number of human lives lost to Hurricane Mitch may never be known. As of December 2003, Honduran authorities indicated that 12,000 Hondurans were either killed or still missing as a result of the damage caused by Mitch. See UNDP and CEPREDENAC (2004).
[17] NOAA (2005).
[18] Wikipedia (2009f).
[19] BBC News (1998).
[20] Wikipedia (2009a).
[21] Some 1,700 drinking water systems were damaged.
[22] Clarke and Pineda Mannheim (eds., 2007).
[23] IADB (2009a).
[24] Wikipedia (2009b).

Landslides

Human losses and damage caused by landslides in Honduras have been extensive. During Hurricane Mitch, some 25 small villages were entirely destroyed by landslides and mudslides. Local disaster risk experts indicated that since Hurricane Mitch's catastrophic events, the country has become even more vulnerable to landslides exacerbated by widespread deforestation and soil degradation that increase the exposure and vulnerability of the population.[25] In November of 2008, in the aftermath of tropical storm Paloma (which killed 67 and directly affected an estimated 320,000 Hondurans), the United Nations deployed a team of geologists to help local authorities identify landslide- and mudslide-prone areas.[26]

Droughts

Honduras has been suffering from periodic droughts, with increasingly negative effects among the country's most vulnerable groups. For instance, in 2001, the Government of Honduras (GoH) declared a state of emergency in eight provinces where thousands of farmers were impacted by a long drought that devastated crops all across Honduras and other Central American countries. This was considered by local farmers and international experts as the worst drought in Central America since 1997, when an ENSO episode seriously disrupted the normal rainy season in the region. With the support of the United Nations World Food Program, the GoH coordinated the distribution of food relief aid for some 20,000 affected farmers.[27]

The Red Cross later reported that child malnutrition in the areas affected by the drought grew from 2.7 to 5.9 percent between July and November of 2001. The expectations were that the percentage of children affected by malnutrition would continue to grow, considering that the drought destroyed 135,064 tons of crops, the main source of income and food of 68,805 affected peasant families. In Central America, peasants sow and harvest their crops twice a year, with the first harvest providing about 65 to 70 percent of the annual harvest. The first harvest of 2001 was severely affected by the drought, causing the loss of between 40 and 100 percent of the projected harvest for that year.[28] Once again, in 2004, another severe drought affected more than a quarter of a million people in Honduras, destroying some 59,400 hectares of crops in 23 municipalities in the provinces of Francisco Morazán, Choluteca, Valle and El Paraíso. The GoH declared a regional food emergency to facilitate the delivery of relief aid to the drought-affected areas.[29]

Exposure and Vulnerability

Honduras' vulnerability to natural disasters has increased dramatically in recent decades, with nominal losses estimated at US$4.7 billion, or nearly half the total losses for the Central American region since 1974.[30]

Much of the impact of Hurricane Mitch in Honduras was the result of the combined and compounded effect of hurricane force winds, extensive flooding and the large number of landslides, exacerbated by the environmental degradation conditions that have occurred over

[25] BBC News (2008).
[26] PreventionWeb (2008b).
[27] BBC News (2001).
[28] Tierramerica (2001).
[29] World Food Programme (2004).
[30] IADB (2009b). Also posted at http://www.reliefweb.int/rw/rwb.nsf/db900SID/LSGZ-7TDGVX?OpenDocument&rc=2&emid=EQ-2009-000108-HND.

several decades[31] and continue to this date. The deforestation and rural-urban migration that created such high vulnerability to Mitch were largely due to the extensive poverty in the area.[32] Data collected in the aftermath of Hurricane Mitch indicated that poor rural households lost 30 to 40 percent of their income from crop production. Poverty increased by eight percent, from 69 to 77 percent at the national level.

Climate Change and Global Warming

Climate Change models[33] have predicted that Honduras will undergo a warming and drying trend and is expected to endure more frequent heat waves and droughts, increased-intensity rainfalls, and rising sea levels, as predicted for the rest of Mesoamerica.[34] Additionally, potential climate change impacts in the Central American region include higher storm intensities and, possibly, more frequent ENSO[35] events, exacerbating existing health, social and economic issues affecting Honduras.

Honduras signed and ratified, in July of 1995, the United Nations Framework Convention on Climate Change (UNFCCC)'s Kyoto Protocol. As a non-Annex I Party to the Protocol, Honduras is not bound by specific targets for greenhouse gas (GHG) emissions. Pursuant to the protocol the Government of Honduras submitted its First National Communication (FNC) to the UNFCCC in 1999. The preparation of the report was delegated to the Secretary of Natural Resources and Environment (SERNA)'s Climate Change Unit. The report included the First National Inventory on GHG Emissions, with 1995 data as its base year.[36] According to the Inventory, agricultural activities, combined with land use change and timber extraction activities, accounted for 77 percent of total emissions in 1999. The FNC indicated, as future impacts from climate change, varying increases in temperature and rainfall in the different regions of the country. The highest rainfall reduction is projected to occur during the months of November and April.[37]

Honduras' population in 2004 was estimated at about 0.1 percent of the world's population. In the same year Honduras accounted for less than 0.1 percent of the world's total carbon dioxide (CO2) emissions, with an average of 1.1 tons of CO2 per person. Honduras' emission levels are below those of Latin America and the Caribbean.[38]

DISASTER RISK MANAGEMENT FRAMEWORK

The Honduran Legislature approved Legislative Decree No. 9-90E, "Law of National Contingencies" (Law 9-90E) on December 18, 1990, mandating the creation of the Standing Commission of Contingencies (Comisión Permanente de Contingencias, COPECO), defining its main responsibilities and authority as follows: "COPECO's main objective will be the

[31] UNDP (2004).
[32] Freeman et al. (2003).
[33] Hadley Centre Coupled Model, Version 2 (HADCM2), as reported in Mulligan (2003). Same modeling data as used by the Intergovernmental Panel on Climate Change (IPCC).
[34] Giannini et al. (2002).
[35] El Niño-Southern Oscillation; commonly referred to as simply El Niño, a global coupled ocean-atmosphere phenomenon.
[36] Government of Honduras. *"Preparación de la Segunda Comunicación Nacional de Honduras a la Convención Marco de Naciones Unidas sobre Cambio Climático."* Funding Appeal presented to the Global Environmental Facility (GEF), in the amount of US$405,000, to support the Institutional Strengthening of the Secretary of Natural Resources and Environment [SERNA] for the preparation of Honduras' Second National Communication to the UNFCCC.
[37] World Bank (2008b).
[38] UNDP (2007).

adoption of measures and policies aimed at response, rehabilitation and reconstruction of damaged areas resulting from natural phenomena that affect economic activity and the population's well-being, as well as to program and develop various activities towards preventing negative impacts in the areas most frequently affected by such phenomena."

Law 9-90E was later amended by Legislative Decree No. 217-93 (Law 217-93), approved on October 13, 1993. The preamble of Law 217-93 described the main reason for the amendment as follows: "There is a need to improve coordination among public and private sectors on prevention, planning and implementation of aid, rescue, rehabilitation and other activities needed to overcome the effects of natural disasters such as floods, droughts, hurricanes and other public calamities." The two main changes included into the Law of National Contingencies were: 1) Article 4 mandated the designation of COPECO representatives at the municipal level: "COPECO will be headquartered in Tegucigalpa… with jurisdiction over the National Territory, and will maintain regional, departmental and municipal representatives." 2) Article 6 expanded COPECO's executive body by adding representatives from the Honduran Legislature and the Catholic Church. COPECO comprises the following: a) the President of the Republic or his/her representative, who will preside; b) a representative of the Republic's Supreme National Congress, c) the Secretary of Governance and Justice; d) the Secretary of National Defense and Public Safety; e) the Secretary of Public Health; f) the Secretary of Finance and Public Credit; g) the Secretary of Planning, Coordination and Budget; h) the President of the Central Bank of Honduras; i) a representative of the Catholic Church; j) a representative of the Private Sector, designated by the Federation of the Commerce and Industry Chambers (FEDEHCAMARA); k) a representative of the peasants' associations; and l) a representative of the Honduran Red Cross.

Honduras participates in several regional Disaster Risk Management forums including the Coordinating Center for the Prevention of Natural Disasters in Central America (CEPREDENAC), a specialized regional DRM entity within the Central America Integration System (Sistema de Integración Centroamericano, SICA). Additionally, in 2005, Honduras adopted the recommendations of the strategic objectives and priority actions of the "Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters" (HFA). COPECO is the national focal point to the HFA.

A major step towards strengthening the legal and institutional framework supporting disaster risk management in Honduras has been the approval of the National Territorial Zoning Law and its regulation. Legislative Decree No. 180-2003, Law of National Territory Zoning, was enacted on November 28, 2003, with its regulation approved by Executive Decree No. 25-20042 in September 2004. The Law of Territorial Zoning defined the Government of Honduras' policies with regard to the integral development of the national territory, and ordered the creation of a National Plan of Territorial Zoning, as well as the development of Departmental and Municipal Territorial Zoning Plans - hierarchically and strategically linked to the National Plan to ensure the implementation of complementary local and regional territorial zoning strategies. The Law also mandated the creation of a National Directorate of Territorial Zoning (*Dirección General de Ordenamiento Territorial,* DGOT), and a National Council of Territorial Zoning (*Consejo Nacional de Ordenamiento Territorial,* CONOT). The CONOT comprises the Secretaries of: 1) Governance and Justice (who presides); 2) Natural Resources and Environment; 3) Agriculture and Livestock; 4) Education; 5) Health; 6) Public Works, Transport and Housing; 7) Finances; 8) the Minister-Director of the National Agrarian Institute (INA); and representatives of the following government and civil society organizations: 9) Standing Commission of Contingencies (COPECO); 10) Honduran Association of Municipalities (AMHON); 11) ethnic bodies; 12) Peasants' Associations; 13)

Workers' Associations; 14) Honduran Federation of Trusts; 15) Honduran Professional Associations; 16) Honduran Council of Private Enterprise (COHEP); 17) women's organizations; 18) youth organizations; 19) a representative of the Honduran universities; and 20) a representative for each legally registered political party.

The CONOT is managed by an executive body (*Comité Ejecutivo de Ordenamiento Territorial*, CEOT). This executive body comprises 1) the Secretary of Governance and Justice (who coordinates); 2) the Secretary of Natural Resources and Environment; 3) the Secretary of Education; 4) the Secretary of Public Works, Transport and Housing; 5) the Secretary of Agriculture and Livestock; 6) The Commissioner of the Standing Commission of Contingencies (COPECO); and 7) the Executive Director of the Association of Honduran Municipalities (AMHON). The CEOT is authorized by law to create any task forces or committees as needed to suit specific needs. The creation of the following committees was already mandated by law: 1. Interagency Technical Commission on Lands (*Comisión Técnica Interagencial de Tierras*, CTIT); 2. Interagency Technical Commission on Spatial Data *(Comisión Interagencial de Datos Espaciales,* CIDES); 3. National Risk Management Commission (*Comisión Nacional de Gestión de Riesgos,* CNGR); 4. National Commission on Human Settlements, Infrastructure and Social Tooling (*Comisión Nacional de Asentamientos Humanos, Infraestructura y Equipamiento Social*, CNAES); 5. Demography and Population Migrations (*Comisión de Demografía y Movimiento Poblacional*, CDMP); 6. Commission on Renewable and Non-Renewable Natural Resources, and Protected Areas (*Comisión de Recursos Naturales Renovables y No Renovables y de Áreas Protegidas,* CRNAP); 7. Natural and Cultural Heritage and Tourism Commission (*Comisión de Patrimonio Natural, Cultural y Turismo*, CPNCT).

Even though Honduras has been one of the Central American countries most affected by major natural disasters, it lags behind other nations in the region with regard to progress towards developing an effective legal and institutional framework for disaster risk management (DRM). However, during the last few years there has been an increasing debate on the need to reform and update the DRM framework and to kick off the development of the National Risk Management System (*Sistema Nacional de Gestión de Riesgos,* SINAGER).[39] The Government of Honduras (GoHN) responded by enacting Executive Accord 190-2006 that created a "High Level Technical Commission[40]", delegating in it the task of preparing a proposal for the "National Risk Management Plan", and the "National Risk Management System". Another important step taken by the GoH has been the establishment of a National Emergency Preparedness and Response Fund (*Fondo Nacional de Preparación y Respuesta a Emergencias*, FONAPRE). Executive Decree No.45-2009 of March 17, 2009 mandated the creation of such a fund as follows: "…As a very special fund, whose sole purpose will be the acquisition of goods and services of any kind needed for preparedness and proper response in cases of emergencies caused by intense natural phenomena and disasters caused by human actions. The Fund will be administered by COPECO through the National Commissioner who, through expedite procedures, proper of a critical situation, can access the Fund's resources to ensure rapid preparedness and humanitarian assistance actions of any kind aimed at mitigating potential damages, and to comply with the Government's obligation to respond to the affected populations in the shortest time and in the best way possible."

The structure of COPECO has been expanded to include the management of emergency prevention and preparedness activities. In addition to its central administrative areas and the

[39] *Concertación Regional de Gestión de Riesgos* (2007).

[40] *La Gaceta. República de Honduras. Sección A Acuerdos y Leyes. Acuerdo Ejecutivo No. 190-2006 de 27 de Septiembre del 2006.* No. 31,116.

prevention, preparedness and emergency response units, COPECO has seven regional offices. This organizational structure reflects the expansion of COPECO's responsibilities in the disaster risk management cycle.[41] With the support of the World Bank, COPECO is exploring new disaster management strategies that place greater emphasis on prevention and mitigation. A revision of the law that created COPECO has been proposed to expand its authority to explicitly articulate its authorities and responsibilities on prevention and mitigation[42], beyond its original responsibilities of emergency response. Under the new law, COPECO will have greater autonomy and authority.

The Government of Honduras, with the financial support of IADB, is implementing activities aimed at strengthening the country's DRM capacities, including performing pre-investment studies required for the preparation of an investment program to strengthen the SINAGER, including capacity building within the agencies and institutions that comprise the SINAGER, and by developing assessments of probable maximum losses (PML) as an input to the development of risk transfer mechanisms.[43]

In June 2009, IADB approved a loan to Honduras in the amount of US$75 million, over 10 years. The first disbursement of US$19 Million specifically targets strengthening of COPECO's DRM capabilities.[44]

The Government of Honduras signed the Central American Policy for Comprehensive Disaster Risk Management in June 2010. This legal agreement, adopted at the 35th Central American Integration System (SICA)'s Ordinary Meeting of Heads of State and Government, held in Panama, represents a major step towards mainstreaming DRM into the national development policies of the Central American nations.

[41] IADB (N. D.).
[42] Freeman et al. (2003).
[43] IADB (2010).
[44] IADB (2009c).

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

The GoH recognizes the importance of developing an effective legal and institutional framework for DRM. As part of the government efforts to develop an effective DRM system, the Honduran legislature enacted the Law of National Contingencies (Law 9-90E) that mandated the creation of the Standing Commission of Contingencies (*Comisión Permanente de Contingencias*, COPECO). Since its inception, changes have been incorporated into the original text of the Law to ensure a better coordination among the diverse government and civic society organizations involved in DRM, as well as to encourage public participation at the municipal and community levels. DRM has been explicitly incorporated into the community development plans within the country's National Strategy for Poverty Reduction.

A comprehensive Law of Territorial Zoning was enacted and several committees have been created to support its implementation. COPECO is represented in the CONOT and is also a member of its executive body, the COET. In addition, the enactment of the Law of Forestry Development is also viewed by local experts as another step towards improving the country's legal and institutional framework for sustainably managing the nation's natural resource base. Honduras has also adopted a Social Protection policy aimed at providing special protection to children during emergency situations.

The Honduran delegation to the Mitch +5 Regional Forum[45] of 2003 in Tegucigalpa highlighted the country's achievements and challenges towards building the foundation for effective DRM in Honduras, and fulfilling the country's commitments within the Hyogo Framework for Action. The report indicated significant progress achieved in the following aspects:

i) DRM has been specifically addressed in sectoral plans and strategies.

ii) Some government agencies have established their own risk management programs.

iii) DRM has been included in the coordination and planning efforts of local governments.

iv) Some programs have been created, aimed at improving the management of the country's natural resources, addressing watershed issues, forests, vulnerable zones, and the environment.

v) Participatory methodologies have been developed for assessing land vocation mapping according to its vulnerabilities.

vi) Lessons learned are being incorporated into current projects and programs, as references for improving current and programs and projects.

vii) Important amendments have been incorporated into sectoral laws to better address and mainstream DRM activities and responsibilities.

Other advances include the creation of a National Health Plan for Disaster Reduction and Response; the issuance of a Policy for the Agro-Feeding and Rural Environment sector in Honduras; and the development of the Honduran Social Investment Fund's Strategic Plan for Contingencies.

HFA Priority #2: Disaster risk assessment and monitoring

The GoH has made important advances in developing the technical infrastructure for managing disaster risk information, including the elaboration of risk maps of an increasing number of jurisdictions across the country. These maps have been prepared by and with the input of government agencies, NGOs and the communities themselves. In this way, more complete and detailed information is available about the drivers and characteristics of vulnerability. To support the territorial zoning process, the National Territorial Information System (SINIT) is in the process of being implemented. The SINIT will maintain a baseline of biophysical and socioeconomic information and is the technological component of the Registry of Territorial Organization Norms (RENOT).

New educational materials are being developed and available to trainers for use in disaster risk awareness campaigns. New risk management plans are being developed at the local level, and DRM topics are being incorporated into graduate-level courses and technical training, including community forestry, ecology, and the environment. Also, DRM topics are being incorporated as components of impact assessments of road construction projects. Disaster mitigation measures have been incorporated into water and sanitation projects, and in the development of health and educational facilities, among others.

Since 1994, a number of institutions including COPECO, the Organization of American States (OAS), and the German Agency for Technical Cooperation (GTZ) have established community-

[45] UNDP and CEPREDENAC (2004).

based early warning systems along the watersheds that originate in the Nombre de Dios Mountain Range and drain into the Caribbean Sea. The data-gathering work is done by volunteers located in different places along the watersheds. Since 2003, early warning systems were developed in the Lean, Cangrejal, Perla and San Juan watersheds. The National Meteorological Service provides data on rainfall and COPECO provides technical support through its regional office, along with local volunteers and municipal officials responsible for early warning programs within their jurisdictions. The data gathered is relayed through a network of radio-transmitters that links all field stations along the watershed.[46]

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

COPECO develops and maintains two public awareness campaigns: "Prevention Is Living" and "COPECO Is Us All". Both campaigns have been very well received by the Honduran population.

DRM has been incorporated into the grade-school curriculum. Several organizations have developed supporting educational material for primary-school children.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

Multiple inter-agency workshops at the community level have been organized to develop local preparedness and emergency response plans. Additionally, with the support of the governments of Germany, Japan, Spain, Sweden, and the United States, several projects for retrofitting the country's critical infrastructure have been implemented.

The GoH has implemented extensive campaigns against the destruction of forests, for reducing forest fires, and for the protection of water sources.

Legal reforms for urban and rural development have been introduced to improve the sustainable management of the country's territory and to facilitate enforcement of land zoning and building code regulations. The Law of Territorial Zoning (enacted in November 2003) and the Water and Sanitation Law (enacted in June 2003) are expected to play an important role in reducing exposure and vulnerability of the population by providing guidelines and the legal and institutional instruments to better manage the territory and water resources. The new Forestry Law is expected to also play an important role in this regard. Additionally, there is an increase in the number of institutional regulations that require the development of risk assessments (e.g. for road construction projects). A National Construction Code[47] is now available and several municipalities, including the Central District, are preparing or have already developed their Territorial Zoning and Urban Development regulations, setting aside areas considered off-limits for urban development, and incorporating the technical recommendations of the Honduran Construction Code.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

Teams of Youth Volunteers, working for COPECO, the Red Cross, and firefighters are being established across the country to support

[46] UN ISDR (2004).
[47] Valladares et al. (2000).

disaster preparedness and response activities across the country.

An International and a Local Aid Coordinating Committee have been created to maximize the benefits of the humanitarian aid received by the country during emergency situations that may overwhelm the country's internal capacity to respond. There are also systems in place to assess the conditions of shelters across the country.

The National Action Plan for Combating Drought and Desertification was developed with input from residents of 76 highly vulnerable municipalities.

Local Disaster Preparedness and Response Committees across the country are being established and strengthened. COPECO also organizes and performs emergency response drills, with the involvement of multiple stakeholders from government agencies, international NGOs, and civil society organizations.

International aid organizations, including the United States Agency for International Development (USAID) are working on disaster mitigation through community-based interventions that emphasize environmental awareness at all levels of society. USAID provides training and technical assistance to COPECO for emergency communication systems, evacuation plans, and disaster preparedness. COPECO's national and regional emergency operation centers have received equipment and training. Municipal and local emergency committees also benefit from this capacity-building support.[48]

ADDITIONAL OBSERVATIONS

The Mitch+10, a Challenge After a Decade Regional Forum held in Guatemala during July 21–23, 2009, under the auspices of the Central American Integration System (SICA) and its regional technical disaster risk management body, CEPREDENAC, led to the analysis of and discussion on the economic, social and environmental causes of disaster risk, and DRM in Central America. The Regional Forum's main findings included the urgent need for promoting, in each country and across the region, integrated disaster risk management as an intrinsic component of the planning processes and public investment, as well as the need of reducing existing gender gaps by promoting equal opportunities through new social and institutional strategies.

Conclusions and Expected Tangible Outputs and Outcomes in DRM

Honduras is expanding its legal and institutional DRM framework and creating innovative structures that can empower the government and civil society organizations to deal with natural disasters, providing better disaster preparedness, response, and reconstruction capabilities at all levels of government administration and civil society. However, it is critical to ensure that mechanisms for effective coordination and complementariness are in place. In that regard, COPECO will need to continue improving its DRM internal capacity and leadership role in Honduras, among the multiple sectoral and geographic

[48] USAID (2009c).

government and civil society stakeholders, local and international, involved in DRM activities in Honduras.

Mainstreaming DRM among government agencies and the general public is still a priority. DRM is a complex endeavor that involves government and civil society participation. The government can provide the core financial and logistical support to the major components of preparedness, response and reconstruction, but still needs the support of the civil society organizations for addressing other aspects of the country's social fabric.

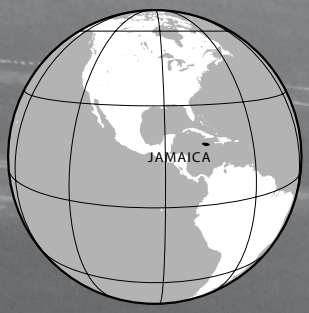
Along with strengthening COPECO by providing it the legal, financial, technical, and political support needed to transform it into the leading DRM institution in the country, an important component for achieving effective DRM in Honduras is the implementation of the National Risk Management System, and the need for such a system to become a priority within the government's agenda.

