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# **STATUS OF HAZARD MAPS VULNERABILITY ASSESSMENTS AND DIGITAL MAPS GUYANA COUNTRY REPORT**

**THE CARIBBEAN DISASTER EMERGENCY  
RESPONSE AGENCY (CDERA)**

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## Preface

From 2002 – 2005, the Caribbean Disaster Emergency Response Agency (CDERA) is implementing two major regional initiatives which are designed to reduce vulnerability to natural and technological hazards. These are the Japanese International Cooperation Agency (JICA) supported Caribbean Disaster Management (CADM) Project and the Canadian International Development Agency (CIDA) supported; Organization of American States executed Caribbean Hazard Mitigation Capacity Building Programme (CHAMP). The hazard mitigation planning component of the latter is being implemented in close collaboration with the Caribbean Development Bank's Disaster Mitigation Facility for the Caribbean. Hazard maps, vulnerability assessment studies, and digital maps are critical inputs to both initiatives.

This survey reviewed the status of these thematic activities in sixteen (16) CDERA Participating States, Haiti, Martinique, Suriname and Puerto Rico over the period August – October 2003. The objectives of the Survey were as follows:

1. To determine the status of hazard maps and vulnerability assessment studies and their use in the socio-economic planning and management of the Caribbean.
2. To determine critical success factors, gaps and best practices in the preparation and use of hazard maps and vulnerability assessment studies in the Caribbean.
3. To compile a database of hazard maps, vulnerability assessment reports, and digital maps available in the Caribbean.

Hazards considered under the survey included natural hazards such as floods, hurricanes, landslides, coastal disasters (surge, wave, and erosion), earthquakes, and volcanic eruptions as well as technological hazards. The types of vulnerability assessment considered were structural, economic, and human assessments.

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# **Status of Hazard Map, Vulnerability Assessments and Digital Maps in the Caribbean: Guyana**

## **1.0 Introduction**

### **1.1 Physical and socio-economic background**

Guyana is located in Northern South America, bordering the North Atlantic Ocean, between Suriname and Venezuela. Its highest mountain peak, Mount Roraima measures 2,835 m. Total land area is 214,970 sq km. It is the third smallest country in South America after Suriname and Uruguay.

The census done in July 2003 reports a population size of 702,100 persons. The estimates for the country take the devastating mortality effects of Acquired Human Immunodeficiency (AIDS) virus. However, a population growth rate of 0.44% is expected in the same year.

The climate is tropical, humid, hot and moderated by Northeast Trade winds. Interestingly, Guyana has two (2) rainy seasons (May to mid-August, mid-November to mid-January). Its terrain comprises a vast majority of rolling highlands, low coastal plains and savannahs in the south. The country's natural resources are bauxite, gold, diamonds, hardwood timber, shrimp, and fish.

The services sector is the highest contributor to the country's Gross Domestic Product (GDP) with 44%. It is closely followed by agriculture, 35% and industry (bauxite, sugar etc.) 21% respectively. <http://www.cia.gov/cia/publications/factbook/geos/gj.html>.

### **1.2 Major Disaster Issues Confronting the Country**

The major hazards which affect Guyana are flooding, drought, and industrial hazards. The country is prone to both coastal and riverine flooding. Drought is a recurrent feature of the environment because of the El Nino factor. Deforestation is occurring along the coast and in the inland regions. The processes used to exploit mineral resources such as bauxite and gold contributes to deforestation, flooding and environmental pollution.

The low-lying nature of the coast makes it prone to flooding in the rainy season. Areas are also prone to flash flooding. The removal of mangrove swamps and over-harvesting of inland forests have worsened flooding. Deforestation has led to soil erosion and the contamination of waterways. Coastal erosion also contributes to the risk of flooding and has resulted in salt-water intrusion into agricultural lands in some areas.

Poor practices in the bauxite and gold mining industries contribute to environmental degradation. These industries contribute to deforestation, soil erosion, air and water pollution. The waste disposal from mining activities that use chemicals such as mercury and cyanide in the recovery processes is a major concern. For example, in 1995 a

cyanide spill at Omai Gold Mines affected 23,000 people. Air pollution is also a concern in industrial areas such as Linden where it has been linked to respiratory disorders. <http://www.epaguyana.org/iczm/articles.htm>

Guyana is also prone for the effects of El Niño Southern Oscillation (ENSO). In the warm phase (El Niño) Guyana experiences reduced rainfall while in the cold phase (La Niña) the country experiences increased rainfall, usually for months. <http://www.agrinetguyana.org.gy/hydromet/glossary.htm>. The El Niño of 1997/98 has been blamed for the severely drought experienced by the Country. This has led water conservation measures <http://www.unep.org/geo2000/english/0039.htm>.

