



Japan International Cooperation Agency



Agence canadienne de  
développement international

Canadian International  
Development Agency



Organization of  
American States

# **STATUS OF HAZARD MAPS VULNERABILITY ASSESSMENTS AND DIGITAL MAPS**

## **HAITI COUNTRY REPORT**

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

October 2003

## Table of Contents

	Page
Preface	1
1.0 Introduction	2
1.1 Physical and socio-economic background	2
1.2 Major disaster issues confronting the country	2
2.0 Hazard mapping initiatives	3
2.1 Methods of preparation and distribution	4
2.1.1 Multi-hazard maps	4
2.1.2 Seismic hazard maps	4
2.1.3 Storm hazard map	4
2.2 Users and uses	5
2.3 Current condition and limitations	5
2.4 Critical success factors	5
2.5 Respondents	5
3.0 Vulnerability Assessment Studies	6
3.1 Methods of preparation and distribution	7
3.2 Users and uses	8
3.3 Current condition and limitations	8
3.4 Critical success factors	8
3.5 Respondents	9
4.0 Digital Maps	9
5.0 Conclusion and Remarks	9

## 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.

This report was prepared by the Jacob Opadeyi, Shahiba Ali, and Eva Chin of the Centre for Geospatial Studies, Faculty of Engineering, The University of the West Indies, St. Augustine, Trinidad and Tobago.

# Status of Hazard Maps, Vulnerability Assessments and Digital Maps in the Caribbean: Haiti

## 1.0 Introduction

### 1.1 Physical and socio-economic background

Haiti occupies the western one-third of the island of Hispaniola, between the Caribbean Sea and the North Atlantic Ocean. Its total area spans some 27,750 sq km. To the east is the Dominican Republic, which also happens to be Haiti's border country. Haiti's geographic coordinates are 19°00'N, 72° 25'W. Its highest point in the country is Chaîne de la Selle, which measures 2,680 m.

The climate is tropical though semiarid. Here, the mountains in the east cut off the trade winds. The terrain is predominantly mountainous and rough. Its natural resources comprise bauxite, copper, calcium carbonate, gold, marble, and hydropower.

The agriculture sector sustains 70% of the population. This sector manifests itself in the form of small-scale subsistence farming. In Haiti, 66.98% of the land is used for other purposes; arable land accounts for 20.32% and permanent crops utilize 12.7% of the land. This is based on 1998 estimates. According to 2001 estimates, the services sector makes a 50% contribution to Gross Domestic Product (GDP). This is followed by agriculture, 30%, and industry, 20%.

Haiti's labour force comprises 3.6 million people. Eighty percent of its population lives in absolute poverty. In 1995, there was a shortage of skilled labour while unskilled labour was extremely abundant. The agriculture sector employs two-thirds of Haiti's active work force, 66%. The services sector employs 25% and the industry sector employs 9%. There is widespread unemployment and underemployment, and informal jobs preoccupy more than two-thirds of this labour force as estimated in 2002.

The total population accounts for 7,527,817 persons. According to 2003 estimates, a population growth of 1.67% is expected. Haiti's total infant mortality rate is quite high. Seventy-six babies born to every 1000 mothers die. Male babies seem to be most susceptible to death. The country's total literacy rate is almost 53%.

### 1.2 Major Disaster Issues Confronting the Country

Haiti is faced by both natural and manmade hazards. The synergy of poverty, a degraded environment, and lack of infrastructure has made Haiti a "disaster prone" country. Every year, large segments of the population suffer from hurricanes, earthquakes, flooding, mudslides or drought.

The island of Hispaniola lies in the middle of the hurricane belt and is subject to severe storms from June to October. The effects of hurricanes and tropical storms such as wind damage, inland flooding and coastal surge are of significant concern. In

September 1998, Hurricane Georges resulted in an estimated \$180 million in damage to crops, infrastructure and housing. There were approximately 400 deaths and rains caused severe flooding in the southern part of the country.