With the technical support of regional DRM organizations, particularly CEPREDENAC, and the financial and technical support of multilateral funding organizations such as the World Bank, the Inter-American Development Bank, and International Cooperation Agencies (ICAs) of developed countries, there is an opportunity to position DRM in the forefront of Honduras' sustainable development strategies.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	UN, Donor, IFI Cooperation (where possible)	Allocated Budget (US$)	HFA Activity Area(s)[49]
Natural Disaster Mitigation – Additional Scale-Up Financing	World Bank	9 million 2007-ongoing	1, 2, 3, 4, 5
Forests and Rural Productivity	World Bank	32.7 million (WB funding: 20 million)	2, 4
Integrated Disaster Risk Management Program	Inter-American Development Bank (IADB)	75 million 2009	1, 2, 3 ,4, 5
Bay Islands Environmental Management	IADB	19,080,000 1995-2005	2, 4
Country Environmental Strategy	IADB	652,000 2000-2004	1, 4
Ecosystem Management of the Bay Islands	IADB	355,000 2002-2004	2, 4
Emergency Program. Flood Protection Work	IADB/ Spanish Fund for Consultants	EUR 366,618 1999-2002	2, 4, 5
Honduras Country Environmental Analysis	IADB	110,000 2005-2008	
Strengthening Disaster Risk Management System	IADB	1,100,000 (IADB funding: 1 million) 2008-ongoing	1, 2, 3, 4, 5
Support for the Modernization of National Environmental Impact Evaluation System	IADB	165,000 (IADB funding: 150,000) 2008-ongoing	1, 2, 4

[49] HFA Priority Action Areas: 1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation; 2. Identify, assess, and monitor disaster risks—and enhance early warning; 3. Use knowledge, innovation, and education to build a culture of safety and resilience at all levels; 4. Reduce the underlying risk factors; 5. Strengthen disaster preparedness for effective response at all levels.



COUNTRIES AT RELATIVELY HIGH ECONOMIC RISK FROM MULTIPLE HAZARDS
(Top 75 Based on GDP with 2 or more hazards)[a]

1. El Salvador
2. JAMAICA
3. Dominican Republic
4. Guatemala
8. Costa Rica
9. Colombia
13. Trinidad and Tobago
14.Antigua and Barbuda
15. Barbados
17. Ecuador
18. Mexico
19. Dominica
20. Nicaragua
21. Chile
33. Haiti

[a] Dilley et al. (2005). Table 7.2.

Tropical storms and floods join the hurricanes among the disasters that have had the greatest impact in Jamaica.

Aerial view, Jamaica

JAMAICA

Natural Disasters from 1980 - 2008[b]

Affected People

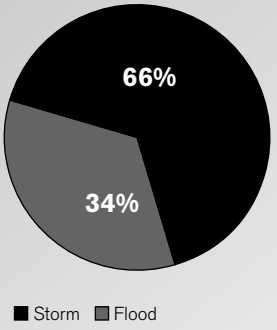
Disaster	Date	Affected (Number of People)
Storm	1988	810,000
Flood	1991	551,340
Storm	2004	350,000
Flood	1986	40,000
Storm	2007	33,188
Storm	1980	30,009
Flood	1987	26,000
Flood	2002	25,000
Storm	2005	8,000
Flood	2006	5,000

Economic Damages

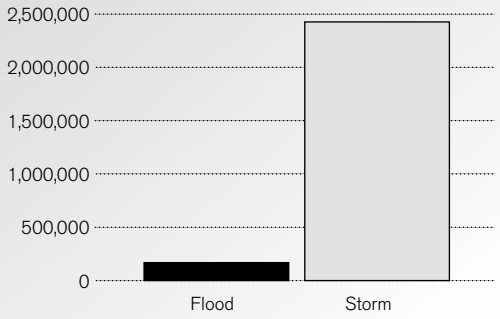
Disaster	Date	Cost (US$ x 1,000)
Storm	1988	1,000,000
Storm	2004	595,000
Storm	2004	300,000
Storm	2007	300,000
Flood	1986	76,000
Storm	2008	66,198
Storm	1980	64,000
Storm	2001	55,487
Flood	1987	31,000
Flood	1991	30,000

Statistics by Disaster Type[b]

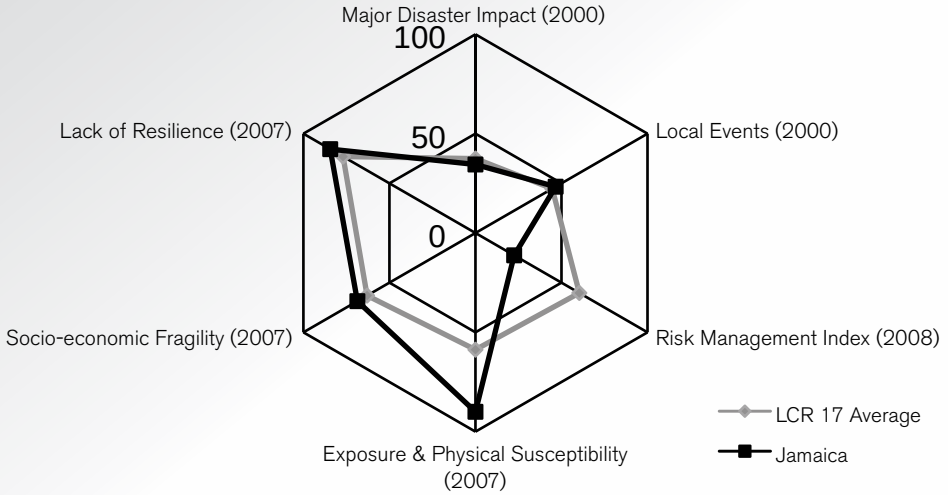
Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



Relative Vulnerability and Risk Indicators[c]



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=86. Source data from EM-DAT. Data displayed does not imply national endorsement.

[c] Relative Vulnerability and risk Indicators are adapted from IADB-IDEA-ERN (2009). Values are normalized on scale of 0 – 100 and presented against the average for 17 LCR countries. Major disaster Impact taken from disaster deficit Index: the ratio of economic losses which a country could suffer during a Maximum Considered event and its economic resilience. Local events taken from Local disaster Index: the propensity of a country to experience recurrent, small-scale disasters and their cumulative impact on local development. risk Management Index is presented as the negative (i.e. 0 = optimal, 100 = incipient) of IADB's risk Management Index: measures a country's risk management capability in (i) risk identification, (ii) risk reduction, (iii) disaster management, and (iv) financial protection. resilience, Fragility and exposure are taken from the component indices of Prevalent Vulnerability Index. Date for local event data depends on information available for each country. Data, and the respective LCR 17 average, from 2000 is used for Dominican Republic, El Salvador, Guatemala, Jamaica and Nicaragua. Data, and the respective LCR 17 average, from 2006-08 is used for Bolivia, Colombia, Costa Rica, Ecuador, Panama and Peru. All LCR 17 averages are calculated based on available data.

DISASTER RISK PROFILE

Jamaica has the second highest economic risk exposure to two or more hazards, according to the 2008 update of the Natural Disaster Hotspot study[2] by the World Bank. In addition to the exposure of 96.3% of the national population, 94.9% of the national territory and 96.3% of the GDP to two or more hazards, vulnerability in Jamaica is also influenced by the debt burden, health status, climate change, weak building code enforcement and other factors.

Major Natural Hazards

Due to its geographical location and geotectonic characteristics, Jamaica is exposed to a variety of natural hazards, including hydrometeorological (it is located in "hurricane alley") and geophysical. Jamaica, along with the Cayman Islands to the West and Haiti, the Dominican Republic, Puerto Rico and the Antilles to the East, is located in one of the most seismically active regions in the hemisphere, situated on the boundary of the Caribbean Plate to the South, and the Gonave Microplate.[3]

Natural disaster data from Jamaica published on the Prevention website[4] indicates 27 natural disaster events for the period 1980 to 2008, with total economic damages estimated at US$2.599 billion. Economic damage by disaster type was reported as follows: storms accounted for US$2.425 billion and floods for US$168.44 million. The number of people killed was reported as 210, with 52 percent of the deaths caused by storms, 46 percent by floods, and the remaining 1 percent caused by epidemics.

Storms and Floods

Hurricanes that have marked Jamaica's history and development include: Charlie in 1951, which killed 154, affected 20,000 people and caused US$56 million in damages; Flora in 1963, which killed 11 and caused US$11.52 million in losses; Allen in 1980 was responsible for 6 deaths, affected 30,000 people and a total of US$64 million in damages; Kate in 1985 killed 7 people and raced up losses of US$5.2 million; and Gilbert in 1988, which claimed 49 lives, affected 810,000 people, and became the most expensive natural disaster in Jamaica's history with damages amounting to US$1 billion.[5] In 2004, two hurricanes - Charley on August 10 and Ivan on September 10 - passed south of Jamaica with waves along the coast from 2 to 8 meters high. Ivan's rains caused flooding of soils saturated by Charley, with floods claiming 17 lives, affecting 369,685 people, damaging 14% of the housing stock. The overall damages were estimated by ECLAC at US$580 million.[6] More recently, the extent of the damages caused by Hurricane Dean in August of 2007, which could not be covered by the Caribbean Catastrophe Risk Insurance Facility (CCRIF), prompted discussions to develop a flood-based parametric, especially for agriculture.[7]

Tropical storms and floods join the hurricanes among the disasters that have had the greatest impact in Jamaica. More than 120 Jamaican rivers flow from the mountains to the coast[8], resulting in numerous low-lying and flood-prone areas. Accounts of flooding in documents from as early as 1837 are available for the areas of Portland and St. Mary. Additional episodes in 1937, 1940, 1943 and 2001 indicate an ever-present probability of recurrence of

[2] GFDRR (2008).
[3] Manaker et al. (2008). See also Mann et al. (1995).
[4] PreventionWeb (2010e).
[5] OAS Department of Regional Development and Environment (1991). See also Tomblin (1979) and USAID/OFDA (1989).
[6] ECLAC, UNDP and the Planning Institute of Jamaica (PIOJ) (2004).
[7] Jackson (p.c.).
[8] HFA-Pedia (2003).

similar events. Hurricane Michelle caused widespread flooding and landslides in 2001.[9] Storms reported in 2004, 2007 and 2008 killed 27 and affected over 388,000 people. Likewise, floods in 1991 and 1996 killed 69 and affected a total of 591,340 people.[10] Floods throughout Western Jamaica in June of 1979 prompted the establishment in July of 1980 of what is today known as the Office of Disaster Preparedness and Emergency Management (ODPEM), a permanent disaster management organization responsible for coordination and monitoring of the response to adverse natural events as well as educating the nation on all aspects of disaster management.

Landslides

In Jamaica, landslides are often associated with periods of extreme precipitation. A total of nine days of rains associated with a low extending across the Caribbean from Nicaragua joined by the Hurricane Michelle weather system pummeled Jamaica from October 28 to November 5 of 2001. Over 1,000mm of rain were reported in stations primarily in northeastern Jamaica, in the Blue Mountain range area, on October 28 and 29. The rains claimed five lives, and affected 11,976 people. 500 homes were destroyed and another 305 were damaged. More than 800 persons were evacuated and 350 were housed in shelters. At least 2,000 were isolated due to the flooding, which caused extensive road damage. More than 40,000 were affected due to loss of electricity, collapse of waste disposal systems, and broken water mains resulting in limited or no access to potable water supplies. A total of 440 roads were damaged island-wide. The worst-affected areas by flash floods and landslides were the Spanish and Swift River watersheds where severe erosion destroyed the approaches of three major highway bridges. In the interior of the parish of Portland, the worst-hit areas were Bybrook, Ann's Delight, Claverty Cottage, Clifton Hill, Swift River, Bloomfield, Chelsea, Shrewsbury, and Fruitful Vale. Another landslide deposited approximately 200,000 cubic meters of material in Bybrook. The community of Swift River also received a landslide which carried 240,000 cubic meters into the village. The total losses were estimated at J$2,521 million, representing 0.8% of the 2000 GDP and 23.4% of agricultural exports in 2000.[11]

Earthquakes and Tsunamis

Jamaica has a long history of destructive earthquakes and owes part of its current geology to past volcanic eruptions. The main fault which affects Jamaica is the 950 km-long Enriquillo-Plantain Garden Fault, a left-lateral strike-slip fault which accommodates about 1/3 of the relative motion between the Caribbean and North American plates. This fault cuts through Jamaica in an East-West orientation, dividing it into the North and South halves of the country. It continues east toward Haiti, where it caused the historic and tragic magnitude-7 earthquake of January 12, 2010, which was strongly felt in Jamaica. The largest recorded earthquakes in Jamaica's history include the June 7, 1692 earthquake which killed 1/4 of the population of Port Royal in southern Jamaica, when the city fell into the ocean due to liquefaction. Another was the estimated 6.5-magnitude event on January 14, 1907, which killed 1,000 people and damaged or destroyed 85% of the buildings in the capital city of Kingston. In terms of ongoing seismic hazard, Jamaica has a number of active faults with the capacity for a 7.5 event without prior warning.[12]

[9] ECLAC Caribbean Development and Cooperation Committee (2001).
[10] PreventionWeb (2010f).
[11] ECLAC Caribbean Development and Cooperation Committee (2001).
[12] Manaker et al. (2008) and edit of this section by Dr. Eric Calais. August 2010.

Tsunamis have been reported in Jamaica since the 1780 "irruption" in Savanna-la-Mar, which killed 300 people.[13]

Volcanoes

The country has over half a dozen volcanoes, none of which are active. However, the past volcanic activity yielded fertile lands for agriculture as well as bauxite and gold mining. Additionally, there are active traces of past volcanic activity such as sulfuric and thermal wells; several are promoted for eco-tourism and health purposes. Jamaica has several rugged mountain ranges, with the highest point, the Blue Mountain Peak, soaring over 2,256 meters (7,402 feet). About sixty percent of the island's bedrock is white limestone; twenty-five percent is volcanic and cretaceous, ten percent alluvial and five percent yellow limestone.[14]

Exposure and Vulnerability

In addition to the exposure of 96.3% of the national population, 94.9% of the national territory and 96.3% of the GDP to two or more hazards, vulnerability in Jamaica is also linked to poverty. The Human Development Index (HDI) for Jamaica is 0.766, which gives the country a rank of 100th out of 182 countries with data. The Human Poverty Index (HPI-1) focuses on the proportion of people below certain threshold. The HPI-1 value of 10.9% for Jamaica ranks it 51st among 135 countries for which the index has been calculated.[15]

Vulnerability to floods, storms, hurricanes and earthquakes, coupled with land degradation, unplanned urban growth in areas unsuitable for development, and weak enforcement of building codes and zoning regulations are the main drivers of most of the current vulnerability in Jamaica.

Climate Change and Global Warming

Jamaica has recently been cited as one of six Caribbean countries in the world's top 40 climate "hot spots" by the Germanwatch Global Climate Change Risk Index (CRI) 2009.[16] The country was ranked 34th out of 150 countries based on an analysis of weather events between 1998 and 2007. Two factors were cited: the impact of global warming on rising sea levels which increase the risk of storm surges, and secondly the increase in the strength of hurricanes. The 2010 Climate Risk Index is based on figures from 2008 and is also an analysis of the worldwide data collection on losses caused by weather-related events during 1998–2008. In 2008, Jamaica was ranked 13th with losses of 0.79% GDP, and it ranked 55th for the decade with GDP losses of 0.96%.[17]

Climate Change models[18] have predicted that Jamaica will undergo a warming and drying trend and is expected to endure more frequent heat waves and droughts, rainfalls with increased intensity, and rising sea levels, as predicted for the rest of the Caribbean, consistent with the projected global median.[19] It is known that inter-annual climate variability of either the Pacific or Atlantic explains a significant amount of the total variance

[13] Fay and Lander (2003).
[14] HFA-Pedia (2003).
[15] UNDP (2009b).
[16] Abeng News Magazine (2008).
[17] Harmeling (2009). Table 5.
[18] Hadley Centre Coupled Model, Version 2 (HADCM2), as reported in Mulligan (2003). Same modeling data as used by the Intergovernmental Panel on Climate Change (IPCC).
[19] Chen et al. (2008).

in rainfall in the Caribbean and Central America.[20] Probable climate change impacts in Jamaica include higher temperatures, higher storm intensities and, possibly, more frequent El Niño-Southern Oscillation (ENSO)[21] events, exacerbating existing health, social and economic challenges affecting Jamaica.

Changes in sea surface temperature as a result of climate variability could increase the intensity of cyclones and heighten storm surges, which in turn will cause more damaging flood conditions in coastal zones and low-lying areas. According to the World Bank study, "Sea Level Rise and Storm Surges",[22] the impact of sea level rise and intensified storm surges in Latin America and the Caribbean will be highest in Jamaica – noting an increase of 56.8% - with 28.49% of the coastal population exposed and potential losses of coastal GDP projected to exceed 26.62%. Furthermore, the inundation risk in Jamaica from storm surges will cover 36.55% of the coastal wetlands.

Jamaica's first National Communication on Climate Change (NCCC)[23] was released in 2000. It cites the cost estimated by the IPCC, in 1990, to protect the relevant sections of Jamaica's 1,022km of coastline from a one-meter sea level rise to be US$462 million. This is equivalent to a cost of US$197 per person or an annual cost that is 19% of GNP.

DISASTER RISK MANAGEMENT FRAMEWORK[24]

The management of ex-ante and some ex-post emergency planning issues is overseen primarily by the Office of Disaster Preparedness and Emergency Management (ODPEM). ODPEM's mandate covers more than disaster response, and includes preparedness, response, mitigation, prevention and recovery. Each parish has a Parish Disaster Committee including Government, private sector, and NGO representatives. The national system of subcommittees is mirrored at the parish level. Below the parish level, some communities also have disaster committees called Zonal Committees, which link with the Parish Disaster Committees. There are a number of functional plans for evacuation, communication, mass casualty events, aircraft accidents, pandemics, pest infestations, etc. Of these, the primary plan is the National Disaster Plan, which is a comprehensive document setting out mitigation, preparedness, response and recovery procedures for a variety of hazards, both natural and man-induced.

Jamaica's ODPEM is responsible for coordinating the response to national threats and emergencies, with coordination being carried out from the National Emergency Operations Centre (NEOC). Under the post-impact conditions, ODPEM coordinates the relief efforts with the input of the international community. There are standing procedures which govern rehabilitation of critical services. For example, hospitals receive priority attention for road clearance and reconnection of power and water supplies after any disaster. Shelters are also given a high priority. Originally known as the Office of Disaster Preparedness and Emergency Relief Coordination (ODIPERC) established in July 1980, the name was changed to the Office of Disaster Preparedness and Emergency Management (ODPEM) in 1993. ODPEM is a statutory body created under the provisions of Section 15 of the Disaster Preparedness and Emergency Management Act. Operating out of the Ministry of Land and Environment, ODPEM is overseen by a Board of Management. The Board of

[20] Giannini et al. (2002).
[21] El Niño-Southern Oscillation; commonly referred to as simply El Niño, a global coupled ocean-atmosphere phenomenon.
[22] Dasgupta et al. (2009).
[23] HFA-Pedia (2003).
[24] UN ISDR (2010b).

Management appoints the Director General, who leads a staff divided into the following divisions: Corporate Services, Preparedness and Emergency Operations, Mitigation, Planning and Research and Projects Implementation, Development and Monitoring Unit. ODPEM is committed to taking pro-active and timely measures to prevent or reduce the impact of hazards on Jamaica, its people, natural resources and economy through its staff, the use of appropriate technology and collaborative efforts with national, regional and international agencies.

All actors and organizations involved in national disaster management efforts are jointly referred to as National Emergency Management Organization. It consists of the National Disaster Committee, the National Disaster Executive, the Office of Disaster Preparedness and Emergency Management (ODPEM), private sector representatives, and several regional and local organizations, non-governmental organizations and volunteers. The National Disaster Committee is responsible for policy issues.

Jamaica's National Disaster Committee (NDC) was established by the Disaster Preparedness Act of 1993.[25] The NDC is an interagency body chaired by the Prime Minister of Jamaica and comprised of various ministers, permanent functionaries and agency heads. Under the leadership of the current Prime Minister, the NDC meets quarterly, as do the subcommittees. The NDC is the main coordinating body for disasters affecting the country. The Prime Minister, as Chairman, is the overall manager of the nation's preparedness, mitigation, recovery, and rehabilitation efforts. A Proclamation is made by the Governor-General to declare that a state of public emergency exists.[26] The committee's executive directs and formulates policies while the Deputy Chairman executes policies, advises and assists the Chairman. He or she is also responsible for coordinating counter-disaster measures and liaising with international agencies. There are a number of agencies that form the National Disaster Committee and work alongside the ODPEM to fulfill its mandate. These agencies are placed on committees to maximize their effectiveness.

Jamaica's NDC Committees and their roles are described as follows:

- Administration Finance & Planning Committee: equipping response agencies, staffing, funding of emergency activities, EOC – Emergency Operation Centre
- Damage Assessment – Recovery & Rehabilitation Committee: damage assessment, coordinating restoration, evaluation planning
- Emergency Operation Communication Transport: rescue evaluation, law enforcement, establishing and maintaining communication links, coordinating transport
- Health Planning - Emergency Health Care: health care
- Public Information and Education: disseminating information, conducting training exercises
- Welfare Shelter – Relief Clearance: shelter relief, coordinating clearance of relief supplies

Jamaica has a disaster response matrix that articulates efforts from the national to the parish level. The National Emergency Response clearly outlines the range of agencies and private sector organizations with which the organization collaborates in disaster events. The matrix is designed primarily for use by the decision-makers during emergency operations at the national level (NEOC) and parish level (PEOC). These include the National Emergency Operations Centre (NEOC) operated by ODPEM, the Parish Emergency Operation Centre (PEOC)

[25] OAS-DSD (1993).
[26] OAS-DSD (1962).

operated by PDC (Parish Disaster Committee), and the heads of agencies who will commit manpower and other resources to preparedness and timeliness of response. The agencies also find it a useful reminder of their role and functions during emergency incidents.

Jamaica has documented policies, plans and procedures at national and parish levels to facilitate a consistent approach to response. Further, simulation exercises and real events have provided opportunities for testing and improvement of the system. The present governance structures therefore allow risk management to be incorporated at local levels, with Parish Councils being given more technical tools, such as hazard maps and risk analyses to guide them in their decision-making.

The promulgation of Jamaica's National Hazard Mitigation Policy represents a significant achievement for the country and a tool for promoting DRM.[27] The Disaster Preparedness Act has been in force since 1993. While it has provided the legal framework for disaster management in the country, it is generally felt that the provisions are not sufficient to deal with the shift in focus from disaster management to disaster risk management. Efforts at drafting a new Act have started, and if passed, will repeal the existing act and provide a strengthened framework for DRM in the country.[28] Hazard mapping for floods, landslides and earthquakes has been done and flood risk mapping is taking place.