## 2.0 Hazard Mapping Initiatives

The Consultant Team was informed that no hazard mapping has been undertaken in recent times in Guyana other than the seismic hazard maps. However, the need for hazard mapping was strongly advocated by the National Disaster Coordinator. Table 1 shows the details of hazard maps in Guyana.

**Table 1 – Hazard Maps in Guyana**

<i>Type</i>	<i>Purpose</i>	<i>Coverage</i>	<i>Scale</i>	<i>Date produced</i>	<i>Primary sources</i>	<i>Author</i>
Seismic	To map general level of earthquake hazard in the Caribbean in the terms of the Modified Mercalli Scale and PGA and SGA values	Country wide	0.25° grid resolution	1999	Seismic Research Unit <a href="http://www.uwiseismic.com/SRU_Site01/Earthquakes/eq_ec_seismicity_hazmm.html">http://www.uwiseismic.com/SRU_Site01/Earthquakes/eq_ec_seismicity_hazmm.html</a>	Seismic Research Unit
Seismic	To prepare Seismic Hazard Maps of the Caribbean	Country wide	0.25° grid resolution	1999	OAS/USDE/CDMP	Seismic Research Unit

## 2.1 Methods of preparation and distribution

A search on the Internet revealed that two sets of seismic hazard maps were prepared for Guyana by the Seismic Research Unit, one, done in 1999, as part of the regular dissemination of information that the Unit routinely performs and the other for the Caribbean Disaster Mitigation Project (CDMP) in 1999. The first set of seismic hazard

maps showed levels of ground shaking using the Modified Mercalli (MM) scale of earthquake intensities and Peak Ground Acceleration (PGA) with 10% probability of exceedance in any 50-year period and One-Second Spectral Ground Acceleration (SGA) for the same probability. The Seismic Research Unit will update the MM maps, and the PGA and SGA maps in the near future. The maps can be viewed at URL: [http://www.uwiseismic.com/SRU\\_Site01/Earthquakes/eq\\_ecseis\\_guyhaz.html](http://www.uwiseismic.com/SRU_Site01/Earthquakes/eq_ecseis_guyhaz.html)

The methodology for arriving at the Seismic Hazard maps for Guyana, showing PGA and SGA values, is given at URL: <http://seismo.ethz.ch/gshap/northam/report.html>

The second set of seismic hazard maps was prepared for the CDMP Hazard Mapping and Vulnerability Assessment workshop in 1999. These maps showed seismic hazard maps of Horizontal Ground Acceleration, Expected Maximum Mercalli Intensity and Horizontal Ground Velocity for Guyana. The maps were prepared using types and intensities of earthquakes, distribution of faults, thrusts and volcanoes in the region. Recurrence models were used to determine how future earthquakes would occur. All this information was combined to produce expected earthquake spectra that showed how amplitude would vary with frequency. Maps of ground acceleration, ground velocity and Modified Mercalli Intensities for Guyana, done at a scale of 0.25° grid resolution, are posted at URL: <http://www.oas.org/en/cdmp/document/seismap/Guyana.htm>

## **2.2 Users and uses**

The seismic hazard maps are intended to be used for developing earthquake resistant designs; determining how soils will react during an earthquake event; for microzonation; public education; informing disaster emergency management and land use planning.

## **2.3 Current condition and limitations**

No information was available on the current condition and limitations of the seismic hazard maps.

## **2.4 Critical success factors**

No information was available on the critical success factors of the seismic hazard maps.

### 3.0 Vulnerability Assessment Studies

Table 1 shows the details of vulnerability assessment study undertaken in the country.

**Table 1 – Vulnerability Assessment Study for Guyana**

<i>Type</i>	<i>Purpose</i>	<i>Coverage</i>	<i>Date produced</i>	<i>Primary source</i>	<i>Author</i>
Bio-geophysical and socio-economic	To assess the effects of sea level rise and potential for adaptation.	Three pilot sites: Leguan, Georgetown, and Onverwagt	2002	EPA and CPACC	Andrea Marie et al

EPA – Environmental Protection Agency

CPACC- Caribbean Planning for Adaptation to Climate Change

### 3.1 Methods of preparation and distribution

The vulnerability and risk assessment for sea level rise was conducted under Component 6 of the Caribbean Planning for Adaptation to Climate Change Project (CPACC). It was implemented in three pilot sites: Leguan, Georgetown, and Onverwagt. The sites were selected based on the presence of at-risk sectors of the economy and/or activities, such as tourism, fishing, settlements, ports, infrastructure, recreation and historic sites. The scenarios used in the analysis are 0.2m, 0.5m and 0.9m rise in sea level. The United Nations Environmental Programme (UNEP) methodology was used for the coastal vulnerability assessment as it allowed use of limited data and involves four stages:

Stage One - Identification of problems and scope of analysis.