Haiti is losing its productive potential because of the loss of vegetative cover. There has been extensive deforestation and this has exacerbated the problems of soil erosion and flooding. Deforestation has resulted in extensive soil erosion, drastically reducing agricultural productivity and damaging infrastructure. Tragically, the island has begun a process of desertification. Only 1.5% of Haiti's natural forest remains and 25% to 30% of the watersheds are denuded (Source of statistics: Central Intelligence Agency (CIA) Fact Book, 2003) found at: <http://www.cia.gov/cia/publications/factbook/geos/ha.html>.

## 2.0 Hazard Mapping Initiatives

Table 1 shows the details of hazard maps in Haiti.

**Table 1 – Hazard Maps in Haiti**

<i>Type</i>	<i>Purpose</i>	<i>Coverage</i>	<i>Scale</i>	<i>Date produced</i>	<i>Primary sources</i>	<i>Authors</i>
Seismic	To map Horizontal Ground Acceleration; Expected Maximum Mercalli Intensity; and Horizontal Ground Velocity	Island wide; as part of the Windward Islands	0.1° grid resolution	1999	OAS/USD E/CDMP	Seismic Research Unit
Storm	Preparation of an atlas of probable storm effects	Island wide; as part of the Leeward Islands	~1km <sup>2</sup> grid resolution	2000	OAS/USD E/CDMP; CIMH	Caribbean Institute for Meteorology and Hydrology (CIMH)
Cyclone	To assess the capacity of the country to respond to natural and human induced disaster	National	1:300,000	2002	Le Bureau D'Oxfam-GB, Haiti	Philippe Mathieu, Jean A. Constant, Josué Noël, and Bobby Piard
Flood						
Drought						
Geological faults						
Seismic						
Landslide						
Human-induced erosion						

## 2.1 Methods of preparation and distribution

### 2.1.1 Multi-hazard maps

The visit revealed that Haiti has just completed a comprehensive multi-hazard mapping exercise. A hardcopy of the project report titled: “Cartes et étude de risques, de la vulnérabilité et des capacités de réponse en Haïti” was provided. The report was written in French and thus will require translation to English before details of the methodology for each of the hazard maps can be incorporated into the standardized country report.

The project was sponsored by Oxfam International and it was implemented in collaboration with all the relevant state agencies and local authorities in Haiti.

The project report is not yet made official and its distribution is limited. It is awaiting approval from the Government.

### 2.1.2 Seismic Hazard Maps

A search on the Internet revealed that seismic hazard maps were prepared for Haiti 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 Haiti. 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 the Windward Islands, done at a scale of 0.1° grid resolution, are posted at URL:

<http://www.oas.org/en/cdmp/document/seismap/windward.htm>

Source of this information:

URL: <http://www.oas.org/en/cdmp/hazmap/Grenada/atwell.htm#Introduction>

### 2.1.3 Storm Hazard Maps

A storm hazard assessment, that included Haiti, was done for the Caribbean basin through the Caribbean Disaster Mitigation Project (CDMP) by the Caribbean Institute for Meteorology and Hydrology (CIMH). The map for Haiti, contained in the *Atlas of Probable Storm Effects in the Caribbean*, shows the likely estimates for storm surge, wave height and wind speeds for the 10-25, 50, and 100-year return periods, associated with the passage of a hurricane. The scale of the map is approximately 1km<sup>2</sup> grid of the Caribbean Basin, using the Plate Carrée projection and WGS84 datum.

The storm hazard map utilized The Arbiter Of Storms (TAOS) model to produce the maximum likely estimates of surge, wind speeds and wave height. The map is

distributed via the Internet and can be found at:  
<http://www.oas.org/en/cdmp/document/reglstrm/index.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.

The storm hazard map is intended for use by coastal engineers, regional planners, emergency management personnel and lending and insurance agencies for vulnerability assessments.

## **2.3 Current condition and limitations**

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

## **2.4 Critical success factors**

The use of collaborative approach, availability of a national GIS database and international funding were critical to the success of this project.