Jamaica has various initiatives on disaster risk information management systems and national public awareness programmers. Disaster management is a part of various curricula and training programs that are available at the undergraduate and post-graduate level. The University of the West Indies has elaborate research and training programs on various areas related to disaster reduction. The mass media and well-known personalities are involved in public awareness campaigns, with specific weeks dedicated to earthquake awareness and disaster risk management in schools and businesses, and a specific month dedicated to disaster preparedness. Several civil society initiatives have taken shape during recent years, showing an increase not only in public awareness but also in public participation in disaster reduction.

Jamaica's integrated risk management system encourages data and information exchange among agencies as well as decision-makers. In the past, the appreciation by the technical agencies of Government of the importance of risk reduction had not been matched at the policy and political level. More recently, however, and particularly after hurricane Ivan in 2004, there has been a marked increase in the acceptance of issues related to vulnerability reduction and mitigation. As an example, the Planning Institute of Jamaica has included risk reduction in its medium-term development strategy plan, and Cabinet has agreed to various suggestions for reducing coastal vulnerability.

Jamaica has successfully integrated the public, private, technical, scientific and voluntary sectors as well as the local Government authorities and communities into its disaster risk management structure, and therefore represents a good example of an integrated approach to risk management. The inclusion of mitigation in the national medium-term development plan also indicates that there is a real effort to integrate risk reduction into national development.

Jamaica has adopted the recommendations of the strategic objectives and priority actions of the "Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters." ODPEM is the national platform's focal point.

[27] ODPEM (2009a).
[28] Ibid.

Jamaica is active in several regional and international forums for Disaster Risk Management, including participating in the Caribbean Disaster and Emergency Management Agency (CDEMA) and the United Nations International Strategy for Disaster Reduction (UN ISDR). Jamaica is Party to the United Nations framework Convention on Climate Change and the Kyoto Protocol.

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

The Government of Jamaica's 2009 report, Jamaica: National progress report on the implementation of the Hyogo Framework for Action 2007-2009[29], highlights the country's accomplishments and challenges toward achieving the goals set forth in each of the five HFA priorities as follows:

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

The National Hazard Risk Reduction policy has not been disseminated on a wide scale and currently there is no implementation or action plan in place. The strategy and the action plan need to be developed. The current Disaster Preparedness and Emergency Management Act needs revisions to make it more applicable to changing disaster risk management practices. It currently does not recognize some of the elements of risk management and does not address critical issues such as evacuation, no-build zones and sanctions for breaches of the Act.

Jamaica reports that substantial achievements were attained, but with recognized limitations in key aspects such as financial resources and/or operational capacities. The promulgation of the hazard mitigation policy represents a significant achievement for the country and a tool for promoting DRM.

Over the next 3-5 years policies, plans and guidelines should be developed to facilitate the integration of DRM into sustainable development. This will be supported by ongoing awareness and advocacy among institutions and the wider public; incorporation of hazard information into development approval process at the national level and local level; and preparation of guidelines for development initiatives in high-risk areas. Specific action points for the government included:

- Fast-tracking the review and enactment of the new Act and repealing the old Act of 1993;
- Vetting the Hazard Risk Reduction policy in fiscal year 2008/09; and
- Advocating the implementation of a National Hazard and Risk Mapping Program.

HFA Priority #2: Disaster risk assessment and monitoring

The resources to undertake sector-specific risk assessments are limited. Priorities for the national disaster office and sectors sometimes differ, so achieving buy-in for implementation can be difficult. There is little ownership of Disaster Management Responsibility at the sector levels. There is an absence of DRM planning and budget; sufficient annual budgetary allocations to the National Disaster Response Fund; and a Risk Mitigation Strategy and Action Plan. There is considerable turnover of internal and external stakeholders.

[29] Ibid.

Institutional commitment was attained, but achievements are neither comprehensive nor substantial. However, extensive work has been accomplished in the establishment of Early Warning Systems for floods and hurricanes as well as for earthquakes through the installation of a National Seismograph Network. Jamaica became a signatory of the Regional Tsunami Warning system. There is a deliberate effort at collecting and making hazard and vulnerability data available. This is usually through damage assessment reports, a national disaster catalogue and annual incident reports and hazard maps prepared by the respective technical agencies. So far, no risk assessments have been undertaken for key sectors, but efforts are currently underway to achieve this in the agriculture and tourism sectors.

The current strategic plan focuses on the agriculture and tourism sectors. The entire project is expected to include risk assessments and mitigation plans. The housing sector will be focused on later in the planning period. Project funding is being recommended for the tourism sector to overcome the funding challenge. The line ministries will make provisions for DRM in the Annual Budget and Strategic Plan. The orientation and training needed at all levels to facilitate support for these efforts will be supported.

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

Jamaica observes that the primary challenge to tapping into as many markets as possible is financial. Ongoing dialogue is maintained with media houses, special interest groups and donor agencies for partnerships to make the goal more achievable. Another challenge is that some educational facilities do not have the capacity to implement the necessary activities to make their institutions more resistant to the likely impact of disasters. Additionally, DRM mainstreaming is slow in many instances simply because it is dependent on personalities and not legislation.

Jamaica reports that substantial achievements were attained, with recognized limitations, in key aspects such as financial resources and/or operational capacities. There has been significant success in the area of dissemination of disaster preparedness information to a wide cross-section of the Jamaican population. The ODPEM continues to use all available media to disseminate information to the wider population. The Organization's website and sub-site serve as a source point of information gathering for individuals and institutions. Major stakeholders such as the Ministry of Education and school administration have been actively involved in promulgating the message of disaster preparedness, thus increasing awareness. A recently concluded UNICEF project has trained more than three hundred principals, teachers and caregivers from approximately one hundred schools and child care institutions in building schools' resilience to disasters.

Jamaica is making recommendations for some of the knowledge-sharing services to be available free of cost or sponsored largely by the corporate entities. The ODPEM envisions being able to carry information to the visually impaired, the hearing impaired and other special populations without being restricted by budgetary constraints through the development of cooperative partnerships with other private and public sector entities. There will be a greater emphasis on budgetary allocation at the local level as well as for partnership-building with donor agencies and the private sector, to improve information dissemination and raise the level of preparedness. ODPEM will support the push for the inclusion of DRM within the School Curriculum at all levels.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

While the link has been made between disasters and environmental protection, there needs to be greater collaboration among agencies, especially as it relates to monitoring and enforcement of legislation regarding the development process, sharing of data, and public education strategies. There isn't a dedicated budget to reduce the vulnerability of populations most at risk. Budgetary allocations lean more towards addressing poverty alleviation strategies through the Government's Public assistance program rather than adopting a socio-cultural approach to reducing risk. There is little or no mainstreaming of DRM principles into the National Macro-Economic Planning Policy. No comprehensive recovery program exists.

There are too many formal settlements in vulnerable areas. Comprehensive management of human settlements is limited due to the outdated nature of numerous development orders and the deficiency in the institutional capacity of monitoring agencies to enforce existing legislations. The capacity of the Local Planning Authorities is limited as it relates to conducting vulnerability/risk assessments. Assessing development applications is not a core function of the National Environment and Planning Agency, which has limited human, technical and financial resources. The volume of applications is quite large and beyond the capacity of the organization, especially as regards the 90-day approval process timeframe.

Jamaica reports that substantial achievements were attained, with recognized limitations, in key aspects, such as financial resources and/or operational capacities. Jamaica has made significant strides in Environmental Management with the establishment of the National Resource Conservation Act (1991); the formulation of a single agency (National Environment and Planning Agency) in 2001 with sole responsibility for addressing environmental issues; and implementation of projects such as "Ridge to Reef", which looks specifically at land use and natural resource management of targeted watershed areas and its effects on marine environment. The country has also examined the whole conceptual framework for the adaptation to climate change. Mainstreaming DRM into development planning, targeting two critical sectors (Agriculture and Tourism) has been an integral component of the work program of the National Disaster Office.

A framework has been developed to minimize risk to vulnerable populations directly and indirectly impacted by disasters. This forms part of the national development plan led by the Planning Institute of Jamaica (PIOJ). The Government of Jamaica, through the Ministry of Labour and Social Security (MLSS), has implemented several programs to address the needs of vulnerable populations who are affected by disasters. Programs include the Program for Advancement through Health and Education (PATH), and Rehabilitation Programs providing compassionate grants and rehabilitation grants. Rehabilitation grants were not issued to families living in very high-risk areas such as coastal habitats until they could provide evidence of the ability to relocate to safer locations. This was supported by No-Build Orders by the local authority. There are other programs operated by NGOs such as the Red Cross, Food for the Poor, Salvation Army and ADRA that provide assistance to vulnerable persons (housing, skills training, healthcare, food assistance, and clothing). There is also a National Shelter and Welfare Action Plan developed by the National Disaster Office in conjunction with the National Shelter and Welfare Committee, which clearly outlines the roles and responsibilities of the welfare agencies. A squatter management unit has also been implemented with the mandate of coordinating the national response to existing and emerging informal settlements. A draft Homeless Policy (conceptual framework to become Green Paper) has also been developed.

The achievements to date in the form of policy and legislation include building codes, the Town & Country Planning Act, the Local Improvements Act, the Parish Council's Act, the NRCA Act, and the Development Approval process. The country's frequent experience with hazards prompted the requirement of an Environmental Impact Assessment for medium- to large-scale projects or those that are undertaken in environmentally sensitive areas.

Jamaica plans to strive to strengthen linkages among agencies and increase enforcement capabilities; review the National Plan for Shelter and Welfare and Emergency Relief Clearance; develop a National Resettlement Policy; allocate a budget to the National Disaster Office and other agencies with lead responsibility in risk mitigation; mainstream DRM into all sectors of the national economy; continue building the capacity of local authorities in DRM; bolster the technical/human resource capacity of the National Disaster Office to deal effectively with DRM; strengthen legislation related to DRM to include development penalties as well as associated sanctions; draft and adopt a post-disaster rebuilding policy; promote a greater focus on DRM in development planning; provide training and tools to the Local Planning Authorities required to undertake hazard and vulnerability assessments; and create a document which provides guidelines for developments in high-risk areas which can be used in the project design stages of development.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

The Local Authorities lack the adequate capacity to administer its disaster management responsibility. Not enough drills and simulation exercises are conducted across all administrative levels. Parish Disaster Coordinators are employed by Parish Councils and as such are not obligated in any way to report to the National Disaster Office.

Economic constraints serve as a hindrance to keep the National Disaster Fund adequately resourced. There isn't a Subnational Risk Transfer Fund in place outside of the anemic National Disaster Fund. Budgetary diversions and the sourcing of loans and grants are sometimes used to respond to large-scale events. The Caribbean Catastrophic Risk Insurance Facility (CCRIF) only provides emergency cover following catastrophic wind-driven or earthquake events and is not triggered by all parameters. The Government of Jamaica has been unable to access the CCRIF despite experiencing over US$1.5 billion in losses over the last four years due mainly to precipitation.

Jamaica reports that substantial achievements were attained, with recognized limitations, in key aspects such as financial resources and/or operational capacities. A National Disaster Plan exists and is comprised of various sub-plans: the National Earthquake Response Plan; the National Fire Management Plan; the National Oil Spill Plan; the National Media Plan; and the National Transport Plan. In addition, parish plans are in place. There is an institutional three-tier matrix comprising the national, local and community levels. After-Action Reports are conducted for major incidents. Damage Assessment Reports are prepared for each major incident (Initial Reports and Detailed ECLAC Reports).

The National Disaster Office employs Regional Coordinators who provide technical expertise to four regions, including the review of plans and conducting simulation exercises to test response capabilities of aspects of parish and municipal plans. Additionally, individual Local Planning Authorities also employ Parish Disaster Coordinators to carry out the Disaster Management Mandate of the Parish Councils. Plans exist to evacuate persons from vulnerable communities. Reporting mechanisms are established through the National Disaster Committee (NDC).

National capacity exists for the assessment of national readiness to face adverse natural events.

National plans and sub-plans are in place to guide the management, response and coordination of hazards.

Contingency plans are a component of the approval process for large-scale developments. Agencies, institutions, and the private sector are all encouraged to develop contingency plans. Training and drills are also carried out within these institutions. The National Disaster Office provides guidance in the preparation of Emergency Response Plans for businesses and institutions. Contingency mechanisms also exist with regional and international partners

A comprehensive response mechanism is in place and is used at every disaster event. This includes standard operation procedures for every hazard and the execution of components of the disaster program through the synergies and work of the national subcommittees and the sector committees (Tourism and Agriculture). Information and lessons learned are shared. The information produced is communicated through reports from all sectors after a disaster event. The ECLAC methodology is also a tool used in reporting losses.

There is a National Disaster Fund, with significant limitations. Jamaica is a subscriber to the Caribbean Catastrophic Risk Insurance Facility (CCRIF), which provides emergency cover in the event of a catastrophic event.

Together the responsible Jamaican authorities and stakeholders strive to institute at least one national simulation exercise annually; institutionalize a framework for monitoring the compliance of disaster management plans; adequately capitalize the National Disaster Fund; promote a culture of risk transfer (insurance) to individuals and companies, as part of the overall Risk Reduction Strategy; improve coordination among agencies on data collection in post-disaster situations at national and parish levels; and establish baseline information for all sectors.

ADDITIONAL OBSERVATIONS

Although disaster management in Jamaica is over 28 years in existence, government policy on economic and spatial development still does not reflect full understanding of the issues, nor does it reflect a clear connection between economic development and disaster risk management. There is a need for clear guidelines for the integration of DRM in sustainable development, policies and plans, especially in key economic sectors. Integration of DRM into project development is also an area of focus as it relates to national development.

At the institutional level, capacity, particularly that of local governance systems, remains the broad area of challenge. However, some other areas of challenge include proper identification of hazards and elements at risk. With this accomplished, a more comprehensive approach can be administered to address mitigation (both structural and non-structural) and risk transfer. This will also support the strengthening of national and local preparedness programs and early warning systems. Action items include identifying critical priorities for capacity building through some critical areas such as legislation, hazard identification, and unmapped areas. It is also envisaged that there will be a sustained capacity-building program in the area of DRM for all local planning authorities, institutions and communities.

Given the consistent lack of human, financial and technical resources, the Jamaican authorities and ODPEM leverage capacities and collaborations domestically and internationally across disciplines and sectors to address ongoing needs and priorities. The Government of Jamaica has been unable to qualify for an insurance payout from the CCRIF despite experiencing over US$1.5 billion in losses, due mainly to precipitation, landslides and storm surge caused by events which

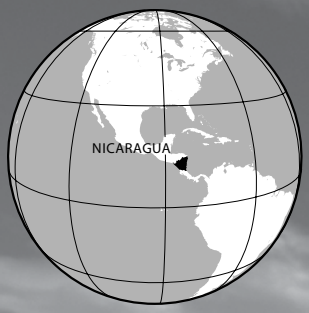
impacted the island in 2007 and 2008.[30] Despite this, the Government, through the Ministry of Agriculture and the Ministry of Finance, has urged the CCRIF to consider the development of a flood-based parametric specifically for the agricultural sector.

KEY DONOR ENGAGEMENTS[31]

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Participatory Community Development and Monitoring to improve the lives of vulnerable populations	CIDA (J$42 million) and IADB (J$12.5 million)	J$54.5 million 2009-2011	3
Enhancing Emergency Storage Capacity and Distribution Capabilities	USAID	24,000 2008-2011	5
Expanding the ODPEM Dedicated Emergency Telecommunications Network and early warning capabilities	IADB (64,500) and Government of Jamaica (8,300)	72,800 2008-2011	2
Knowledge and Awareness Building	UNICEF	J$2 million 2008-2011	3
Mainstreaming Disaster Risk Management into the Agricultural and Tourism Sectors	CDEMA and FAO*	J$2.75 million	4
Community Mitigation – Developing Community Risk Management Programs	IADB (111,500) and Government of Jamaica (16,800)	128,300	4
Incorporate hazard information into the Development approval process at the national and Parish Levels	Partially through IADB and WB	208,000 2009-2011	5
Enhance the Damage Assessment Process	CIDA and USAID*	*J$2.8 million (est.) 2008-2011	5
Enhance the utilization ICTs in Disaster Risk Management	CDEMA	J$5.2 million	2

* Amount unavailable

[30] Ibid.
[31] ODPEM (2009b).



COUNTRIES AT HIGH ECONOMIC RISK FROM MULTIPLE HAZARDS
(Top 75 based on GDP with 2 or more hazards)[a]

1. Taiwan, China
2. El Salvador
3. Jamaica
4. Dominican Republic
5. Guatemala
10. Costa Rica
11. Colombia
15. Trinidad and Tobago
19. Barbados
22. Ecuador
23. Mexico
26. NICARAGUA
27. Chile
30. Venezuela
34. Argentina

[a] Dilley et al. (2005). Table 7.2.

Nicaragua is considered a leader in Central America because of its legal framework that enables a comprehensive and multi-sectoral approach to disaster risk management (DRM).

NICARAGUA

Natural Disasters from 1980 - 2008[b]

Affected People

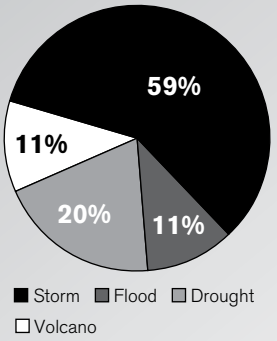
Disaster	Date	Affected (Number of People)
Storm	1998	868,228
Storm	1988	360,278
Volcano	1992	300,075
Drought	1997	290,000
Storm	2007	188,726
Drought	2001	188,000
Storm	1993	123,000
Flood	1999	107,105
Flood	1990	106,411
Drought	1994	75,000

Economic Damages

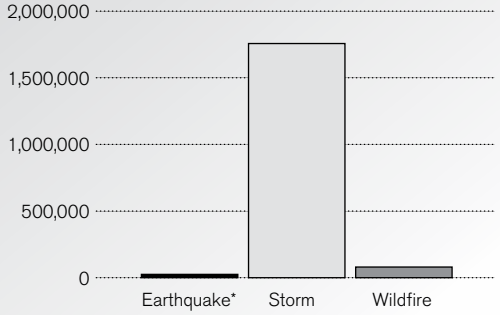
Disaster	Date	Cost (US$ x 1,000)
Storm	1998	987,700
Storm	1988	400,000
Storm	1982	356,000
Wildfire	1991	80,000
Earthquake*	1992	25,000
Drought	1994	16,000
Storm	1996	10,000
Drought	1997	2,000
Storm	2000	1,000
Storm	2001	1,000

Statistics by Disaster Type[b]

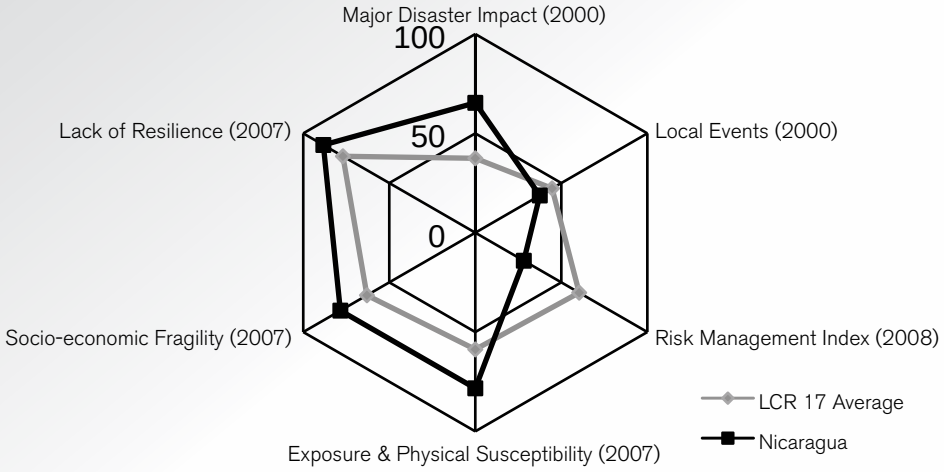
Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



Relative Vulnerability and Risk Indicators[c]



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=124. Source data from EM-DAT. Data displayed does not imply national endorsement.

[c] Relative Vulnerability and risk Indicators are adapted from IADB-IDEA-ERN (2009). Values are normalized on scale of 0 – 100 and presented against the average for 17 LCR countries. Major disaster Impact taken from disaster deficit Index: the ratio of economic losses which a country could suffer during a Maximum Considered event and its economic resilience. Local events taken from Local disaster Index: the propensity of a country to experience recurrent, small-scale disasters and their cumulative impact on local development. risk Management Index is presented as the negative (i.e. 0 = optimal, 100 = incipient) of IADB's risk Management Index: measures a country's risk management capability in (i) risk identification, (ii) risk reduction, (iii) disaster management, and (iv) financial protection. resilience, Fragility and exposure are taken from the component indices of Prevalent Vulnerability Index. Date for local event data depends on information available for each country. Data, and the respective LCR 17 average, from 2000 is used for Dominican Republic, El Salvador, Guatemala, Jamaica and Nicaragua. Data, and the respective LCR 17 average, from 2006-08 is used for Bolivia, Colombia, Costa Rica, Ecuador, Panama and Peru. All LCR 17 averages are calculated based on available data.

DISASTER RISK PROFILE

Nicaragua ranks second among countries most affected by tropical storms and 30th among countries most affected by earthquakes, according to the UN's Global Report on Reducing Disaster Risk. Nicaragua has the 26th highest economic risk exposure to two or more hazards, according to the Natural Disaster Hotspot study[2] by the World Bank. It is estimated that 10% of Nicaragua's territory is exposed to natural hazards, including low-frequency, high-impact events such as earthquakes, volcanic eruptions, hurricanes, and high-frequency, but lower-impact events such as floods and landslides.

Geological Hazards

The Pacific area of Nicaragua, including all major urban areas, is located in zones of high or very high seismic risk. As shown in Figure 1, Nicaragua as a whole is situated on two tectonic plates: the Caribbean Plate and the Cocos Plate. The subduction of these plates creates high seismic risk. Earthquakes in Nicaragua have caused significant damage and have destroyed cities, such as León and Managua, in the past. This situation requires special attention since the entire Pacific Coast continues to be exposed to seismic activity.

There are 25 volcanoes in Nicaragua, distributed along the central mountain range. The active volcanoes that result in increased risk exposure are Masaya, Momotombo, Santiago, Concepción and Madeas.

Floods and Landslides

Large parts of Nicaragua's territory are susceptible to flooding, especially in the lower basins and valleys of the principal rivers. The Estero Real Watershed on the Pacific coast and the Rio Escondido Watershed on the Caribbean coast are the most affected areas. The North Atlantic Autonomous Region and South Atlantic Autonomous Region are susceptible to flooding, as demonstrated by Hurricane Felix in September 2007.