Stage Two - Scenarios for Coastal Vulnerability Assessment.

Stage Three - Impact Assessment.

Stage Four - Autonomous and Planned Adaptation.

There has been no distribution of this study. It is awaiting approval from CPACC and EPA.

### 3.2 Users and uses

It is anticipated that the general public would use the assessment studies to increase its awareness of the impact of sea level rise and climate change. Further, the information generated would be used to develop an effective coastal zone management plan by the relevant state agencies.

### 3.3 Current condition and limitations

Problems were encountered with the non-availability of high-resolution data. Furthermore, challenges were experienced with respect to the collection and handling of the data variables needed to analyze the coast's susceptibility to sea level rise.

Consequently, statistical precision was diminished. The fact that the project was focused on three (3) sites along the coast is another limitation.

### 3.4 Critical success factors

It is too early to determine these critical success factors of this study.

### 3.5 Respondent

Respondent to the vulnerability assessment section of the questionnaire was:

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 GIS Specialist  
 Environmental Protection Agency  
 Georgetown, Guyana  
 Tel: 592-222-2277  
 Fax: 592-222-2442  
 Email: [raj3singh@yahoo.com](mailto:raj3singh@yahoo.com)

## 4.0 Digital Maps

Table 2 shows details of digital data themes available in the country.

**Table 2 – Digital Maps Available in Guyana**

<i>Data Theme</i>	<i>Scale of input map</i>	<i>Year input map was produced</i>	<i>Area covered</i>	<i>Primary Source</i>	<i>Digital File format</i>
Roads	1:500,000	2002	Whole Country	GL&SC	Shapefile
Rivers	1:500,000	2002	Whole Country	GL&SC	Shapefile
Vegetation	1:1,000,000	2001	Whole Country	GFC	shapefile
Soils	1:500,000	2002	Whole Country	NARI	Shapefile
Geology	1:1,000,000	2000	Whole Country	GGMC	MapInfo
Geochemistry	1:1,000,000	2000	Whole Country	GGMC	MapInfo
Population	1:1,000,000	2002	Whole Country	EPA	Shapefile
Contours	1:50,000	1986	Coastal areas, Iwokrama Reserve, Kanuku Mountains, the Kaieteur National Park, Admin. Regions 3, 7 & 10.	GL&SC	shapefile
Land use	1:200,000	2002		GL&SC	shapefile
Roads	1:50,000	1986		GL&SC	Shapefile
Rivers	1:50,000	1986		GL&SC	Shapefile
Geology	>1:1,000,000	2003	Parts of country <sup>2</sup>	GGMC	MapInfo
Geochemistry	>1:1,000,000	2003	Parts of country <sup>2</sup>	GGMC	MapInfo
Social facilities <sup>1</sup>	1:50,000	1986	Coastal Areas	GL&SC/EPA	Shapefile
Economic facilities <sup>3</sup>	1:50,000	1986	Coastal Areas	GL&SC/EPA	Shapefile

1. Content of Social facilities: Schools, places of worship, fire station, police stations, etc.
2. Specific names of location covered is being awaited
3. List of economic facilities is being awaited

List of abbreviations:

GL&SC – Guyana Lands and Surveys Commission  
EPA – Environmental Protection Agency  
NARI – National Agricultural Research Institute  
GGMC – Guyana Geology and Mines Commission  
GFC – Guyana Forestry Commission

\* The data themes have the following datum and map projection:

Datum: Provisional South American Datum, 1956

Projection: Universal Transverse Mercator

## 5.0 Conclusions and Remarks

There is no record of hazard mapping in Guyana. The vulnerability assessment study reported above is the only known such study in the Country. In light of the natural hazards in which the country is exposed to, it is imperative that investment in hazard mapping and vulnerability assessment studies such be given a higher priority in Guyana.

A search on the Internet indicated that seismic hazard maps were prepared for Guyana.