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

## **2.5 Respondents**

Dr. Marie Yolene Surena  
Director of Civil Defense  
Office of the President  
Tel: 509-228-2266/2227  
Fax: 509-228-2185  
Email: [ysurena@yahoo.com](mailto:ysurena@yahoo.com)

Bernard C. Gardith  
Chef Section/Formation  
National Civil Protection Directorate (DPC)  
Tel: 509-222-2284/8231  
Email: [gard\\_lba@yahoo.fr](mailto:gard_lba@yahoo.fr)

### 3.0 Vulnerability Assessment Studies

Table 2 shows the details of vulnerability assessment studies undertaken in the country.

**Table 2 – Vulnerability Assessment Studies for Haiti**

<i>Type</i>	<i>Purpose</i>	<i>Coverage</i>	<i>Date produced</i>	<i>Primary source</i>	<i>Authors</i>
Human	To assess the capacity of the country to respond to natural and human induced disasters	National	2002	Le Bureau D'Oxfam-GB, Haiti	Philippe Mathieu, Jean A. Constant, Josué Noël, and Bobby Piard
Human and structural	To develop community evacuation plans in the event of flood, fire, hurricane, and earthquake.	L'Artibonite watershed	Jan., 2003	Pan American Development Foundation (PADF), Haiti	Pan American Development Foundation (PADF), Haiti
Structural	To establish community-based disaster preparedness and prevention programs.	Jeremie	May, 1999	Unit of Sustainable Development and Environment, OAS <a href="http://www.oas.org/en/cdmp/document/jeremie/exsum.htm">www.oas.org/en/cdmp/document/jeremie/exsum.htm</a>	Ravidya Maharaj and Axel Kravatzky
Coastal erosion	To measure, assess and manage phenomena associated with beach erosion	Selected sites in Haiti	1999	Coastal Zone Management Project, Ministry of the Environment	Coastal Zone Management Project, Ministry of the Environment; University of Puerto Rico, Sea Grant College Program

OAS: Organization of American States

### 3.1 Methods of preparation and distribution

The details of the national vulnerability assessment study are contained in the report cited in section 2.1.

The L'Artibonite project is titled "Program for the Reduction in the Impact of Disastrous Events" (PRIDE). This is a community-based disaster management project financed by United States Agency for International Development (USAID) and implemented by PADF in collaboration with the local authorities and communities in the project sites. The project focuses on the vulnerability of the local communities to flood hazard, hurricane, earthquake, and fire. The project produced local area risk map, early warning system, and response action plan. Training in response management was conducted and training manuals written in local language (Creole) were produced.

A CD of the final project report was provided. The following files and folders are on the CD:

- a. *PRIDE Final Report.pdf*: English version of the PRIDE Final Report
- b. *Rapport final sur les abris du Sudest.pdf*: French report describing all of the buildings that could serve as emergency shelters in the Southeast Department
- c. *Rapport Final Simulation.pdf*: French report describing the disaster simulation held in Cayes-Jacmel.
- d. *Cyclone SIMUL 2002.MPG*: Ten minute Creole video showing the simulation held in Cayes-Jacmel. This video requires a video player such as Realplayer or the Microsoft Media Player.
- e. *RAPPORT FINAL FORMATION.pdf*: French report describing the training conducted for both the local disaster committees and the Community Emergency Response Teams.
- f. *Idée de Projet de Déviation de la Rivière des Orangers.pdf*: French Report describing the possibility of redirecting the Orangers River away from the town of Jacmel to reduce flooding.
- g. *Draft Document fòmasyon Protection Civile.pdf*: A first draft of the Creole language training manual for the Community Emergency Response Teams. This document will be finalized in subsequent projects.
- h. *Plan national d'intervention.pdf*: The national response plan developed by FEMA for Haiti. Final French version.
- i. Photos: Folder containing a variety of photos showing the successes in PRIDE.
- j. Radio Spots: Mp3 versions of the radio spots partially financed by PRIDE for the 2002 hurricane season.