Landslides occur frequently as a result of the topography in the north of the country. Landslides can be attributed to hydrological phenomena. The main causes in Nicaragua are due to the softening of the ground from heavy rains and flooding of existing bodies of water.

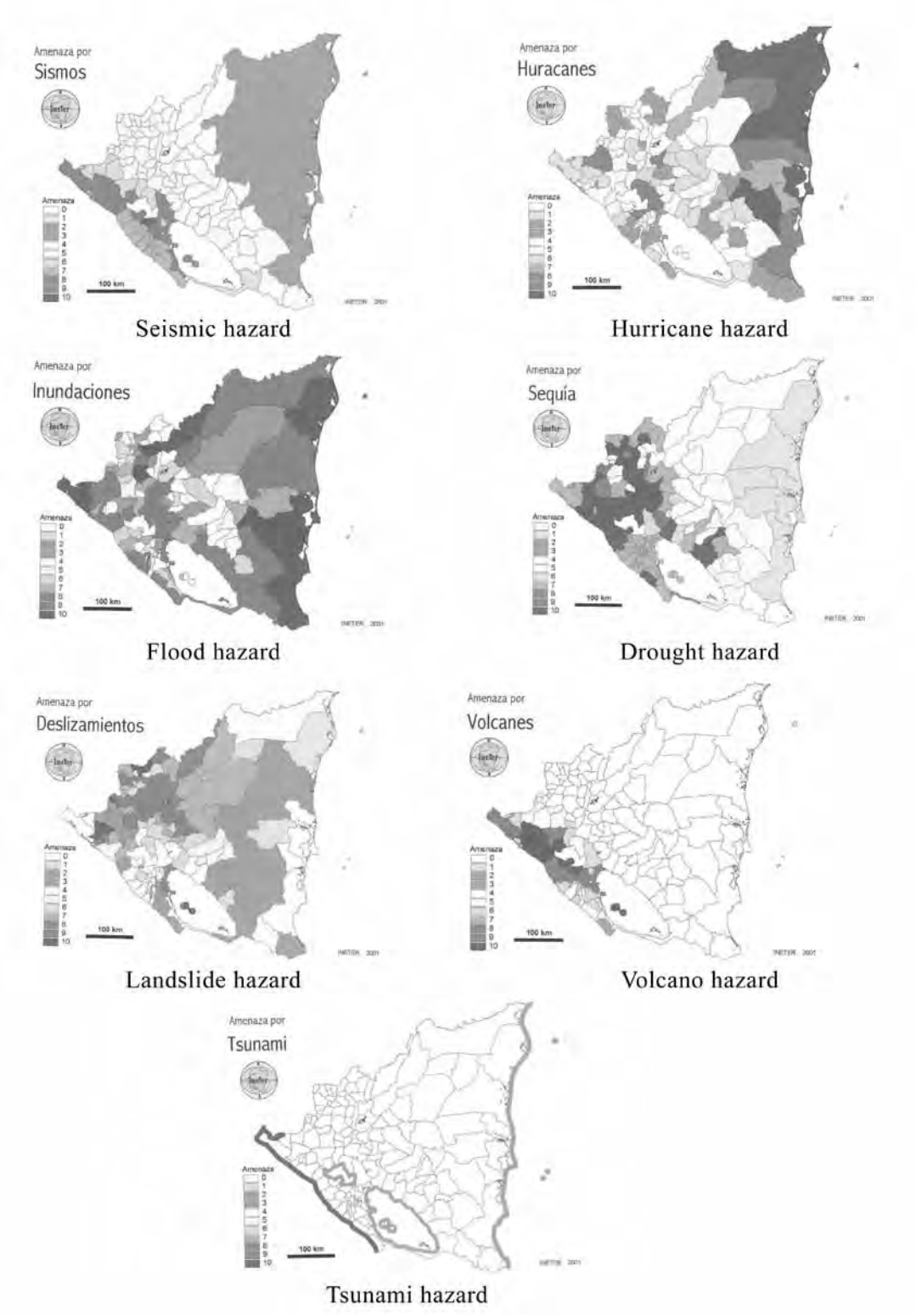
Determinants of Vulnerability to Adverse Natural Events in Nicaragua

Rapidly increasing urban population has intensified Nicaragua's exposure to adverse natural events. As is the case in most Latin American countries, Nicaragua has seen a large increase in its urban population in the last fifty years. In 2005, the total population of Nicaragua was 5,483,447 inhabitants[3], with a density of 42.3 persons per km^2. The population has multiplied by 10 within a century, from 4 to 43 inhabitants per km^2. Managua's population has increased 26 times between 1906 and 2005, with an approximate 360 people per km^2. The four largest cities in Nicaragua account for 48% of households and the vast majority of household income generated in the country.

Unplanned urban growth has disproportionately increased Nicaragua's vulnerability to adverse natural events. Most Nicaraguan cities have followed an unplanned growth pattern that has directly contributed to heightened vulnerability in many communities. Some of the most important challenges in urban areas include the predominance of unplanned

[2] Dilley et al. (2005).
[3] *Instituto Nacional de Estadística y Censos* (INEC).

Figure 1. Hazard maps for Nicaragua.



Source: National Institute for Territorial Studies (INETER in Spanish).

expansions, a sharp increase in informal settlements, a lack of adequate construction practices, environmental degradation, poor transport infrastructure, and a lack of adequate public spaces.

Informal settlements tend to be situated in areas of high risk and are a physical and spatial manifestation of poverty and inequality in cities. About 85% of the houses in Nicaragua are self-constructed. According to the building code, any house built larger than 100 square meters must apply the municipal code for construction; however, this requirement is rarely met in these informal settlements and many remain poorly constructed, lack basic social services, and are located in high-risk areas.

DISASTER RISK MANAGEMENT FRAMEWORK

Nicaragua is considered a leader in Central America because of its legal framework that enables a comprehensive and multi-sectoral approach to disaster risk management (DRM). Nicaragua created the National System for Disaster Management and Prevention (SINAPRED in Spanish), regulated by the Law 337, in November 2000. This framework facilitated the creation of a comprehensive National Disaster Prevention and Attention Plan.

For both hydrometeorological and geological hazards, Nicaragua has developed methodologies for hazard analysis. Nicaraguan experts in disaster risk management have played an important role in developing a strong knowledge base, mainly through the National Institute for Territorial Studies (INETER in Spanish) and SINAPRED. Risk reduction achievements have included the mapping of hazards, vulnerabilities, and risks for the 30 most vulnerable municipalities in the country. As part of the key activities in risk reduction, Nicaragua developed municipal programs, updated building codes and improved the enforcement of these codes, and incorporated risk management in school curricula in coordination with the Minister of Education.

Investments in DRM, including risk reduction, are managed in Nicaragua through various levels of government: the national government, departmental governments, and municipal governments. In the 30 most vulnerable municipalities and poor settlements of Managua, significant investments in DRM were also carried out by the SINAPRED through the Social Investment Fund (FISE in Spanish), from 2004 to 2008.

Further action will need to be taken to avoid an unreasonable accumulation of new vulnerabilities, despite efforts in preventive planning in 30 municipalities and mitigation actions in 16 municipalities (including Managua). This will require continued and improved attention by the Government of Nicaragua.

Nicaragua has made little progress with urban reforms and requires comprehensive legislation for land use planning, despite some initial efforts made in several municipalities. For example, in 2000, when the Law 337 created the National System for Disaster Management and Prevention, none of the municipalities in the country, including Managua, had yet incorporated risk in their plans and programs. Between 2003 and 2008, 30 municipalities adopted land use planning with risk taken into account through the integration of hazard, vulnerability and risk maps in urban growth planning. Continued investments at the local level are required to effectively improve preparedness and long-term risk reduction.

Concepcion Volcano, Nicaragua

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

Nicaragua has built a National System for Disaster Management and Prevention (SINAPRED) based upon the National Disaster Prevention and Attention Plan. With public and private sector participation, SINAPRED is responsible for: (i) the prevention and mitigation of risk, (ii) attention to emergencies, and (iii) the rehabilitation of territories affected by disasters. The system is coordinated by the Executive Secretariat of SINAPRED (SE-SINAPRED) and has an operative arm coordinated by a National Operative Committee and a technical/scientific arm coordinated by the Nicaraguan Institute for territorial studies (INETER). There are regional, departmental and municipal committees presided over by the provincial governors and mayors.

Nicaragua, through its National System for Disaster Management and Prevention, has been a leader in instituting a policy and legal framework that enables a comprehensive and multi-sectoral approach to disaster risk management. Nicaraguan experts and graduate-level trainees in disaster risk management in the country have played an important role in this process.

Since 2003, Nicaragua has decentralized disaster risk management responsibilities and has made disaster risk management a national development priority. Recognizing the high cost of disasters and the need to encourage investment in disaster mitigation, SINAPRED has been institutionally strengthened by the Executive

Secretariat of SINAPRED with World Bank support for the Natural Disaster Vulnerability Reduction project. Strategic studies for vulnerability reduction have been developed, risk management capacity has been enhanced in local committees, preventive municipal planning in 30 municipalities has been promoted, and mitigation measures (structural and non-structural) have been improved upon.

Nicaragua's challenge is to resist pressures to fall back into an emergency focus. In order to resist these pressures, there is a pressing need to upgrade, integrate, and further consolidate SINAPRED. Though good work is being done in most institutions in the system, technical capacity is a limiting factor, particularly at local levels, and institutional coordination remains a challenge.

SINAPRED, through its Executive Secretary (SE-SINAPRED), has demonstrated their leadership in mainstreaming disaster risk management. Although significant work remains to be done, SE-SINAPRED is the agency leading these initiatives and coordinating DRM activities in Nicaragua.

HFA Priority #2: Disaster risk assessment and monitoring

Nicaragua has strengthened information collection, early warning capacity, and risk mapping for hydrological, seismic and landslide events. With resources from the national budget and technical assistance from various donors, INETER has purchased and installed equipment to update existing systems for monitoring catastrophic events, especially for seismicity and tsunamis; however, this network is insufficient and additional resources are needed to establish an effective system.

Nicaragua has organized and improved the flow of information for vulnerability and risk evaluations and also risk reduction programs. At a scale of 1:50,000 for municipal areas and 1:5,000 for urban areas, Nicaragua has risk maps with excellent resolution (including hazard, vulnerability and risk maps) for 30 municipalities and has developed final products for land use planning and risk management plans. Urban landslide and flooding hazard maps have been produced by INETER in some vulnerable municipalities. This information is publicly available and has been used for prioritizing investments in risk reduction. It is important to institutionalize this information and to promote preventive planning in other vulnerable municipalities, as well as the North Atlantic and South Atlantic Autonomous Regions, and other areas that lack information, aerial photography and strategic studies for vulnerability reduction.

Nicaragua has worked to create a culture of risk reduction through the integration of disaster risk management in education. SE-SINAPRED has worked with the Ministry of Education to incorporate risk management in the school curricula and to train teachers.

Currently, SE-SINAPRED is establishing a Disaster Risk Information System. The system will provide a platform for agencies to further develop the National System for Disaster Management and Prevention in order to effectively manage and share information about vulnerability and risk, including scientific and technical data, and geographic information. Some modules focused on response and disaster preparedness have been developed. This project needs additional assistance to reach its objectives since it is not dynamic and is currently very expensive to update. SE-SINAPRED will receive a grant from DIPECHO to improve the module on Damage and Needs Assessment (EDAN in Spanish).

[4] http://ecapra.org.

In order to facilitate a comprehensive understanding of disaster risk and risk management, SE-SINAPRED and INETER worked with the World Bank on a proposal to expand the Central American Probabilistic Risk Assessment Platform (CAPRA)[4] to cover Nicaragua. CAPRA provides a broad set of sectors with a baseline catalogue of data required for risk evaluations, as well reference methodology and interactive software tools to support risk identification and applications for risk analysis. This helps establish standards for sharing data and a common language for understanding risk. The applications CAPRA supports are adjusted to the needs of each sector and user, such as emergency response, land use planning, and investments in mitigation or financial protection strategies. The transparent nature of the models and open architecture of the CAPRA system ensure that future users can understand, adjust, and continue to evolve these tools as their needs change. The CAPRA platform for Nicaragua has been finished, and some municipalities have probabilistic risk assessments for different hazards including earthquakes, floods, landslides, hurricanes, and tsunamis. The CAPRA experience will be applied in twelve municipalities through the IADB Project for the next two years.

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

One of the reasons for Nicaragua's relative success in moving towards a proactive disaster risk management environment is the existence of a human-capital base with the appropriate technical training. At least two higher-education institutions in Nicaragua offer post-graduate training and specialization in risk management. At primary and secondary school levels, the curricula include concepts and good practices for risk management. The Government has developed and implemented various tools and strategies to train teachers and community leaders on how to incorporate disaster risk management in the school curricula.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

Corrective action to address existing disaster risk is one of Nicaragua's main disaster risk challenges. Investments in risk reduction can involve both structural mitigation works, such as seismic retrofitting, and non-structural investments, such as relocating people from high-risk areas (mainly in Managua). Often these decisions should be made at a decentralized level, as close as possible to the assets and people at risk. With such high exposure to natural hazards, the political challenge is to define the acceptable level of risk and to adequately finance the mitigation of the risk.

Most of the investments in risk reduction in Nicaragua at a municipal level are made by the national government and donors. This is because the municipal incomes are very low and highly dependent upon the national budget and subsequent resource allocations. Grant funds could play an important role to integrate disaster risk reduction into these projects and thereby leverage significant amounts of additional resources while deriving lasting benefits.

Work still needs to be done in terms of building awareness and capacity within governments in smaller municipalities. The project supported by the World Bank's loan to Nicaragua's national government expanded coverage of this issue to a large number of municipalities. The project was completed in February 2009 and up to 140 municipalities in the country have benefited from it.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

In Nicaragua, the disaster response structure has several levels of organization that increase the complexity of decision-making during an emergency. Response to a given adverse event starts with the local level to determine if the event is of a magnitude that the local response committee can handle or if additional help needs to be requested at the municipal, departmental or national level.

Since 2004, the National System for Disaster Prevention and Response has been providing training at local, municipal, and departmental levels through committees for disaster prevention and response. SE-SINAPRED is seeking additional financial support for this critical activity.

To test existing capacity, simulations and drills have been carried out in Managua. The latest and largest exercises have been earthquake simulations in Managua in 2004, 2008 and 2010. Responders, national and district authorities, and the general population participated in the exercise.

The response capacity when the entire system is activated at the same time has been tested many times since its creation, including in 2007 after Hurricane Felix, which caused thousands of deaths and damaged productive infrastructure in the North Atlantic Autonomous Region. Immediately after Hurricane Felix, the Government of Nicaragua coordinated the reconstruction of housing, productive infrastructure, and equipment, with the support of different donors. This was the first time the country financed such reconstruction through the regional government in this Region. The World Bank also approved an Emergency Recovery Credit of US$15 million to support this region through the reconstruction phase. The SINAPRED has also been activated with Tropical Storm Ida in 2009 and other local disasters.

With regard to disaster response, the main challenge for the Government of Nicaragua is to finance and rapidly initiate the recovery phase in the aftermath of an adverse natural event. Nicaragua needs to reinforce its fiscal strategy to provide financial support after disasters that cause damage that cannot be funded through internal reserves.

The current Government has focused on disaster risk management, but has not yet developed a financial strategy that would ensure medium- to long-term DRM commitments for Nicaragua. It is necessary to reinforce actions for disaster risk management in the following areas: (i) develop policies and strengthen institutions, (ii) identify and monitor risk and disseminate its knowledge, (iii) reduce and prevent risk, and (iv) reduce fiscal vulnerability.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Nicaragua Disaster Vulnerability Reduction Project	World Bank	10 million 2001-2009	1, 2, 3, 4, 5
Hurricane Felix Emergency Recovery	World Bank	17 million 2008 -2011	4
Support for DesInventar online disaster database creation of the National Disaster Prevention and Management Information System (SIAPAD)	PREDECAN	not available 2008-2009	2
Seminars and guidance for municipalities on risk reduction	PREDECAN	not available 2008-2009	2
A study to update the Disaster Risk Management Indicators	IADB	2009	2
Development of a Risk Assessment Platform for Nicaragua	World Bank (GFDRR)	350,000 2009-2010	2,3
Development of disaster risk management capacity at the local level in Bonsai	Japan International Cooperation Agency	300,000 2008-2011	2,4
Program for the Reduction of Vulnerability and Environmental Degradation in Nicaragua (PREVDA)	European Commission	3.33 million 2007-2011	1, 2, 4
Regional Plan for Disaster Reduction (PRRD)	Norway, Spanish International Cooperation Agency	400,000 2006-2011	1
Disaster Risk Management for volcanic and landslide hazards in Ometepe island	Disaster Preparedness Programme of the European Commission's Humanitarian Aid Department (DIPECHO)	520,000 2008-2011	2, 4
Training on disaster risk management to local authorities	UNDP	400,000	1
Disaster risk reduction program for Nicaragua	Swedish Cooperation COSUDE	2.2 million 2008-2012	1, 2, 3, 5
Earthquake Risk Reduction in Guatemala, El Salvador and Nicaragua with regional cooperation support to Honduras, Costa Rica and Panama (RESIS II)	Norway	2.4 million 2007-2010	2
Regional Program of Environment in Central America (PREMACA)	Danish Cooperation (DANIDA)	not available	2, 4
Mesoamerican coordination system for territorial information	IADB	800,000 2009-2011	2
Technical assistance to strengthen Information and Communication Tools for CEPREDENAC and National Commissions	World Bank	446,000 2007-2009	1, 2
Technical assistance for vulnerability reduction and response in Nicaragua (five local projects)	Humanitarian Assistance Office for Disaster Preparedness of the European Commission (DIPECHO)	not available	3, 4, 5
Capacity Building for Risk Management in Central America (BOSAI)	JICA	2,500,000 2007-2012	1, 2
Strengthening of communication systems at national and regional levels (Regional program)	China (Taiwan)	1,130,000 2009-2011	3
Action Plan AECID-CEPREDENAC (Regional level)	Spanish Cooperation for International Development (AECID in Spanish)	763,750 2009-2010	1, 2
Strengthening of CAPRA Implementation (Regional Level)	CEPREDENAC	50,000 2010	1, 2


Leon City, Nicaragua

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GLOBAL FACILITY FOR DISASTER REDUCTION AND RECOVERY (GFDRR): ACTION PLAN

Given Nicaragua's disaster risk profile and its existing framework for disaster risk management, the key priority in Nicaragua is to increase awareness of the importance of disaster risk reduction and to mainstream disaster risk management at the local levels. Strategic actions are needed in the following areas to enhance disaster risk management in Nicaragua: (i) strengthen institutional capacity for strategic planning and coordination at central and local levels, (ii) reduce vulnerabilities at the municipal level, and (iii) develop a comprehensive risk assessment and monitoring capacity.

Despite important advances in data gathering and knowledge production, as well as advances in raising awareness, Nicaragua still has significant challenges ahead. The main challenge lies in knowledge creation among decision-makers and citizens at local levels. This is critical for improving urban planning processes that will avoid development patterns that exacerbate vulnerability. Successful implementation of the National Risk Management Plan (NRMP) and the Risk Assessment Platform will help address this challenge. The NRMP has been supported through a World Bank loan that was completed in February 2009. GFDRR support for the application of the CAPRA pilot project prior to the Mesoamerican coordination system for territorial information project financed by the IADB in twelve municipalities would greatly improve awareness while significantly advance the local tools available to effectively manage disaster risks.

The following activities have been identified in consultation with local authorities and international donor agencies. These actions support Nicaragua's disaster risk management program and reflect HFA priority action areas.

Indicative Program for GFDRR Funding (Projects and engagement areas being considered for GFDRR funding)	Implementing Agency / International Partners	Indicative Budget and Period (US$)	HFA Activity Area(s)[5]
Support for the Pilot Project on Early Warning Systems for Hydrometeorological Hazards in Central America	World Bank (GFDRR) World Meteorological Organization	266,000 2009-2011	1, 2, 3, 4, 5
Phase II in the development of a Risk Assessment Platform for Nicaragua	IADB, UN ISDR, CEPREDENAC, SINAPRED, INETER, Municipalities, CSUCA (University Network)	600,000 2009-2010	2, 3
Strengthening of local, municipal, departmental disaster risk management	SINAPRED, Municipalities, UNDP	2.1 million 2009-2012	1, 2, 3, 4, 5
Institutional strengthening of SINAPRED and support to develop mitigation projects	SINAPRED, Municipalities	1.4 million 2009-2011	1, 4, 5
Improve information, monitoring, and knowledge dissemination of hazards	INETER	540,000 2009-2010	1, 2
Implementation of communication and educational strategies at national and local levels	SINAPRED, Minister of Education, National Communication Agency	460,000 2009-2012	1, 2, 3
Initial Budget Proposal:		**US$5.366 million**	

Ongoing dialogue with Nicaraguan authorities will determine next steps to further implement effective DRM strategies. Additional activities currently under consideration are: (i) risk financing strategies for insurance of assets and agriculture, and (ii) support for the implementation of climate change and adaptation programs.

[5] HFA Priority Action Areas: 1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation; 2. Identify, assess, and monitor disaster risks—and enhance early warning; 3. Use knowledge, innovation, and education to build a culture of safety and resilience at all levels; 4. Reduce the underlying risk factors; 5. Strengthen disaster preparedness for effective response at all levels.

COUNTRIES AT HIGH ECONOMIC RISK FROM MULTIPLE HAZARDS
(Top 33 based on GDP with 3 or more hazards)[a]

1. Taiwan, China
2. Dominican Republic
3. Jamaica
4. El Salvador
5. Guatemala
8. Costa Rica
10. Colombia
12. Chile
15. Barbados
18. Ecuador
20. PERU
21. St. Kitts and Nevis
24. Honduras
27. Mexico
32. Bolivia

[a] Dilley et al. (2005). Table 7.2.

Peruvian cities are at high risk for earthquakes and there are a dearth of resilience-building programs for essential buildings and infrastructure.

PERU

Natural Disasters from 1980 - 2008[b]

Affected People

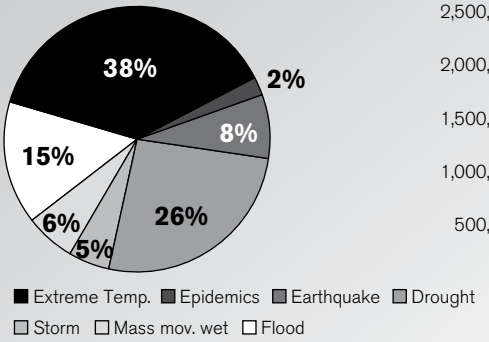
Disaster	Date	Affected (Number of People)
Drought	1990	2,200,000
Extreme temp.	2004	2,137,467
Extreme temp.	2003	1,839,888
Drought	1992	1,100,000
Extreme temp.	2007	884,572
Mass mov. wet	1983	700,000
Storm	1997	580,730
Flood	2008	495,000
Earthquake*	2007	479,955
Earthquake*	2001	349,978

Economic Damages

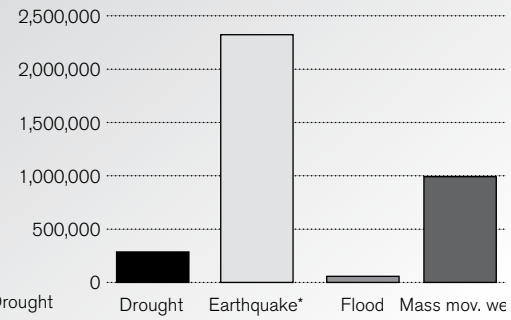
Disaster	Date	Cost (US$ x 1,000)
Earthquake*	2007	2,000,000
Mass mov. wet	1983	988,800
Earthquake*	2001	300,000
Drought	1992	250,000
Flood	1994	50,000
Drought	1990	36,000
Earthquake*	1986	22,000
Storm	1997	12,000
Flood	1981	6,000
Mass mov. wet	1984	3,000

Statistics by Disaster Type[b]

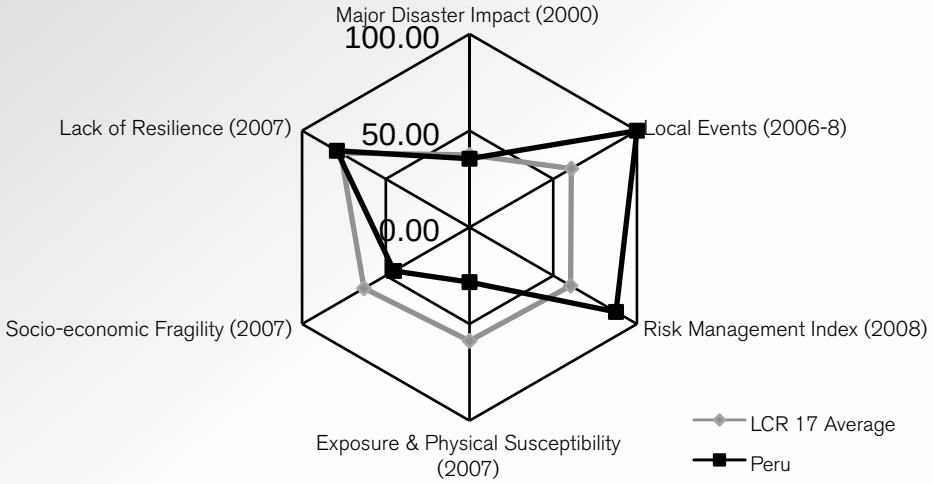
Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



Relative Vulnerability and Risk Indicators[c]



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=134. Source data from EM-DAT. Data displayed does not imply national endorsement.

[c] Relative Vulnerability and risk Indicators are adapted from IADB-IDEA-ERN (2009). Values are normalized on scale of 0 – 100 and presented against the average for 17 LCR countries. Major disaster Impact taken from disaster deficit Index: the ratio of economic losses which a country could suffer during a Maximum Considered event and its economic resilience. Local events taken from Local disaster Index: the propensity of a country to experience recurrent, small-scale disasters and their cumulative impact on local development. risk Management Index is presented as the negative (i.e. 0 = optimal, 100 = incipient) of IADB's risk Management Index: measures a country's risk management capability in (i) risk identification, (ii) risk reduction, (iii) disaster management, and (iv) financial protection. resilience, Fragility and exposure are taken from the component indices of Prevalent Vulnerability Index. Date for local event data depends on information available for each country. Data, and the respective LCR 17 average, from 2000 is used for Dominican Republic, El Salvador, Guatemala, Jamaica and Nicaragua. Data, and the respective LCR 17 average, from 2006-08 is used for Bolivia, Colombia, Costa Rica, Ecuador, Panama and Peru. All LCR 17 averages are calculated based on available data.

DISASTER RISK PROFILE[2]

Geological Hazards

Peru is a country with a high seismicity. In Peru, as in its Andean neighbors, seismic activity originates in the subduction zone between the Nazca and South American plates and in the continental fault system in the Andes Mountains. Over the past 400 years, Peru has been hit by at least 30 major earthquakes, the most recent of them near the coast of Lima (1940), Arequipa (1948), Ancash (1970), Nazca (1996), Arequipa (2001), and Pisco (2007). The highly seismic hazard zones are concentrated along the coastal region, home to the nation's capital, Lima (see Figure 1).[3] This is Peru's disaster hotspot.

The coastal region of Peru has a history of tsunamis. Most of the destructive tsunamis that have struck the west coast of South America in the last four centuries have occurred from the Callao harbor, coast of Lima, southward. According to recent studies[4], at least ten Peruvian Regions are at risk for tsunamis, notably Piura, Lambayeque, Lima, Ica, and Arequipa, where the bulk of the coastal port, oil and gas infrastructure is located.

Volcanic hazards in Peru are localized in the southern part of the country. The 15 existing active volcanoes pose a threat mainly to four Regions: Tacna, Moquegua, Arequipa, and Ayacucho (see Figure 2). The city of Arequipa is the most exposed because of its proximity to the Misti volcano, an area home to over a million people, and because of infrastructure development near the volcano's cone. The most recent event was the eruption of the Sabancaya volcano, 70 kilometers northwest of Arequipa, where explosive activity was recorded between 1990 and 1992. The potential hazard in this case is ashfall toward the Arequipa region with lahars and flows into the Colca Valley.

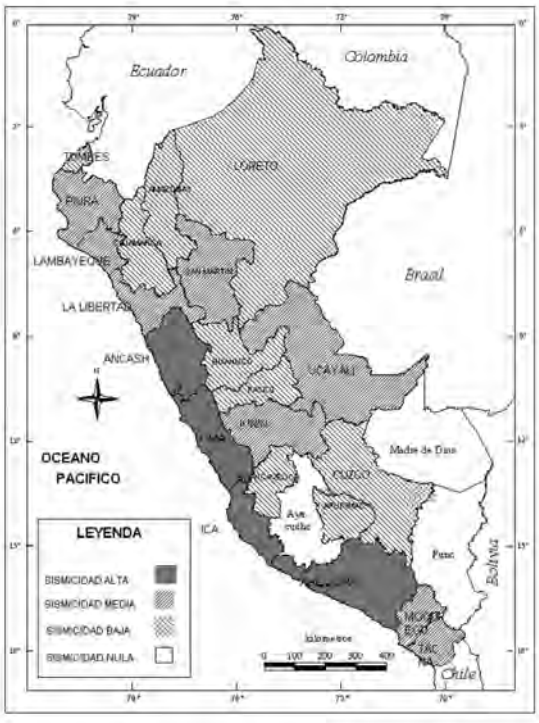
Landslides are a recurring hazard for Sierra communities and strongly affect infrastructure in the country. The most landslide-prone zones are the steep mountainsides and flanks, the Coast and the high Amazonian valleys, and the inter-Andean valleys of the Huallaga, Marañón, Apurimac, and Urubamba rivers, among others. These events take their heaviest toll on road infrastructure. Also included in this disaster category are flash floods, avalanches, and torrential down-slope flows of water-saturated earth and rock ("huaycos"). The Machu Picchu sanctuary region experiences complex events of this type.[5] Such catastrophic slope failures have occurred primarily in the Andean Mountains, due to seismic activity or heavy rains, claiming thousands of casualties in communities downstream from the Huaytapallana, Huayhuash, Urubamba, and Vilcabamba cordilleras (1883, 1938 and 1970).[6]

Hydrometeorological Hazards

Peru's northern coast is especially vulnerable to El Niño oscillations, which are typically characterized by prolonged torrential rains mainly in the Regions of Tumbes, Piura, Lambayeque, La Libertad, and Ancash (except for the high Andean provinces). The 1982-83 and 1997-98 El Niño events were devastating for Peru's economy and people, with losses tallying US$2.277 billion and US$3.569 billion respectively in destroyed and damaged homes, infrastructure and production equipment, cropland,

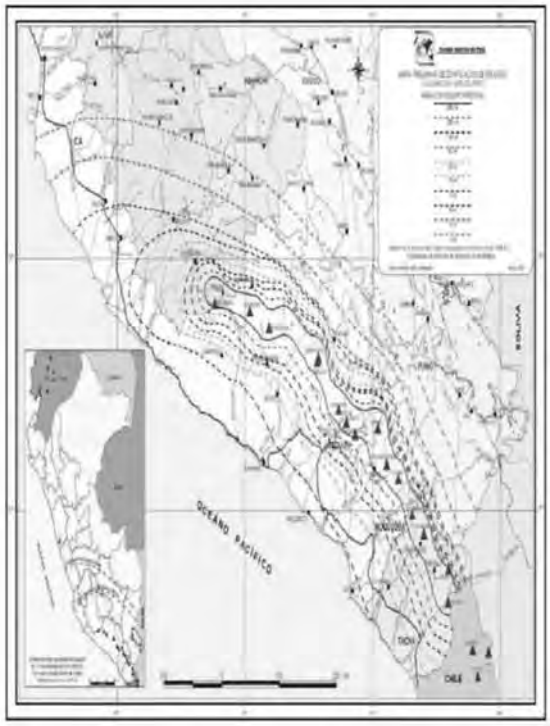
[2] One of the primary sources referenced to develop this profile was DIPECHO (2008).
[3] From Tavera and Bernal (2006) and Tavera (2008).
[4] *Dirección Hidrográfica y de Navegación – Marina de Guerra del Perú* (2007).
[5] See Vilcanota Valley Slope Monitoring for Flash Flood Prevention, Peru. Geophysical Flow Observatory, University of Maryland, Baltimore County.
[6] See Atlas of Natural Hazards in Peru (2004).

Figure 1. Seismic Hazard Map of Peru.



Source: Tavera (2008).

Figure 2. Volcanic Hazard Map of Peru.



Source: *Instituto Geofísico de Perú.*

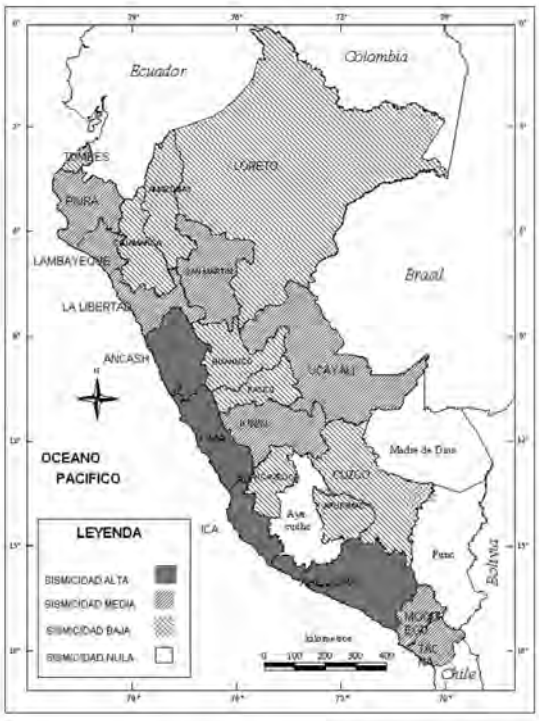
and transportation stock, among others.[7] Following the 1997-98 El Niño, the World Bank approved a US$150 million loan for a project to assist the Peruvian Government's reconstruction efforts.[8]

At least 23 percent of Peru's population lives in flood-prone areas.[9] As is typical for the Andean region, the particular water regimen conditions in Peru favor flooding. In Peru, flooding is more intense along the rivers that flow toward the coast–which are dry most of the year–when they receive freshets during the Sierra rainy season between November and April. Major Amazon Basin Rivers also inundate floodplains, as Figure 3 illustrates. The Regions of Puno (Titicaca watershed), Piura, Lambayeque, and Ucayali have a history of recurrent flooding. An assessment by the Multisectoral Commission on Risk Reduction in Development (CMRRD) classifies 55 Peruvian provinces as high flood risk (Figure 3).

Southern Peru is prone to droughts, frosts, severe cold snaps and other hydrometeorological events. The south Andean region (Puno, Cuzco, Apurímac, Arequipa, Moquegua, and Tacna) is the most recurrently drought-prone. Its 1.3 million people living beyond 3,500 meters above sea level are the hardest hit because farming and stock-raising is their livelihood. Frosts occur mainly from May to August and affect the Sierra regions (center and south) that lie above 2,900 meters above

[7] See ECLAC Economic Evaluation.
[8] See World Bank ICR P054667.
[9] UNDP (2004).

Figure 3. Peru's Flood Hazard Potential.



Source: CMRRD (2004).

sea level. The cumulative effect of these events is devastating for agriculture and has long-term impacts on the livelihood of local populations.

Determinants of Vulnerability to Adverse Natural Events in Peru

Soil and water quality degradation are Peru's main vulnerability-heightening environmental factors. Forty percent of the coastal region soils exhibit some degree of salinization resulting from over-irrigation and poor drainage. Water and wind erosion owing to sparse or no plant cover, overgrazing, and stubble burning affects 60 percent of Andean farmlands. Pollution caused mainly by the mining and metal industry, household wastes, and farm chemicals has impaired water quality: 16 of the 53 rivers in the coast are partially polluted with lead, manganese, and iron. Moreover, water and sanitation system coverage (around 68 percent) and the quality of those services are limited, so several million people have no access to safe drinking water or sewer systems. Informal management of potable and wastewater is a structural driver of environmental degradation, primarily on the mountainsides.

Unplanned urban development and the population distribution have intensified Peru's vulnerability. Close to 76 percent of Peruvians are urban dwellers, and cities are growing quickly and haphazardly. There has been a sharp shift in population distribution by natural region; today the coastal area is home to 54.6 percent of the total population, the Andean regions to 32 percent, and the Amazon Basin to 13.4 percent–a lopsided land occupation pattern. One third of the provinces (home to over 71 percent of Peru's population) are at very high or high seismic risk. Informal and illegal settlements account for a large share of city growth, especially in Lima, with several consequences for sustainable development. More than 4,000 human settlements and 900,000 households countrywide have yet to see physical-legal title regularization problems resolved (50 percent of Lima settlements, for instance), so residents of these communities are living without essential services such as water and sanitation or access to public housing programs.[10]

Peruvians' socio-economic conditions increase Peru's vulnerability to socio-natural hazards. More than one-third of Peru's population (39.3 percent) is living below the poverty line and 13.7 percent subsists in extreme poverty (INEI[11] 2008), with a sharp disparity between urban and rural rates–25.7 percent and 64.6 percent, respectively. According to

[10] See Habitat International Coalition (2005).
[11] *Instituto Nacional de Estadísticas e Informática.*

the National Information System on Disaster Prevention and Management (SINPAD) figures for 1995-2007, the Regions hardest hit by disasters were Apurímac, Loreto, Lima, Cajamarca, Puno, and Cusco, where poverty rates are highest. Compounding the problem are weak institutions and a dearth of planning instruments to deliver social policies more efficiently.

DISASTER RISK MANAGEMENT FRAMEWORK

Peru's ongoing decentralization process is an opportunity to build institutional capacity and implement a comprehensive disaster risk management policy. In the medium term, the bulk of disaster risk management responsibilities and resources will be handled by the regional, provincial, and district governments. Since decentralization is still in early stages, it is imperative to bolster the institutional capacity of these various levels of government through technical assistance.

Monitoring systems and information technology tools need to be scaled up to provide the requisite knowledge to support subnational governments and relevant sectors. It is critical for Peru to ensure that subnational governments have the appropriate technological tools and mechanisms to generate, manage, and access hazard and risk information pertinent to their particular needs. The Comprehensive Approach for Probabilistic Risk Assessment[12] (CAPRA) platform can be very useful at this juncture.

Peru recently strengthened its environmental and planning institutions. In 2008, the national Environment Ministry was created and began operating. The National Center for Strategic Planning (CEPLAN) was launched. These two events, indirectly, will help make the country more disaster-resilient. Countering watershed deterioration, assuring careful reserve area management, and enhancing spatial and sector planning instruments are examples of actions to address the structural drivers of disaster risk.

Peru's infrastructure and productive sectors are highly exposed to socio-natural hazards. There is a need to scale up efforts to inventory, analyze, and prioritize interventions required to make existing infrastructure more resilient to earthquakes, flash floods, landslides, and flooding. Agriculture, tourism, the oil and gas industry, and fisheries are among the sectors most exposed to the impact of El Niño and other extreme hydrometeorological events.

Peruvian cities are at high risk for earthquakes and there are a dearth of resilience-building programs for essential buildings and infrastructure. Considering the direct and indirect toll that such catastrophes can have on people in major cities, as well as on the economy and social stability, the country is faced with the twofold challenge of fixing the unplanned urban development model and unregulated occupation of quake-prone areas while making the housing, health, education, urban infrastructure, and government sectors more earthquake resilient.

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

Peru's National Civil Defense System (SINADECI) is an institutional platform for disaster risk management. Headed by the National Civil Defense Agency (INDECI), this network has five regional

[12] http://ecapra.org.

bureaus (Iquitos, Piura, Lima, Arequipa and Cusco) and Civil Defense offices in the different government agencies. INDECI brings together and coordinates with a number of ministries and science and technology agencies by way of Civil Defense Committees, the Multisectoral Commission, and the Advisory Council on Science and Technology. The country's two policy pillars in this sphere are the National Pact's Risk Prevention and Management Policy and the National Disaster Prevention and Management Plan.

The ongoing decentralization process is an opportunity to build up institutional capacity and implement the risk management policy. The decentralization program launched in 2002 saw elected regional authorities institute a process to establish regions and the associated mechanics of transferring responsibilities and resources to the regional governments. As part of this exercise, INDECI began transferring powers and responsibilities to the regional governments where Regional Civil Defense Systems (SIREDECI) were set up. Under this arrangement, the regional governments take on responsibility for design and delivery of their own disaster prevention and management plans, guided by national government policies. Support and assistance to the regional, provincial, and district governments in those areas clearly could accelerate and bolster this process, which is still in the early stages.

The SINADECI policy framework needs to be updated in line with the new organization of the State, the focus on risk management, and decentralization policies. The Government is promoting the institutional reform (the original law dates back more than 36 years). This entails changes to disaster prevention provisions as well as greater attention to this issue in laws and policies governing environmental protection, land-use planning, and the Public Investment System (SNIP) in particular. These are key areas of focus for the country to overcome structural impediments to resilience-building for development.

HFA Priority #2: Disaster risk assessment and monitoring

In recent years, Peru has made a considerable effort to produce and compile information on hazards and risk at the national level. INDECI produced its 2004 Atlas of Natural Hazards in Peru in concert with 13 other science and technology institutions, which, for a year and a half, compiled data on potential adverse geological and hydrometeorological natural events and other kinds of hazards such as epidemics, pandemics, and environmental pollution. The Multisectoral Commission on Risk Reduction in Development (CMRRD) created by the Presidency of the Council of Ministers in 2003 also updated and unified several of these hazard, vulnerability, and risk maps.

Many Peruvian science and technology institutions are engaged in the study of these natural events. Much of the country's hazard and risk assessment technical capacity is concentrated in six institutions represented on the SINADECI Advisory Council on Science and Technology.[13] A number of public and private universities run academic and research programs in this field. Although this is considered a strength, these efforts need to be optimized and targeted to concrete information needs, i.e., prioritize events, zones, scope, work scales, methodologies, and so on. Strengthening national technical coordination mechanisms and agencies will help achieve that aim.

Monitoring systems and technology tools for modeling and assessment need to be scaled up to address subnational government and sectoral knowledge needs in particular. It is critical for Peru to ensure that subnational governments have the right technology tools and mechanisms to generate, manage, and access hazard and risk information pertinent to their particular needs. CAPRA can offer valuable support for data management, analysis methods, and interactive tools. The tool will help in standard setting,

[13] *Instituto Geofísico del Perú* (IGP), *Instituto del Mar de Perú* (IMARPE), *Instituto Geológico, Minero y Metalúrgico de Perú* (INGEMMET), *Servicio Nacional de Meteorología e Hidrología* (SENAMHI), *Dirección de Hidrografía y Navegación de la Marina de Guerra de Perú* (DHN), and Japan-Peru Center for Earthquake Engineering and Disaster Mitigation (CISMID).

data sharing, and use of a common language to facilitate communication about disaster risk. CAPRA applications can be tailored to sector and user needs in such matters as emergency response, land use planning, investing in mitigation, and financial protection strategies. The CAPRA system's transparent models and open architecture will enable future users to understand this tool and adapt it to their needs.

HFA Priority #3: Use of knowledge, innovation, and education to build a culture of safety and resilience at all levels

INDECI's "Learning to Prevent" training program has shown some 4,000 teachers how to integrate disaster risk management into the academic curriculum. Another initiative targeted at fourth-year high school students develops knowledge and skills in civil-defense-related activities. Several public and private universities offer post-secondary specializations, notably the National Engineering University (UNI), which has graduate programs in disaster risk management. These institutional programs need continuity within the SINADECI policy framework.

NGO engagement in school- and community-based risk management projects in Peru is very important. Numerous NGOs and agencies are running risk management projects with financial support from the United Nations, the European Union, USAID, and other international agencies. Though the outcomes of these separate projects are important, tighter coordination is needed to avoid dispersion and duplication of effort. Dialogue mechanisms likely would need to be instituted with partner organizations and NGOs to come to a consensus on policies and priorities in the SINADECI framework.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

Peru recently strengthened its environmental and planning institutions. In 2008, the national Ministry of Environment was created and began operating and the National Center for Strategic Planning (CEPLAN) was launched–two events that will indirectly help make the country more disaster-resilient.[14] The Environment Ministry is now coordinating several institutions and existing programs involving watershed recovery, reserve area protection, and land use planning, among others.[15] CEPLAN, for its part, is starting strategic development area macroplanning. In both cases, technical assistance and capacity development, among other supportive mechanisms, will be very important to help roll out these long-term processes that will so heavily impact Peru's sustainable development.

Reducing vulnerability of public investment projects has been a priority for the Ministry of the Economy and Finance (MEF). Over the past few years, the MEF has developed methodology and technical tools that public institutions and local governments are now required to use to mainstream disaster risk reduction into the National Public Investment System project development and approval cycle.[16] Though this marks a significant move to make new projects more resilient, a great deal remains to be done to make existing infrastructure (roads, health, education, etc.) more disaster-resilient in the areas of analysis, quantification, and charting of strategies for adoption by the central and subnational governments and the production sectors. This should be given priority consideration in any initiative to support the Peruvian Government.