The OAS implemented Caribbean Disaster Mitigation Project (CDMP) undertook a vulnerability assessment in Jeremie. The assessment was focused on the following communities: Basse Ville, La Source, Berquier, Bordes, Rochasse, Brouette, Caracoli, Versailles, Gebeau, La Digue, St. Helene, La Point, Mackandal.

The methodology used involved twelve local volunteers from Jeremie. These persons were given 3 days of training in the techniques of Rapid Rural Assessment, and surveying using participatory learning techniques. The consultants worked with the volunteers to do a priority rating of critical facilities and develop hazard mitigation and vulnerability reduction plans. The rating is based on a determination of the phase of the disaster cycle in which the facility is most critical. LEVEL 1 = preparedness (during or before event); LEVEL 2 = response and relief and LEVEL 3 = recovery and rehabilitation.

Project report is web-distributed: [www.oas.org/en/cdmp/document/jeremie/exsum.htm](http://www.oas.org/en/cdmp/document/jeremie/exsum.htm)

Haiti is part of an on-going project called *Managing Beach Resources and Planning for Coastline Change, Caribbean* formerly *Coast and Beach Stability in the Caribbean (COSALC)*. It is a programme, started in 1996, led by Dr. Gillian Cambers of the University of Puerto Rico Sea Grant College Programme, with support from the Caribbean Development Bank (CDB), Organisation of the American States (OAS), Organization of the Eastern Caribbean States (OECS), UNESCO, the Associated Schools Programme Caribbean Sea Project and the Coastal Regions and Small Islands (CSI) Platform.

The coastal erosion study involved monitoring beach erosion, documenting possible causes and providing recommendations on coastal setbacks to be adopted by all concerned. Information on Haiti's involvement in the project can be found at the URL: [http://www.unesco.org/csi/act/cosalc/haiti\\_andres.htm](http://www.unesco.org/csi/act/cosalc/haiti_andres.htm)

### **3.2 Users and uses**

The local communities and the office of the Civil Defense are the main users. It was anticipated that the training and manuals would lead to a decrease in losses in the event of natural hazards.

The findings and recommendations of the coastal erosion study are to be used for coastal planning and erosion mitigation.

### **3.3 Current condition and limitations**

The report is yet to be adopted by the Mayor of the community.

No information was provided on the Internet on the current conditions and limitations of the coastal and beach stability study.

### **3.4 Critical success factors**

The full cooperation of the local communities is responsible for the success attained to date.

No information was provided on the Internet on the critical success factors of the coastal and beach stability study.

### **3.5 Respondents**

Dr. Marie Yolene Surena  
Director of Civil Defense  
Office of the President  
Tel: 509-228-2266/2227  
Fax: 509-228-2185  
Email: [ysurena@yahoo.com](mailto:ysurena@yahoo.com)

Daniel J. O'Neil  
Project Director,  
PADF, Haiti  
Tel: 509-246-0841/9459/9462  
Fax: 509-246-9464  
Email: [doneil@padfhaiti.org](mailto:doneil@padfhaiti.org)

Roosevelt Compere  
Prevention Coordinator  
National Civil Protection Directorate (DPC)  
Tel: 509-228-2537

### **4.0 Digital Maps**

Every effort made to obtain this information from the relevant agency has proved futile at the time of the submission of this report. The report will be updated as soon as this information becomes available.

### **5.0 Conclusions and Remarks**

The visit to Haiti reveals that active and current works in the areas of hazard mapping and vulnerability assessment studies are being done in the country. The language barrier, however, limits the proper documentation of work done to date. It is suggested that the CDERA Coordinating Unit and relevant members of the CADM project visit the Town of Jacmel in south east Haiti in order to gain an insight of the impact of the Project PRIDE on the local communities.

If funding permits, a limited English translation of the documents collected is highly recommended.