[14] Legislative Decree 1013 enacted on May 13, 2008.
[15] For example, *Instituto del Mar de Perú* (IMARPE), *Comisión Ambiental Regional* (CAR), and *Comisión Ambiental Municipal* (CAM).
[16] See *Guía metodológica para la incorporación del análisis de riesgo asociado a peligros naturales en la formulación y evaluación de proyectos en el Sistema Nacional de Inversión Pública. Dirección General de Programación Multianual.*

Peru's productive sectors are highly exposed to socio-natural hazards. Its hydrocarbon and fishing industries and agriculture are among the sectors most frequently buffeted by natural events. The 1997-98 El Niño, for one, caused an estimated US$1.627 billion in production sector losses.[17] Assessing disaster risk in those segments of the economy and devising comprehensive risk reduction strategies is a country priority given the growth and development dynamic in the last decade. This will likely mean strengthening the government agencies that make, coordinate, and regulate these sector policies, dialogue with the private sector, and support for reactivating the Resilience-Building Program to Manage Recurring El Niño Events (PREVEN).[18]

The concentration of the population in cities such as Lima (30.8 percent of the national total), Piura (6.1 percent), and Arequipa (4.2 percent)[19] and their exposure to seismic hazards constitutes the country's greatest disaster risk. Since the direct and indirect impacts of an earthquake in these large urban centers are devastating for people as well as for the economy and social stability, Peru is faced with the twofold challenge of fixing the unplanned urban development model and unregulated occupation of earthquake hazard zones while making the housing, health, education, urban infrastructure, and government sectors more earthquake-resilient. Given the magnitude of the investment this will call for, an effective mitigation-project analysis, assessment, and prioritization process is required, as is a comprehensive financial protection strategy for the city.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

The most recent earthquake to strike Peru, in the south, provided valuable lessons about the country's capacity to manage major disasters and post-event reconstruction. On August 15, 2007, an M8.0 earthquake (on the modified Richter scale) rattled Peru's southern coast, causing severe damage in towns such as Chincha, Pisco, Cañete, and Ica.[20] An INDECI self-evaluation of the emergency response, produced some months after the quake, identified the need for improvements in such areas as regional government capacity development, coordination, logistics, and communications, among other areas.[21] From the outset, the provisional agency (FORSUR), created to manage the reconstruction, had to surmount administrative, legal, and technical hurdles as well as resolve coordination problems with other public agencies and regional governments. Peru needs to maintain and enhance response capacity development programs at all levels and address post-disaster recovery issues as part of comprehensive risk management.

A comprehensive financial strategy is needed to manage post-disaster situations. Since Peru is exposed to frequent disasters and emergencies, a comprehensive financial protection strategy needs to be devised to establish financial vehicles (for risk transfer and retention) appropriate to resource needs and flows depending on the type of emergency. Regulations on states of emergency and other arrangements to ensure solid institutional coordination and efficient expending of resources are also important factors to address. As a result, the MEF has begun implementing some measures: to establish a contingency fund, to get a contingency credit with the *Corporación Andina de Fomento* (CAF), and to continue the negotiation process with the World Bank for a CAT DDO (catastrophe deferred drawdown option development policy loan).

[17] Andean Development Corporation (2000).
[18] Executive Orders 073-2006-PCM and 024-2009-PCM.
[19] INEI, National Censuses (2007).
[20] According to INEI data, the quake destroyed close to 52,000 homes and severely damaged 23,600 and left 320,000 casualties and victims in its wake. Road infrastructure and the education and housing sectors were particularly hard-hit.
[21] See *Lecciones Aprendidas del Sur – Sismo de Pisco, 15 de agosto del 2007, Instituto Nacional de Defensa Civil* (INDECI).

KEY DONOR ENGAGEMENTS

Ongoing Donor or IFI-Supported Activities	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Disaster Risk Management in Urban Areas/Housing Sector	Inter-American Development Bank	1 million 2010-2011	1, 4
Disaster Risk and Risk Management Indicators	Inter-American Development Bank	750,000 (for 14 countries including Peru) 2009	1, 2
Catastrophic Seismic Risk Profile	Inter-American Development Bank	400,000 (for 4 countries including Peru) 2008-2009	2
Disaster Preparedness and Early Recovery for Earthquake and Tsunami in Lima and Callao	European Commission/ ECHO/ UNDP	2.6 million 2009-2011	5
Andean Program for Disaster Risk Prevention	PREDECAN	9.45 million Euros for the Andean Countries 2005-2009	1, 3, 4
Enhancement of Earthquake and Tsunami Disaster Mitigation Technology	Government of Japan/ JICA	5 million 2009-2014	
Integration of Disaster Risk Management Information in Peru's Planning System	The World Bank (SFLAC Grant)	300,000 2010-2011	1, 2, 4

Peru's priority risk management objectives can be summarized as follows: (i) develop local government capacity through the decentralization process, (ii) ensure existing infrastructure and the productive sectors are disaster-resilient, and (iii) reduce disaster risk by making Lima, Arequipa, and other major cities earthquake-resilient.

- **Regional, provincial, and district government capacity development for risk reduction policy design and delivery will require support,** primarily for risk diagnosis, technical assistance, and training.
- **Efforts to increase inventories in addition to the analysis and prioritization of interventions required to make existing infrastructure more resilient to earthquakes, flash floods, landslides, and floods, need to be scaled up.** GFDRR support in key sectors—such as roads, education, and health—can facilitate investment program selection and design.
- **Extreme weather disturbances such as El Niño could derail Peru's production and economic growth.** Support for the PREVEN program (focusing on northern Peru) and for scaling up of event monitoring networks and early warning systems, partnering with the private sector, will help to considerably reduce exposure to socio-natural hazards.
- **To efficiently pursue the above-listed actions, it is essential to overcome impediments of technical data dispersion, methodology tools, and technology infrastructure for risk modeling at different scales.** GFDRR support will make it possible to develop initial activities toward structural solutions like CAPRA.
- **There is a dearth of disaster risk reduction programs to make essential buildings and infrastructure in Lima, Arequipa, and Piura earthquake-resilient.** The advances that can be achieved with GFDRR funding support for analysis and design of medium- and long-term programs will have a very strong impact.

In addition to the above-mentioned activities, continued dialogue with the Government of Peru will lead to the prioritization of future initiatives to ensure adequate mainstreaming and implementation of disaster risk reduction measures.

COUNTRIES AT HIGH ECONOMIC RISK FROM MULTIPLE HAZARDS
(Top 33 based on GDP with 3 or more hazards)[a]

1. Taiwan, China
2. Dominican Republic
3. Jamaica
4. El Salvador
5. Guatemala
8. Costa Rica
10. Colombia
12. Chile
15. Barbados
18. Ecuador
20. Peru
21. ST. KITTS & NEVIS
24. Honduras
27. Mexico
32. Bolivia

[a] Dilley et al. (2005). Table 7.2.

The revision of the National Disaster Plan has imparted a greater level of organization to the preparedness and response process, and disaster management is a priority at all levels of government.

SAINT KITTS AND NEVIS

Natural Disasters from 1984 - 1999[b]

Affected People

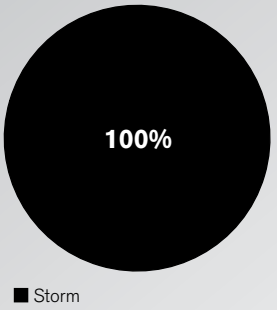
Disaster	Date	Affected (Number of People)
Storm	1998	10,000
Storm	1995	1,800
Storm	1989	1,300
Storm	1999	1,180
Storm	1984	0
Flood	1987	0
Storm	1990	0

Economic Damages

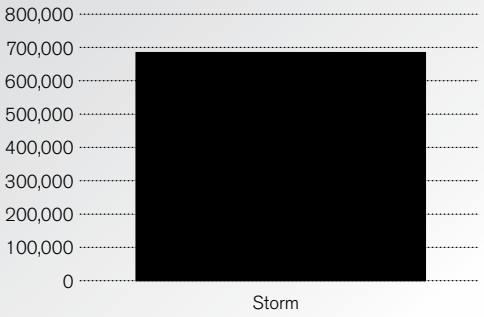
Disaster	Date	Cost (US$ x 1,000)
Storm	1998	400,000
Storm	1995	197,000
Storm	1989	46,286
Storm	1999	41,400
Flood	1987	500
Storm	1984	0
Storm	1990	0

Statistics by Disaster Type[b]

Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=144. Source data from EM-DAT. Data displayed does not imply national endorsement.

DISASTER RISK PROFILE

St. Kitts and Nevis are located in the Leeward Island chain of the Caribbean at approximately 17° 15′ N latitude, and 62° 40′ W longitude. The larger of the two islands is St. Kitts, with a land area of approximately 168 km² measuring approximately 29 km north-south by 8 km along the east-west axis. Nevis, the smaller of the two islands, is located some 3 km south of St. Kitts and covers an area of approximately 93 km². The island is roughly circular measuring approximately 8 by 10 km. Both Nevis and St. Kitts are of volcanic origin and both islands have active volcanic centers.

The combined population of St. Kitts and Nevis is estimated at approximately 50,000 with approximately 35,000 persons on St. Kitts and 12,000 on Nevis. As is the case with most of the Caribbean islands, the economy of St. Kitts and Nevis is dominated by the service industry (including tourism) which represents some 69% of GDP. This is followed by industry which contributes an estimated 28% of GDP. Agriculture is estimated at 3% GDP.

In 1998, Hurricane Georges, a Category 3 storm[1], hit St. Kitts and Nevis and was among the most devastating storms experienced in the region. Damage to St. Kitts was extensive, with lesser impact to Nevis. In total, Georges caused an estimated US$445 million in damages including damages to some 80% of the housing stock. There was extensive damage to electric power infrastructure and the impact on tourism was felt for some time after the storm. Most recently, in 2008, Hurricane Omar passed some 150 km east of the islands as a Category 4 storm, causing significant damage to coastal infrastructure from wind and storm surge. Since 1950, 16 named storms have passed within 100 km of the islands.

A single storm event can directly impact the entire country. The principal hazard event affecting St. Kitts and Nevis is the potential for hurricanes and tropical storms. High winds and rainfall are the major risk factors. Much of the islands' construction is relegated to urban centers where there is little protection from the direct impacts of wind forces. In flood-prone areas, prolonged rainfall coupled with storm surge conditions are the principal causes however impacts are generally limited as these areas are comparatively few given the islands' topography.

Saint Kitts and Nevis is identified among the world's top 60 countries exposed to risk of mortality from 2 or more hazards. An estimated 39.1% of the population of St. Kitts and Nevis is considered at risk. Additionally, St. Kitts and Nevis is among the top 40 countries with significant economic risks from 2 or more hazards as a percentage of GDP. GDP risk is estimated at 64.9%.[2]

Geological Hazards

Both Nevis and St. Kitts are of volcanic origin and both islands have active volcanic centers. Hot springs and fumaroles are active in both locations. Mt. Liamuiga, located on the northern end of St. Kitts, is an active volcano with an elevation of approximately 1155 m. The island of Nevis is the volcanic slopes of Mount Nevis. The peak is centrally located on the island at an elevation of approximately 984 m. Both volcanoes are active, as evidenced by continuing hot spring and fumarolic activity. Information relating to the eruption history of volcanoes in St. Kitts and Nevis is incomplete and not all eruption types result in a lasting geologic record. Eruptions in recorded history are unsubstantiated but are noted in anecdotal accounts from 1642 and 1843. Both describe perceived eruption activity. Geologic studies have suggested an eruption cycle of 2,000 years for Mt. Liamuiga on

[1] Saffir-Simpson Scale.
[2] Dilley et al. (2005). Table 7.2b and Table 1.2.

St. Kitts. For Nevis, there are not sufficient data to suggest an eruption cycle.

St. Kitts and Nevis is regularly exposed to low-level earthquake activity related to shallow origins associated with the volcanic centers. Large earthquakes are uncommon but owing to the proximity of plate boundaries, are a possibility for St. Kitts and Nevis. Most recently, the 7.3-magnitude earthquake off the coast of Martinique in November 2007 was felt throughout the region. Based on engineering risk assessments, the hazard posed by earthquake for St. Kitts and Nevis is significant and should be considered a factor in building construction. St. Kitts and Nevis is located in seismic zone 3, on a 0-4 scale[3] indicating that seismic risk ranges from moderate to substantial.

Regional tsunami risk is generally associated with the potential effects of an eruption of Kick-'em-Jenny located approximately 500 km south of St. Kitts and Nevis. However, given the proximity to active plate boundaries and the volcanic centers located in the region, there exists a risk associated with tsunami to St. Kitts and Nevis.

Floods and Landslides

Flood risk in St. Kitts and Nevis is largely associated with storm surge in low-lying coastal areas. Flash flooding from mountain streams coupled with storm surge events presents the greatest risk. Effects are generally localized to communities located in the coastal margins or along stream passages. These are usually coastal fishing villages located where access to the sea is open as much of the islands' coast is marked by cliff formations. Additionally, tourism and port facilities owing to their access to the sea are particularly susceptible to surge events.

Landslides are a risk in areas where slope and soil stability present appropriate conditions. The risk is limited, however, owing to St. Kitts and Nevis' geology and in particular, the topography of St. Kitts. Unlike other islands in the region, slope instability in inhabited areas is not a major risk-producing factor but is increased with heavy rainfall and saturated soil conditions. Agricultural risks from flooding largely stem from poor site drainage and are usually associated with prolonged periods of heavy rainfall.

Determinants of Vulnerability to Adverse Natural Events in St. Kitts and Nevis

Perhaps the most significant factor contributing to the vulnerability of St. Kitts and Nevis is the tendency toward urbanization and the exposed nature of urban centers to impacts from wind damage. Mixed construction with enforcement challenges contribute to the vulnerability of the islands' population to adverse natural events.

Much of St. Kitts and Nevis' tourism development is in the coastal zone. With beach areas and coastal access as a major tourism resource, infrastructure supporting these activities is necessarily located in zones of increased risk from hurricane and storm surge impacts.

Two ports and two airports service St Kitts and Nevis. Basseterre is the container port for the islands. Bradshaw International serves as the airport for St. Kitts and Newcastle for Nevis.

The Pogson Medical Center was recently constructed in Sandy Point, St. Kitts, and is one of two 24-hour Urgent Care Centers.

[3] SEOC (Structural Engineers Association of California) zone system. Zone 2 corresponds to a Z factor of 0.500 as defined under CUBiC 1985. Values obtained from Gibbs (1999), Appendix 1, Table 3.

Climate Change and Global Warming

St. Kitts and Nevis were cited in the Germanwatch 2010 Global Climate Change Risk Index. The 2010 Climate Risk Index is based on figures from 2008 and is also an analysis of the worldwide data collection on losses caused by weather-related events during 1998–2008. In 2008 St. Kitts and Nevis was ranked 104th with losses of 0.02% GDP, and 74th for the decade with GDP losses of 7.80%.[4] Two factors were cited: the impact of global warming on rising sea levels which increase the risk of storm surges, and secondly the increase in the strength of hurricanes.[5]

Climate change models[6] have predicted that St. Kitts and Nevis will undergo a warming and drying trend and is expected to endure more frequent heat waves and droughts, rainfalls with increased intensity, and rising sea levels as predicted for the rest of the Caribbean consistent with the projected global median.[7] It is known that inter-annual climate variability of either the Pacific or Atlantic explains a significant amount of the total variance in rainfall in the Caribbean and Central America.[8] Probable climate change impacts in St. Kitts and Nevis include higher temperatures, higher storm intensities and, possibly, more frequent El Niño-Southern Oscillation (ENSO)[9] events, exacerbating existing health, social and economic challenges affecting the country.

Changes in sea surface temperature as a result of climate variability could increase the intensity of cyclones and heighten storm surges, which in turn will cause more damaging flood conditions in coastal zones and low-lying areas. According to the World Bank's study, "Sea Level Rise and Storm Surges",[10] the impact of sea level rise and intensified storm surges in Latin America and the Caribbean will be high. While data is not available for St. Kitts and Nevis, data for Puerto Rico is showing an increase of 51.84% - with 53.81% of the coastal population exposed and potential losses of coastal GDP projected to exceed 52.71%.

DISASTER RISK MANAGEMENT FRAMEWORK

Disaster management in St. Kitts and Nevis is managed through the National Emergency Management Agency (NEMA). Originally established in 1995, its mandate was strengthened with the passage of the Disaster Management Act of 1998 which provides the legal framework for NEMA operations.

NEMA functions as a disaster response and planning agency and works through a series of committee structures. On St. Kitts, The National Disaster Committee (NDC) composed of relevant national ministers and ranking government officials, private sector, and non-governmental organizations, serves as the coordinating body between the office of the Prime Minister and Cabinet. It is chaired by the Prime Minister. The National Disaster Executive (NDE) reports to the NDC and oversees the operational aspects of the NEMA program.

NEMA implements policies and programs in planning, preparedness and disaster response

[4] Harmeling (2009). Table 5.
[5] McLymont-Lafayette (2009).
[6] Hadley Centre Coupled Model, Version 2 (HADCM2), as reported in Mulligan (2003). Same modeling data as used by the Intergovernmental Panel on Climate Change (IPCC).
[7] Chen et al. (2008).
[8] Giannini et al. (2002).
[9] El Niño-Southern Oscillation; commonly referred to as simply El Niño, a global coupled ocean-atmosphere phenomenon.
[10] Dasgupta et al. (2009).

and coordinates their activities at the local level in conjunction with the District Disaster Committees and respective sub-committees. The Governor-General may by proclamation declare that a state of emergency exists in Saint Christopher and Nevis.[11] On Nevis, NEMA collaborates with the Nevis Disaster Management Office who reports to the Nevis Island Disaster Committee, the Nevis Island Administration and the office of the Premier. The office coordinates local activities in conjunction with the District Disaster Committees and respective sub-committees.

Disaster management activities are managed in accordance with the current Disaster Management Plan, authorized in 1999. A National Disaster Mitigation policy and plan was produced in 2001. In accordance with the plan, disaster planning and response is organized through district and local committees. NEMA works with the local and district committees to develop response capacity and contingency plans for execution during a disaster event. Additionally, NEMA has been active in the development of a national shelter system which has resulted in the construction and improvements to national shelter facilities.

During a disaster NEMA serves as the national coordinating body for disaster response, reporting to the office of the Prime Minister. Line agencies, such as the national police, government ministries, and agencies such as the airport authority and port authority, conduct their activities in accordance with the responsibilities assigned under the plan and under the authorities of their respective enabling legislation. During a disaster NEMA reports through the Office of the Prime Minister and locally in Nevis through the office of the Primer.

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

NEMA maintains a staff of 6 persons including professional and support staff. NEMA is housed in a disaster-hardened office facility and maintains a warehouse to pre-position various supplies. NEMA is yet to construct satellite storage facilities at the community level. Additionally, NEMA currently lacks GIS support and is actively seeking to develop that capability within the organization.

Disaster risk reduction through development policy and planning is still in its early development and national policy currently does not yet mandate DRM as a development objective. However, NEMA is working to formally advance the concept of Comprehensive Disaster Management as a stated objective.

HFA Priority #2: Disaster risk assessment and monitoring

Comprehensive hazard mapping studies have been completed in St. Kitts and Nevis. These maps focus on volcanic, hurricane and flood risks. Base mapping is relatively complete and includes

[11] OAS-DSD (1983).

topographic studies including the development of digital elevation models. Maps include Volcanic, storm surge, wind, wave, and inland flooding hazards. Base maps have also been prepared to include geology, soils, land use, vegetation, population, roads, rivers and rainfall. Maps are maintained at the Physical Planning Unit on St. Kitts. Maps have been produced at a 1:20,000 scale which have limited applicability at local scales. Vulnerability studies have been completed for government buildings and in particular schools.[12]

Meteorological monitoring and early warning services are provided through the National Meteorological service. This office assesses storm potential and regularly issues bulletins used by the public and NEMA to prepare for storm events. The office coordinates with the U.S. National Oceanic and Atmospheric Administration for forecasting support and weather satellite imagery access. NEMA assists in coordinating the distribution of these warnings and provides public preparedness advice.

Seismic monitoring is accomplished through the University of the West Indies Seismic Research Center (UWI-SMC). A total of eight monitoring stations have been installed in St. Kitts and Nevis by the UWI Seismic Research Center, including one seismograph located at Mt. Liamuiga and seven GPS stations to monitor deformation. The UWI-SMC regularly analyzes data and provides notification to NEMA as conditions warrant. Of particular interest is crustal deformation and the occurrence of earthquake swarms which may indicate elevated volcanic activity.

HFA Priority #3: Use knowledge, innovation, and education to build a culture of safety and resilience at all levels

NEMA promotes an active campaign of training and public information through press releases and workshops. Thematic workshops are scheduled as needed and have included, for example, shelter management and post-disaster damage assessment. Additionally, NEMA issues an annual public address at the beginning of each hurricane season and provides regular public service announcements to promote public awareness and disaster preparedness. Disaster preparedness has not yet been integrated into the formal educational curriculum.

NEMA meets regularly with the Disaster Mitigation Council to coordinate disaster information transfer among the national ministries. During these meetings, NEMA promotes and follows disaster risk reduction activities undertaken by various line ministries. All Ministries are represented on the council.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

A building code was adopted in St. Kitts and Nevis and its implementation was formalized under the Development Control and Planning Act #14/2000. While new construction for public buildings is monitored for code compliance, private constructions are variously monitored for compliance. Eligibility requirements for mortgages and private insurance are likely factors driving improvements to construction design and promoting compliance with the national code.

While progress is being made in DRM, it is largely in the form of public education. Risk mapping has been completed but building code enforcement still has limitations. To date no formal national legislation for the disaster risk reduction is in place apart from the contributions of the national building code.

[12] CDERA (2003e).

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

The revision of the National Disaster Plan has imparted a greater level of organization to the preparedness and response process, and disaster management is a priority at all levels of government. Since Hurricane Georges, disaster preparedness and awareness has improved. Citizens react when informed of impending storm events and are more aware of the seriousness of preparing for possible events.

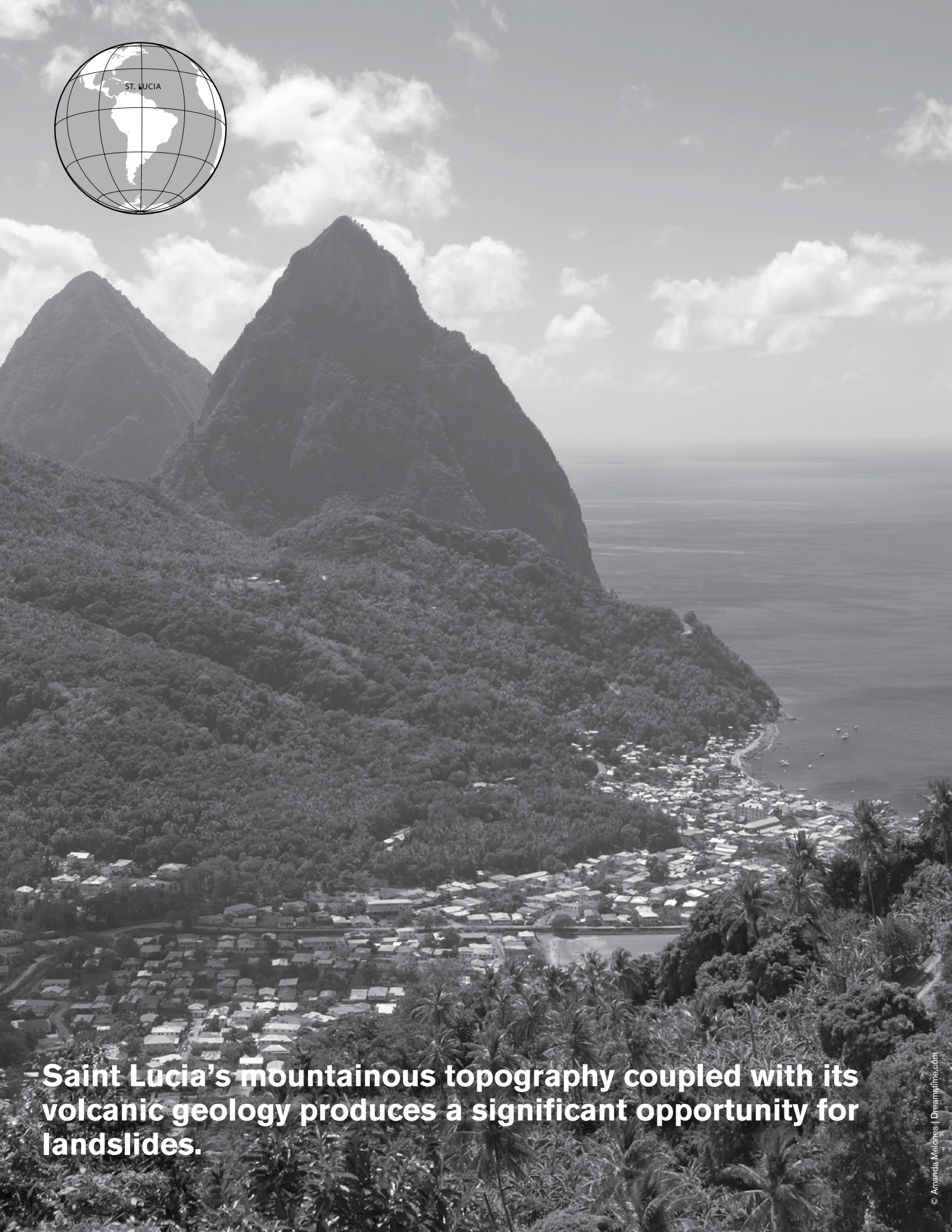
Certain critical facilities are protected to a greater degree. An emergency operations center has been constructed and warehousing of disaster response supplies is maintained through NEMA. Schools and shelters have been retrofitted to a degree to improve resilience.

The tourism sector, a major contributor to the St. Kitts and Nevis economy, is largely insured by commercial underwriters. Other sectors, such as agriculture, transport, and housing, remain relatively vulnerable. Regarding public sector risks, St. Kitts and Nevis is a subscriber to the Caribbean Catastrophic Risk Insurance Facility (CCRIF).[13] This offers short-term liquidity in the event that the policy is triggered.

KEY DONOR ENGAGEMENTS

Outside the CCRIF there are currently no donor or international financial institution engagements in disaster risk management in Saint Kitts and Nevis.

[13] The CCRIF is the first multi-country risk pool in the world, and is also the first insurance instrument to successfully develop a parametric policy backed by both traditional and capital markets. It is a regional insurance fund for Caribbean governments designed to limit the financial impact of catastrophic hurricanes and earthquakes to Caribbean governments by quickly providing financial liquidity when a policy is triggered.



Saint Lucia's mountainous topography coupled with its volcanic geology produces a significant opportunity for landslides.

SAINT LUCIA

Natural Disasters from 1980 - 2007[b]

Affected People

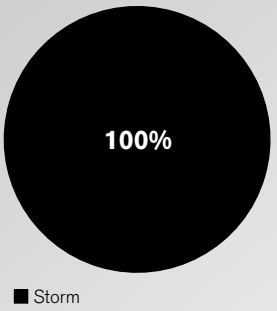
Disaster	Date	Affected (Number of People)
Storm	1980	80,000
Storm	1983	3,000
Storm	1994	750
Storm	1999	200
Mass mov. wet	1996	175
Storm	1980	0
Storm	1986	0
Storm	1987	0
Storm	1988	0
Storm	2004	0

Economic Damages

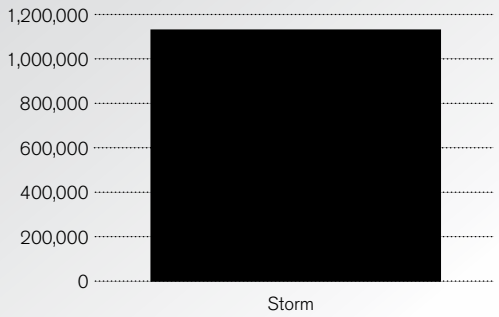
Disaster	Date	Cost (US$ x 1,000)
Storm	1988	1,000,000
Storm	1980	87,990
Storm	2007	40,000
Storm	1983	1,290
Storm	2004	500
Storm	1980	0
Storm	1986	0
Storm	1987	0
Storm	1994	0
Mass mov. wet	1996	0

Statistics by Disaster Type[b]

Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



[a] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=145. Source data from EM-DAT. Data displayed does not imply national endorsement.

DISASTER RISK PROFILE

Saint Lucia is located in the Eastern Caribbean in the Windward Island chain at 13º 53' N latitude and 60o 58' W longitude. Bordered to the north by Martinique and to the south by St. Vincent and the Grenadines, Saint Lucia supports a population of approximately 170,000. The island of Saint Lucia occupies approximately 616 km^2 with a length of approximately 50 km on the north-south axis and 25 km along the east-west axis. The island is mountainous of volcanic origin, with its highest peak, Mt. Gimme, rising some 950 meters above sea level.

Saint Lucia is located in the Atlantic hurricane belt, and while infrequent, the island is exposed to potentially serious storm impacts. Notable storms include Hurricane Allen, 1980; Tropical Storm (later Hurricane) Debby, 1994; and while not making landfall in Saint Lucia, Hurricane Lenny in 1999 and Dean in 2007.

Hurricane Allen was devastating, causing extensive damage to Saint Lucia as a Category 3 storm. The storm claimed 9 lives and severely damaged infrastructure and agriculture. Tropical storm Debbie caused extensive damage in the agricultural sector and heavy rainfall resulted in extensive landslide in Saint Lucia. Most recently, Hurricane Dean in 2007 passed in the straits between Martinique and Saint Lucia. While a Category 2 storm, at that time, damage to Saint Lucia was estimated in excess of US$6 million due primarily to high winds, flooding and storm surge. While Hurricane Lenny (1999) did not directly impact Saint Lucia, waves generated by the storm had major coastal impacts. Damages from 6-meter waves were significant in Saint Lucia and throughout the island chain.

Saint Lucia experiences landslides, particularly in the aftermath of heavy rains. Additionally, the island periodically experiences earthquakes of generally lower magnitudes. The island is classified as seismic zone 2 on a 4-class scale, indicating low to moderate earthquake risk. Finally, storm surge and flash flood are among the other risks regularly faced by the island.

Geological Hazards

Saint Lucia is exposed to low to moderate seismic risk (seismic zone 2 on a 0-4 scale[1]). The island lies on the eastern margin of the Caribbean plate and is regularly subjected to low intensity tremors (less than magnitude 4.0) associated with regional plate activity. While considered a relatively low risk to the country, earthquake is a concern. A magnitude 7.4 event occurred in November 2007 located off the coast of Martinique. The shock was felt throughout the Caribbean and in Saint Lucia caused minor damage to some structures.

Volcanic hazards are limited with one active center on the island. The Qualibou Caldera is located on the south-west side of the island and includes active steam vents, hot springs and boiling muds. The last recorded eruption was in 1766. This was relatively minor, ejecting ash into the air that thinly spread over a large area. Recent activity includes a swarm of minor volcanic earthquakes which was recorded in 1990.

Floods and Landslides

The principal flood threat in Saint Lucia is from storm surge and coastal wave action. Particularly at risk are low-lying coastal areas such as the town of Dennery and the area of Anse La Raye which

[1] SEOC (Structural Engineers Association of California) zone system. Zone 2 corresponds to a Z factor of 0.500 as defined under CUBiC 1985. Values obtained from Gibbs (1999), Appendix 1, Table 3.

have experienced significant flooding in the past. Flash flooding in the interior presents a risk to local inhabitants along streams and coastal erosion due to wave action can threaten adjacent tourism activities.

Saint Lucia's mountainous topography coupled with its volcanic geology produces a significant opportunity for landslides. Much of the island's housing is distributed along steep slopes and poorly engineered and constructed housing is particularly at risk. Loss of watershed integrity, particularly on slopes above inhabited areas serves to destabilize slopes and increase risks for property losses. This risk is increased during the annual rainy season (May-November) and during the passage of tropical depressions and hurricanes from July to November.

Determinants of Vulnerability to Adverse Natural Events in Saint Lucia

Saint Lucia maintains a large dam[2] located at the Roseau Reservoir in the mountains near the center of the country. The reservoir serves as the principal water supply for the northern portion of the country. Commissioned in 1996, the John Compton Dam was designed and constructed to international specifications. However, the impact of potential seismic events on the structure must be considered when developing downstream areas.

Poorly regulated construction and land use practices are among the biggest contributors to risk from losses in Saint Lucia. Lack of uniform enforcement of building codes contributes to the vulnerability of island infrastructure.

Due to the steep topography of the island, land use is a major factor in determining vulnerability to adverse events. Loss of vegetation, particularly in upper watersheds, has resulted in increased runoff potential and slope destabilization. In some cases, poor drainage management associated with small interior communities promotes soil saturation and subsequent landslip.

Informal settlements are generally located in the interior where landslip risk is greatest. These are also the communities least likely to have access to significant engineering support. The lack of legal title (land ownership/tenure) has led to unsustainable land use and poor land conservation practices which results in soil erosion and land slippages as well as silting of rivers and coastal waters.

Other environmental aspects such as deforestation and soil erosion, particularly in the northern region, might be a result of the impact of natural hazards and may impact Saint Lucia's vulnerability.

Critical infrastructure in Saint Lucia is relatively concentrated, as is the case on most of the islands. The principal port in the capital, Castries, is the island's primary supply center and its only significant container facility. The vast majority of the goods and supplies available in Saint Lucia pass through this port. Power-generating capacity is dependent on three diesel-generating facilities. Water production for the north of the island is managed through the Theobalds water treatment facility in Castries and in the south by steam extraction systems supplying water to various small treatment centers around the south of the island. George F. L. Charles Airport is located in Castries and facilitates regional travel while the Hewanorra International Airport is situated in the south of the island, about 50km from the capital.

Towns in Saint Lucia built in relatively flat stream valleys adjacent to the coast are the areas most susceptible to storm surge and flooding. This risk has increased over years with loss of upper watershed

[2] Named after John Compton, former Prime Minister of Saint Lucia.

through its conversion to agricultural use. Increased rainfall runoff has increased coastal flood potential.

Economically, Saint Lucia is heavily invested in tourism. Some 62% of the national GDP is derived from the services sector of which tourism is a major contributor. Dependence on agriculture has steadily decreased. Estimated at 5.4% of GDP, the agriculture sector has shrunk some 14% from 2000 to 2005. The increased importance of the tourism industry as a major economic force presents a significant economic risk to the country as disaster losses in this sector include reputational risks that can affect tourism travel well beyond the disaster recovery period.

The health infrastructure is comprised by 36 health centers/policlinics, a psychiatric hospital, a private facility and 4 hospitals.[3] The Victoria Hospital is the main healthcare facility in the country. St. Jude Hospital was partially destroyed by fire in September 2009 and it is currently closed, though it continues to function out of the nearby George Odlum Stadium. In the north a new general hospital is under construction with the support of the European Commission.

Climate Change and Global Warming

St. Lucia has recently been cited as one of six Caribbean countries in the world's top 40 climate "hot spots" by the Germanwatch Global Climate Change 2009 Risk Index.[4] The country was ranked 27th out of 150 countries based on an analysis of weather events between 1998 and 2007. The 2010 Global Climate Risk Index is based on figures from 2008 and is also an analysis of the worldwide data collection on losses caused by weather-related events during 1998–2008. St. Lucia was ranked 92nd for the decade with GDP losses of 0.57%.[5] Two factors were cited: the impact of global warming on rising sea levels which increase the risk of storm surges, and secondly the increase in the strength of hurricanes.[6]

Climate change models[7] have predicted that St. Lucia will undergo a warming and drying trend and is expected to endure more frequent heat waves and droughts, rainfalls with increased intensity, and rising sea levels as predicted for the rest of the Caribbean consistent with the projected global median.[8] It is known that inter-annual climate variability of either the Pacific or Atlantic explains a significant amount of the total variance in rainfall in the Caribbean and Central America.[9] Probable climate change impacts in St. Lucia include higher temperatures, higher storm intensities and, possibly, more frequent El Niño-Southern Oscillation (ENSO)[10] events, exacerbating existing health, social and economic challenges affecting St. Lucia.

Changes in sea surface temperature as a result of climate variability could increase the intensity of cyclones and heighten storm surges, which in turn will cause more damaging flood conditions in coastal zones and low-lying areas. According to the World Bank's study, "Sea Level Rise and Storm Surges",[11] the impact of sea level rise and intensified storm surges in Latin America and the Caribbean will be high. While data is not available for St. Lucia, data

[3] PAHO (2007).
[4] McLymont-Lafayette (2008).
[5] Harmeling (2009). Table 5.
[6] McLymont-Lafayette (2009).
[7] Hadley Centre Coupled Model, Version 2 (HADCM2), as reported in Mulligan (2003). Same modeling data as used by the Intergovernmental Panel on Climate Change (IPCC).
[8] Chen et al. (2008).
[9] Giannini et al. (2002).
[10] El Niño-Southern Oscillation; commonly referred to as simply El Niño, a global coupled ocean-atmosphere phenomenon.
[11] Dasgupta et al. (2009).

for Puerto Rico is showing an increase of 51.84% - with 53.81% of the coastal population exposed and potential losses of coastal GDP projected to exceed 52.71%.

DISASTER RISK MANAGEMENT FRAMEWORK

Disaster preparedness and response activities are vested with the National Emergency Management Organization (NEMO) in conformance with the responsibilities and authorities assigned in the Disaster Management Act of 2006.[12] These include Disaster management/response, disaster planning, and risk assessment and mitigation activities. Saint Lucia is a signatory to the Caribbean Disaster Emergency Response Agency[13] Agreement which provides regional support to Saint Lucia in the event of a major disaster.

Saint Lucia's revised Disaster Management Plan has been formally adopted (2007). Under this plan, disaster coordination is focused on the offices of NEMO which is charged with planning, mitigation, and response functions. NEMO operates under the direction of the Prime Minister who chairs NEMAC, the National Emergency Management Advisory Committee. This committee is composed of the Permanent Secretaries of the various Saint Lucian Ministries, as well as chairs of the national committees and heads of key agencies such as police, fire, Red Cross, ports authority and others.

Fifteen national disaster committees have been established with a focus on their respective sectors such as telecommunications, shelters, works, health, transport and others. These committees work with NEMO to provide specialized expertise in their respective sectors. Additionally, community-based response and planning is represented by eighteen District committees which cover the country.

The National Emergency Management Plan includes numerous plans and policy documents to guide prevention, mitigation and response. These documents guide disaster mitigation and management by assigning specific responsibilities and procedures under a policy framework for disaster risk management and reduction. Documents supporting the national plan include Standard Operating Procedures (SOPs), policy documents, guideline documents, national emergency plans, sectoral/agency response plans, and a number of agreements.[13] The Governor-General may, by proclamation which is then published in the Official Gazette, declare that a state of emergency exists.[13]

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

Saint Lucia has enacted a significant disaster legislation and is signatory to a number of regional and international conventions for disaster management. The country has developed and approved a number of policies, plans and

[12] OAS-DSD (2006a).
[13] As of September 2009, the agency was renamed to the Caribbean Disaster Emergency Management Agency.
[14] http://stlucia.gov.lc/nemp.
[15] OAS-DSD (1978b).

St. Lucia

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standard operating procedures relevant to disaster risk reduction. These include:

- The Emergency Powers (Disasters) Act #5/1995[16]
- The Disaster Preparedness and Response Act, 2000[17]
- The Disaster Management Act # 30/2006
- Mitigation Policy & Plan
- Integrated Natural Hazard Risk Management Policy 2004 (draft)

NEMO leads the disaster management initiative with the support and the participation of most agencies in all sectors. However, a coherent national multi-sectoral plan is yet to be developed.

NEMO is working with other national ministries and agencies to systematically integrate DRM within specific agency activities and what currently exists is not as systematic as it could be. However, NEMO provides DRM elucidation to the activities, programs and projects of a number of public and private sector agencies including the Climate Change Unit, the Sustainable Development Unit, the Ministries of Physical Development, Agriculture, Fisheries, etc.

While much progress has been made, DRM policy implementation advancements at the national level are impeded by staffing and funding constraints. Additionally, individual Ministries have yet to fully integrate DRM principles in the management of their respective portfolios.

[16] OAS-DSD (1995).
[17] OAS-DSD (2000b).

HFA Priority #2: Disaster risk assessment and monitoring

Vulnerability assessments, hazard maps and risk assessments for critical facilities have been prepared for flooding due to storm/wind surge, high wind, drought and debris flow. While maps have been developed, they have not been integrated in the decision support or policy-making process. Presently, NEMO does not support a GIS capability and there is currently no program supporting additional hazard mapping or updates to current hazard maps. Supporting base maps have been prepared in a GIS format and include infrastructure and drainage, national topography, land use, rainfall, soils, geology, etc. These are of varying age, prepared in the 1980s and 1990s, and may not reflect current conditions.[18]

The Saint Lucia Meteorological Service provides 24-hour weather forecasting service and is a member of the Caribbean Meteorological Organization. The US National Hurricane Center provides longer-term hurricane forecasting support to the region.

The Seismic Monitoring Unit based at the University of the West Indies in Trinidad monitors seismic activity (earthquakes and volcanoes) in Saint Lucia. There are seven seismic monitoring sensors on the island.

Systems are in place for early warning at the community level for weather phenomena and volcanoes; however, early warning for other hazards is presently lacking. Although efforts are underway to establish an early warning system for tsunami on a national scale and for floods due to rain on a community-level, both themes are being pursued under regionally promoted projects.

A regional Tsunami Early Warning System is currently being addressed under an international effort. Wave monitoring sensors are located within Saint Lucian territorial waters. Information from these sensors all feed into the Global Tsunami Monitoring Network. National Focal Points have been identified and efforts are ongoing to establish community level warning mechanisms.

HFA Priority #3: Use knowledge, innovation and education to build a culture of safety and resilience at all levels

Information has been made available and accessible through most media forms to reach the public audiences. This includes TV, posters, newspapers, radio, internet, text messaging, libraries, town criers, loud hailers, fliers, and others. Work on current media programs needs to focus on influencing behavioral change rather than simply sharing information. Available technology such as Geographic Information Systems (GIS) is under-utilized. Additionally, programs need to be strengthened that educate residents to the availability of the information, and how to use it to reduce their vulnerability and improve personal safety.

A Safer Buildings Program was introduced at a tertiary-education-level institution and efforts are ongoing in an attempt to make it an elective in the curriculum. With the support of USAID-Office of Foreign Disaster Assistance (OFDA) a 'Safer Schools Program' is being introduced into the Saint Lucia Education System.

Saint Lucia was involved in the development of the B-Tool and is a B-Tool user. The Disaster Risk Management Benchmarking Tool (B-Tool) was developed by the OECS as a Disaster Risk Management assessment tool; it is also a methodology for identifying and prioritizing a country's risk reduction

[18] CDERA (2003d).

activities and for quantifying reductions in risk profiles. Saint Lucia ranked third of the five countries that took part in the activity.

NEMO has provided Public Service Announcements (PSAs), both audio and video, for all major hazards to all major media houses for public distribution. These were received under a regional project coordinated by CDEMA. Additionally, NEMO has developed ten video and audio productions in English and Creole on response planning for the key hazards. Ad-hoc expert presentations are done for specific hazards via radio and TV; and NEMO staff and volunteers also engage in presentations to communities, public and private sector agencies and town hall meetings, sensitizing citizens to DRM.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

The Physical Planning Act includes some DRM considerations and requires the enforcement of some building codes. The act provides for the review of development plans by NEMO to evaluate how DRM considerations are addressed. While progress is being made in this area, existing building codes need revision and updates. Additionally, there is a need for improved enforcement. Input by NEMO on development plans needs to be incorporated to improve the incorporation of DRM considerations.

The Program for the Regularization of Unplanned Developments (PROUD) is aimed at regularizing squatter settlements in the country and integrates DRR-related considerations. Responsibilities under the program, including the DRR considerations, were recently transferred to the Ministry of Housing.

The development approval process requires that Environmental Impact Assessments be conducted for development proposals of a certain size and/or located in certain locales. Enforcement of EIA recommendations, however, is an issue as they are sometimes not incorporated into a projects design requirements.

Saint Lucia has for more than a decade invested in vulnerability reduction through public works and community level investments. These investments have included hurricane proofing of health facilities, small mitigation works, sea defenses at Dennery Village, the construction of a hazard proof Emergency Operations Center in Castries with associated satellite warehouses across the island, and community based landslide risk reduction.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

NEMO maintains a national warehouse for disaster response equipment and supplies as well as satellite warehouses distributed throughout the island to pre-position response supplies. The Emergency Operations Center is co-located with the national warehouse.

Under the National Disaster Response Mechanism, eighteen district committees report to the NEMO Secretariat to coordinate local response and assess damages. Communication is maintained via VHF, HF & CB radios and telephone, text messaging and email. Additionally, a national Damage Assessment and Needs Analysis (DANA) Committee is fed into by eighteen district-level DANA committees. These committees are responsible for making the required assessments before and after disaster events.

NEMO supports an annual disaster exercise with the Air and Sea ports Authority. NEMO also participates in two regional exercises (FA HUM and Region Rap). Other exercises are held on a more ad-hoc basis.

Saint Lucia is a member of the regional Caribbean Disaster Emergency Management Agency (CDEMA). A security agreement (the Regional Security System, RSS) also provides security and other support in disaster response. An MOU with Martinique caters for the provision of air-lift for medical evacuations from Saint Lucia to Martinique and other such air services by the Martinique military. Seismic activity in Saint Lucia and the other CDEMA Participating States is being monitored by the Seismic Monitoring Unit in Trinidad.

An initial allocation of funds is set aside from the National Consolidated Fund for response to any declared disaster. It is expected that this allocation will be augmented depending on the magnitude of impact and the scale of the response. Additionally, Saint Lucia is a subscriber to the Caribbean Catastrophic Risk Insurance Facility, CCRIF.[19]

Vulnerability assessments of the health sector infrastructure have been carried out relatively recently. The Victoria Hospital, main healthcare facility in the country, was assessed in 1993 and 1996. These assessments looked at the structure of the facility. A revision of that assessment was carried out in 2000. Soufriere and St. Jude Hospitals were both assessed in 1993.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Additional Financing to the Saint Lucia Disaster Management Project II	World Bank	3.96 million 2008-2011	1, 2, 3, 4, 5
Disaster Management II project (DMP II)	World Bank	8.9 million 2004-2011	1, 2, 3, 4, 5
Comprehensive Disaster Harmonised Implementation Program (CDM HIP)	CDEMA / CIDA / DFID		1
Caribbean Risk Management Initiative	UNDP	2.1 million 2004-2010	1,2,3
Enhancing Resilience to Reduce Vulnerability in the Caribbean	Government of Italy	4.5 million 2009-2011	1, 2, 3, 4, 5
Mainstreaming DRM in the OECS countries	IADB	400,000 2008-2011	
Regional DRM Strategy for the Caribbean Tourism sector	IADB	800,000 2007-2009	
Regional Monitoring and Evaluation Framework for DRM in the Caribbean Tourism Sector	IADB	750,000 2009-2012	

[19] The CCRIF is the first multi-country risk pool in the world, and is also the first insurance instrument to successfully develop a parametric policy backed by both traditional and capital markets. It is a regional insurance fund for Caribbean governments designed to limit the financial impact of catastrophic hurricanes and earthquakes to Caribbean governments by quickly providing financial liquidity when a policy is triggered.

COUNTRIES AT RELATIVELY HIGH MORTALITY RISK FROM MULTIPLE HAZARDS
(Top 96 based on population with 2 or more hazards)[a]

1. Bangladesh
2. Nepal
3. Dominican Republic
4. Burundi
5. Haiti
10. Guatemala
13. Trinidad and Tobago
20. Niger
37. Peru

54. SAINT VINCENT AND THE GRENADINES

55. Mexico
57. St. Kitts and Nevis
61. Belize
63. United States
78. Bolivia
96. Thailand

[a] Dilley et al. (2005). Table 1.2.

Under the structure of the National Disaster Management Plan, government ministries, business and non-governmental organizations actively cooperate in the area of disaster management.

SAINT VINCENT AND THE GRENADINES

Natural Disasters from 1980 - 2005[b]

Affected People

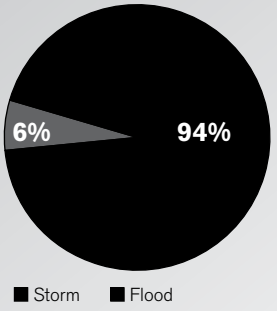
Disaster	Date	Affected (Number of People)
Storm	1980	20,50
Storm	2004	1,004
Flood	1987	1,000
Storm	2005	530
Storm	1987	208
Flood	1992	200
Flood	1986	152
Storm	1999	100
Storm	2002	0

Economic Damages

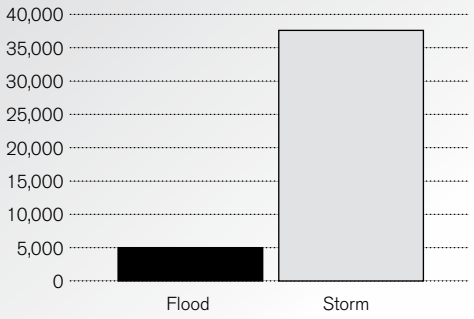
Disaster	Date	Cost (US$ x 1,000)
Storm	1980	16,300
Storm	2002	11,000
Storm	1987	5,300
Flood	1987	5,000
Storm	2004	5,000
Flood	1986	0
Flood	1992	0
Storm	1999	0
Storm	2005	0

Statistics by Disaster Type[b]

Population Affected by Disaster Type



Economic Damages / Disaster Type (1000s US$)



[b] UN (2009). http://www.preventionweb.net/english/countries/statistics/?cid=146. Source data from EM-DAT. Data displayed does not imply national endorsement.

DISASTER RISK PROFILE

Saint Vincent and the Grenadines (SVG) comprises some 32 islands and cays, the largest being St. Vincent, followed by Bequia, Mustique, Canouan, Union Island and others. The population on SVG is approximately 104,000. The largest of the islands, St. Vincent, is approximately 29 km north to south and 17.7 km wide on the east-west axis. It covers some 344 km^2. In contrast, Bequia, the next largest island, covers some 18 km^2, with the remaining islands each covering 8 km^2 or less. All the major islands are of volcanic origin. Island topography is typically deeply dissected with steep slopes tending toward island centers.

Multiple hazards impact SVG and the most common threat is the potential for hurricanes and tropical storms. High winds and rainfall coupled with the islands' mountainous topography are the principal risk factors. Much of the islands' construction occurs on steep slopes often exceeding 45 degrees. There is little protection from the direct impacts of wind forces and prolonged rainfall promotes slope de-stabilization. Informal constructions are at greatest risk as they do not benefit from adequate engineering.

The island group is located in the southern portion of the Atlantic Hurricane belt and suffered some damages from Hurricane Ivan in 2004. Since 1900, St. Vincent has been hit by 8 named storms, the strongest being Hurricane Allen (Category 4), which passed between St. Lucia and St. Vincent in 1980. Prior to that, Hurricane Hazel, a Category 1 storm passed some 38 km south of St. Vincent in 1954. These Islands were also severely affected by Hurricane Lenny in 1999, a Category 4 storm.[1] Lenny passed the Eastern Caribbean as a tropical storm reaching hurricane strength as it approached the Virgin Islands. Exceptionally strong waves produced by Lenny caused damages regionally and throughout the Windward Islands of the Caribbean.

St. Vincent and the Grenadines experience rainy and dry seasons and are variously vulnerable to drought, landslides and coastal flooding. Landslides, particularly on the larger islands, are a significant hazard and the risk is increased during the seasonal rains. Coastal flooding is a major concern particularly relating to storm surge and high wave action. The Grenadines are more susceptible to drought, as there are no rivers and rain water harvesting is their main source of water. Additionally, 2009-2010 has seen one of the worse dry spells or droughts in the last decade, with the country declaring a drought alert in March and mandated to form a drought alert task force by the Cabinet.

The active volcano La Soufriere, located on the north end of St. Vincent is another risk factor, posing threats from shallow earthquake and eruption events. It is an active volcano rising some 1,234 meters and has erupted in historical times. Direct impacts are generally limited to the Island of St. Vincent; however, potential ash fall can threaten the neighboring islands.

Economic risks are related to the country's dependence on agriculture and services sector (largely tourism). These two sectors are responsible for approximately 11 and 64 percent of the country's GDP, respectively.

Some 41.6% of the population of Saint Vincent and the Grenadines (SVG) is exposed to risk of mortality from 2 or more hazards. This places SVG among the top 60 countries with relatively high mortality risks. Additionally, economic risks from 2 or more hazards as a percentage of GDP are similarly estimated at 41.6%.[2]

[1] Saffir-Simpson Scale.
[2] Dilley et al. (2005). Table 7.2b and Table 1.2.

Geological Hazards

The country is exposed to low-to-moderate seismic risk (seismic zone 2 on a 0-4 scale[3]). Its location along the eastern margin of the Caribbean plate exposes the islands to seismic and/or tectonic activity. Additionally, SVG is particularly vulnerable to shallow seismic activity from one of the more active volcanoes in the eastern Caribbean, La Soufriere, located on the northern portion of St. Vincent.

La Soufriere has erupted five times in recorded history beginning with the eruption of 1712, the largest recorded being the eruption of 1979. In 1902, the second largest eruption occurred with devastating results. Over 1,500 people lost their lives from a combination of volcanic forces including flood, lahar, and exposure to superheated gasses known as nuee ardente.

Tsunami risk is generally associated with the potential effects of an eruption of the volcano Kick-'em-Jenny located some 100 km to the south off the coast of Grenada. The 1939 eruption reports indicate that a 2-meter tsunami was generated. Given the proximity of the volcano to inhabited lands, should a tsunami be generated, travel times will be rapid and afford little opportunity for warning.

Floods and Landslides

Flash flooding from mountain streams coupled with storm surge events present the greatest risk from flooding. Effects are generally limited to communities located in the coastal margins along stream passages. These are usually coastal fishing villages located where access to the sea is open, as much of the island's coast is marked by cliff formations. While bay and harbor areas are particularly at risk, storm surge and wave action pose a particular risk to the eastern side of St. Vincent where the coast is exposed to potentially very long fetch waves. The east coast road, a principal route linking the east and west sides of the island, was constructed very near the coastal margin and is vulnerable to wave action and storm surge.

SVG is vulnerable to landslides resulting from the combination of its volcanic geomorphology and steep terrain. As is the case with similar islands, road cuts and building constructions on steep slopes contribute to landslide potential and there is little flat land available for construction. Structures built without adequate design or quality control are at greatest risk. Landslides are usually associated with periods of prolonged rainfall as occurs during the rainy season from May to November. As recently as 2008, heavy rains provoked over 25 landslides in SVG resulting in 1 death and the activation of search and rescue operations.

Determinants of Vulnerability to Adverse Natural Events in St. Vincent

Areas of higher population density, such as Kingstown and villages located along the west coast of St. Vincent, as well as coastal low-lying villages throughout the islands, are particularly vulnerable to the effects of storm surge. New construction, particularly in relation to tourism, continues with little attention to natural hazard risk or with little formal land use planning on some of the smaller islands. Construction codes exist but are not evenly applied. Informal settlement continues to occur and vulnerabilities associated with these activities are greatest as settlements tend to be located in areas of increased risk without benefit of engineering support.

[3] SEOC (Structural Engineers Association of California) zone system. Zone 2 corresponds to a Z factor of 0.500 as defined under CUBiC 1985. Values obtained from Gibbs (1999), Appendix 1, Table 3.

One container port serves the SVG islands. It is located in the capital Kingstown, on the island of St. Vincent. It is the principal deepwater port and the access point for international trade and commerce. A single airport is located on the leeward side of St. Vincent but does not have adequate runway to accept commercial jets. Canouan and Bequia support small air strips. A larger airport capable of handling larger aircrafts is planned to be located on the windward side of St. Vincent. Air transport currently is managed through a regional service network and the larger islands in SVG support modest runway capacity.

Marinas and related business activities are at particular risk from storm surge and wave impacts. Sailing is an important element of the tourism economy and occurs in virtually every bay that can accommodate these activities. The fishing industry, largely artisanal, is also at significant risk from surge and wave actions.

Power generation, drinking water, and international port services are generally concentrated in a limited number of facilities with few alternatives. As is the case with most island states, critical infrastructure is particularly at risk as alternative services are limited. When these facilities are damaged, services are lost until repairs can be completed.

The health infrastructure is comprised of 39 health centers and 8 hospitals.[4] The Milton Cato Memorial Hospital (MCMH) in Kingstown is the only general hospital in St. Vincent and the Grenadines and is the main acute referral healthcare facility in the country.

Climate Change and Global Warming

St. Vincent and the Grenadines were cited in the Germanwatch 2010 Global Climate Change Risk Index. The 2010 Climate Risk Index is based on figures from 2008 and is also an analysis of the worldwide data collection on losses caused by weather-related events during 1998–2008. In 2008 St. Vincent and the Grenadines were ranked 72nd with losses of 0.17% GDP, and 89th for the decade with GDP losses of 0.43%.[5] Two factors were cited: the impact of global warming on rising sea levels which increase the risk of storm surges, and secondly the increase in the strength of hurricanes.[6]

Climate change models[7] have predicted that St. Vincent and the Grenadines will undergo a warming and drying trend and is expected to endure more frequent heat waves and droughts, rainfalls with increased intensity, and rising sea levels as predicted for the rest of the Caribbean consistent with the projected global median.[8] It is known that inter-annual climate variability of either the Pacific or Atlantic explains a significant amount of the total variance in rainfall in the Caribbean and Central America.[9] Probable climate change impacts in St. Vincent include higher temperatures, higher storm intensities and, possibly, more frequent El Niño-Southern Oscillation (ENSO)[10] events, exacerbating existing health, social and economic challenges affecting St. Vincent and the Grenadines.

Changes in sea surface temperature as a result of climate variability could increase the intensity of cyclones and heighten storm surges, which in turn will cause more damaging flood conditions

[4] PAHO (2007).
[5] Harmeling (2009). Table 5.
[6] McLymont-Lafayette (2009).
[7] Hadley Centre Coupled Model, Version 2 (HADCM2), as reported in Mulligan (2003). Same modeling data as used by the Intergovernmental Panel on Climate Change (IPCC).
[8] Chen et al. (2008).
[9] Giannini et al. (2002).
[10] El Niño-Southern Oscillation; commonly referred to as simply El Niño, a global coupled ocean-atmosphere phenomenon.

in coastal zones and low-lying areas. According to the World Bank's study, "Sea Level Rise and Storm Surges",[11] the impact of sea level rise and intensified storm surges in Latin America and the Caribbean will be high. While data is not available for St. Vincent and the Grenadines, data for Puerto Rico is showing an increase of 51.84% - with 53.81% of the coastal population exposed and potential losses of coastal GDP projected to exceed 52.71%.

DISASTER RISK MANAGEMENT FRAMEWORK

Enabling legislation has been established for disaster management in St. Vincent and the Grenadines. Disaster preparedness and emergency response in SVG is implemented under the authority of the National Emergency and Disaster Management Act No. 15 of 2006,[12] the Emergency Powers Act No. 45 of 1970, and the Natural Disaster (Relief) Act of 1947.

The National Emergency and Disaster Management Act establishes the disaster planning and response framework. This is executed through the National Emergency Management Organization (NEMO) which consists of the National Emergency Council, the National Emergency Executive Committee, and the District Disaster Management Committees. . The Governor-General may, by Proclamation which is then published in the Official Gazette, declare that a state of public emergency exists.[13]

The National Emergency Council is chaired by the Prime Minister and is composed of Ministers, permanent secretaries, district representatives and key ex-officio members from government agencies, corporations, businesses and non-governmental organizations. The council functions to coordinate the development of national disaster policy and serves as the interagency focus during disaster events. The National Emergency Executive Committee monitors progress on national disaster policy implementation and provides the technical implementation supervision on behalf of the national council.

District Disaster committees function at the local level and operate to implement planning and disaster response operations in their respective districts. Additionally, local disaster committees have been organized to operate at the community level.

Disaster management activities are conducted in accordance with the National Disaster Response Plan (2005). This plan assigns planning, preparedness, and response activities to the various agencies and representatives and provides for the assignment of specific responsibilities among agencies during disaster response. Under the plan, response activities are managed by NEMO at the direction of the Prime Minister.

ACTIVITIES UNDER THE HYOGO FRAMEWORK FOR ACTION

Hyogo Framework for Action (HFA) Priority #1: Policy, institutional capacity and consensus building for disaster risk management

National Emergency and Disaster Management Act No. 15 of 2006 established the National

[11] Dasgupta et al. (2009).
[12] OAS-DSD (2006b).
[13] OAS-DSD (1979).

Emergency Management Organization, NEMO, and its operational authorities. Under the act, NEMO is the focal point for disaster planning and response in conjunction with national line ministries. During emergencies, NEMO reports directly to the office of the Prime Minister.

The National Disaster Plan has been developed and is operational. The plan assigns responsibilities for disaster response and planning among national ministries and private sector organizations, and provides specific plans for a variety of hazard profiles including hurricane, flood and volcanic activity. The plan provides a strong framework for committee participation at various levels including the participation of local emergency management committees.

A full-time core staff has been assigned to NEMO and an Emergency Operations Center has been constructed to house NEMO activities. Disaster response and planning in St. Vincent occurs at three basic levels. National committees composed of ministry representatives and representatives from core service sectors (transportation, communications, electric power and water services), whose functions include both planning and response, provide the management planning framework. District committees provide a mechanism for the decentralization of disaster response and planning, and local committees function at the community level.

Under the national system, line ministries are responsible for their respective functional areas during a disaster. These ministries have achieved varying readiness capabilities and work is proceeding in this area.

Disaster risk reduction through development policy and planning is still in its early development. The national policy currently does not yet mandate DRM as a development objective.

HFA Priority #2: Disaster risk assessment and monitoring

Progress in preparation of hazard maps is limited. Mapping and GIS capability is managed largely through the Ministry of Planning with some use in other ministries. NEMO supports limited GIS and mapping capacity. To date risk mapping in St. Vincent is limited. Volcanic risks have been mapped and some coastal vulnerability analysis has been completed. A limited number of base maps have been prepared in a GIS format and include roads, contours, rivers and coastline, and agricultural and urban land use. These are variously available through the Ministry of Planning and NEMO.[14]

Meteorological hazards are monitored by St. Vincent and the Grenadines Meteorological Service, which issues warnings. This is supported with information made available through the U.S. National Oceanic and Atmospheric Administration and the National Hurricane Center. NEMO assists in coordinating these warnings and provides public preparedness advice under a system prescribed under the national plan. Warnings are distributed through radio, television and loudspeaker broadcasts, as well as storm warning flags displayed at police stations. The Ministry of Agriculture maintains a system of stream gauges and meteorological stations on the island. These are not automated systems.

Seismic monitoring is provided regionally through the University of West Indies Seismic Research Centre and locally through the Soufrière Monitoring Unit under the Ministry of Agriculture. Apart from the regional monitoring network, the UWI Seismic Research Center supports a network of local monitoring stations located on the island of St. Vincent. A collection of five seismic stations coupled with eight GPS stations and dry tilt sites collect information that is transmitted to the Belmont Observatory. These stations

[14] CDERA (2003f).

are maintained locally by the Soufrière Monitoring Unit under the Ministry of Agriculture. Data are relayed via internet to the UWI Seismic Research Center for analysis and reporting.

HFA Priority #3: Use knowledge, innovation and education to build a culture of safety and resilience at all levels

NEMO regularly sponsors risk-focused public awareness events and at the onset of each hurricane season, the Prime Minister has adopted the custom of issuing an annual public address. St. Vincent is regularly exposed to hazard events, particularly landslides, storm surge and coastal flooding. The last volcanic eruption in 1979 is still a relatively recent experience. As a result, the population is acutely aware of disaster-related risks and potential impacts. Efforts on the part of NEMO have continued to provide information and promote risk awareness through meetings, public campaigns and the introduction of disaster preparedness in the educational curriculum.

Under the structure of the National Disaster Management Plan, government ministries, business and non-governmental organizations actively cooperate in the area of disaster management. As most of these efforts are focused on preparedness and response, risk reduction through planning and risk avoidance strategies remains the next advancement to be achieved.

HFA Priority #4: Reduction of the underlying risk factors (reduction of exposure and vulnerability and increase of resilience)

Government-sponsored constructions and larger infrastructure investments generally include resilient design; however, the practice is not employed on a widespread basis. Progress in risk reduction is still in the developing stages. The passage of the National Building Code legislation has provided the legal framework for advances in this area and regulations are to be issued during 2009; however, the integration of resilient practices and designs for vulnerability reduction are not yet mainstreamed.

Currently, a draft DRR plan has been prepared for the tourism sector and plans are underway to strengthen risk mapping as a first step in the development of DRR strategies. Apart from aspects addressed in the current building code, sector-based initiatives are being considered in the reduction of underlying risk factors.

Land use planning is currently not a factor for disaster risk reduction in St. Vincent. While some land use planning occurs, its translation into actual land use constraints based on risk reduction principles is limited.

HFA Priority #5: Disaster preparedness, recovery and reconstruction at national, regional, and local levels

NEMO has invested significantly in raising public awareness and citizens react when informed of impending storm events. As a result, they are more aware of the seriousness of preparing for possible events. The revision of the National Plan has imparted a greater level of organization to the preparedness and response process and disaster management is a priority at all levels of government.

SVG is a member of the regional Caribbean Disaster Emergency Management Agency (CDEMA).

St. Vincent's capacity to respond to a major disaster without major outside support will remain

limited for the foreseeable future. Risk reduction and improved insurance coverage will be key factors supporting reconstruction capacity. As to public sector risks, St. Vincent is a subscriber to the Caribbean Catastrophic Risk Insurance Facility.[15] This offers some relief in the event that the policy is triggered.

The tourism sector, a major contributor to St. Vincent's economy, is largely insured by commercial underwriters. Other sectors, such as agriculture, transport, or housing remain relatively vulnerable.

Forty community disaster groups have been established. These groups have received training in damage assessment, shelter management, relief supplies management, first aid and related activities. Work continues to strengthen the emergency communications network at the local level with the expansion of the national emergency HF radio system.

Risk reduction and improved insurance coverage will be key factors supporting reconstruction capacity.

Vulnerability assessments of the health sector infrastructure have been carried out recently. The Milton Cato General Hospital, main healthcare facility in the country, was assessed in 1996, and more recently in 2008 using PAHO/WHO hospital safety index. The assessment provided an estimate of the hospital's capacity to continue providing services during and after a large-scale disaster or emergency and guided necessary interventions actions to increase the hospital's safety in case of disasters. The recommendations addressed structural, non-structural and functional aspects of the facility. Some of these recommendations have already been implemented.

KEY DONOR ENGAGEMENTS

Existing Projects with Donors and International Financial Institutions	Funding Agency / International Partners	Allocated Budget and Period (US$)	HFA Activity Area(s)
Disaster Mitigation Project – Community Disaster Risk Reduction (Paget farm, Bequia)	UNDP / OECS Secretariat	71,000	4
Comprehensive Disaster Harmonized Implementation Program	CDEMA / CIDA / DFID		1
Caribbean Risk Management Initiative	UNDP	2.1 million 2004-2010	1, 2, 3
Enhancing Resilience to Reduce Vulnerability in the Caribbean	Government of Italy	4.5million 2009-2011	1, 2, 3, 4, 5
Mainstreaming DRM in the OECS countries	IDB	400,000 2008-2011	
Regional DRM Strategy for the Caribbean Tourism sector	IDB	800,000 2007-2009	
Regional Monitoring and Evaluation Framework for DRM in the Caribbean Tourism Sector	IDB	750,000 2009-2012	

[15] The CCRIF is the first multi-country risk pool in the world, and is also the first insurance instrument to successfully develop a parametric policy backed by both traditional and capital markets. It is a regional insurance fund for Caribbean governments designed to limit the financial impact of catastrophic hurricanes and earthquakes to Caribbean governments by quickly providing financial liquidity when a policy is triggered.

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