CDERA
The Caribbean Disaster Emergency Response Agency
Managing Disasters with Preparedness

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STATUS OF HAZARD MAPS VULNERABILITY ASSESSMENTS AND DIGITAL MAPS

DOMINICA 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 Maps, Vulnerability Assessments and Digital Maps in the Caribbean: DOMINICA

1.0 Introduction

1.1 Physical and socio-economic background

Dominica, a small island developing state, is situated at approximately 15º 25'N and 61º 20'W, between Martinique to the south and Guadeloupe to the north, in the Eastern Caribbean chain of islands. With a total area of 291.1 square miles (754km$^{2)}$, this volcanic island is the most mountainous and rugged island in the Lesser Antilles. Two of the highest peaks in the Lesser Antilles are found in Dominica, namely, Morne Diablotins 4381ft (1,447m), and Morne Trois Pitons 4221ft (1394m). The island has one of the highest drainage densities in the world, having some 365 rivers flowing in deep, narrow valleys over short distances to the sea. Their significant hydroelectric potential contributes as much as 56% of the island's electricity.

The island has a tropical marine type of climate, being affected by the prevailing Northeast Trade winds throughout the year. The dry season is from January to May and the wet season from June to December. Dominica is affected by tropical storms and hurricanes, mainly from June to November, during the wet season.

Roughly 66% of the island is covered by forest and vegetation from dry scrub woodland on the coast to tropical rainforest in the interior, providing habitats for a wide range of flora and fauna.

The population of Dominica, about 70,000 (2003), lives mainly on a narrow coastal plain. 28% of its people are under 15 years old and the economically active population makes up 64% of the population. Its per capita Gross Domestic Product (GDP) is an estimated US$5,400, with the sectors of agriculture, industry and services contributing 18%, 24% and 58% respectively to the GDP (2002). Two hurricanes in 1994 and 1995 devastated the country's banana industry. Tourism is developing, but slowly, due the rugged terrain, sparse beaches and lack of an international airport (CIA Fact Book, 2003).

1.2 Major disaster issues confronting the country

Dominica is part of a volcanically and tectonically active ridge formed along the subduction zone in the Eastern Caribbean. The island has eleven potentially active volcanic centres, one of the highest concentrations in the world and is therefore affected by volcanic, geothermal and seismic activity. Southern Dominica is at a high risk of future magmatic eruptions from Morne Anglais, Morne Plat Pays and Morne Micotrin that would generate pyroclastic flows and surges, ash falls, and lahars The majority of on-land earthquakes are shallow,

and the 1998 volcanic swarms were mainly related to the Play Pays volcanic complex - Morne Anglais centre in southern Dominica. Geothermal activity is associated with a very active area that includes the Valley of Desolation, Boiling Lake and the Eastern and Western Hot Springs. An estimated 90% of the population lives within five kilometers of a live volcano. (Seismic Research Unit 2000)

Between 1886-1996, Dominica experienced 59 storms, of which 40 were tropical storms and 19 were hurricanes between Category 1 –3 on the Saffir/Simpson scale. The island experienced 13 years in which there were multiple storms in one year (CDMP, 1996). Storm surges, floods and landslides often accompany these events.

Coastal erosion, along its 148 km of coastline, is a continuous threat to property and communication networks, along with anticipated sea level rise that make the coastal zone particularly vulnerable to beach erosion, loss of habitat for marine life, loss of fresh water aquifers, and damage to coastal infrastructure.

Volcanoes, earthquakes, hurricanes, storm surges, floods, landslides and coastal erosion are potential disaster issues facing the country, given the fact that the majority of the population lives on a narrow coastal plain.

2.0 Hazard Mapping Initiatives

Table 1, shows the particulars of hazard maps that have been prepared for Dominica.

Table 1: Hazard Maps in Dominica

Type	***Purpose***	***Coverage***	***Scale***	***Date produced***	***Primary sources***	***Author***
Landslide Risk	To map landslides occurrence.	Entire country	1:50000	Nov. 1987	Physical Planning Section	Jerome de Graff
Volcanic hazard assessment	To Map& assess volcanic hazards	Entire country	1:50000	June 2000	Physical Planning Section	Seismic Research Unit
Multiple hazard map	To identify risk areas and take preventative measures by the community	Village level: Bagatelle, Portsmouth, Salisbury, Point Michel, Paixbouche	1:2500	On-going from (Jan 2002 – Dec 2003)	Dominica Red Cross	Red Cross & Disaster Committees of communities
Flood	To undertake flood hazard mapping of the Roseau River Basin.	Roseau River Basin	Unknown	Dec 2002	CDERA	Caribbean Council of Science and Technology

2.1 Methods of preparation and distribution

2.1.1 Landslide risk map

The landslide risk map for Dominica produced by deGraff in 1987 used landslide susceptibility to arrive at landslide hazard. It tries to show where landslides will occur in the future and their probability of occurrence, rather than their actual occurrence. Relative landslide hazards are given in four zones of probable occurrence, namely, "Low", "Moderate", "High", and "Extreme". The map is meant to be used as a guide for identifying possible landslides that would affect development projects, a means for comparing the degree of possible landslide occurrence for alternatives considered and for identifying sites requiring remedial measures. The map is to be used for regional planning purposes and not for specific site use. Mr. deGraff, of the Forest Service, Department of Agriculture, was the technical specialist for the OAS, who worked on the "Natural Hazards Risk Assessment and Disaster Mitigation Pilot Project in Latin America and the Caribbean Basin", carried out by the Department of Regional Development, OAS.

The map has been digitized by the Physical Planning Division, Ministry of Housing, Dominica, and is distributed in *.shp* format on request.

2.1.2 Volcanic hazard Map

The Seismic Research Unit, in collaboration with the Government of Dominica, produced in 2000, a report that contained volcanic hazard maps relating to six live volcanic centres found in Southern Dominica and an integrated hazard map of the area incorporating the relative risk from all hazards identified. The hazards described were pyroclastic flows and surges, lahars, ash falls and geothermal activity.

Hazard maps were prepared for two dome-forming eruptions with volcanic centres at Morne Canot and Morne Trois Pitons/Micotrin and two explosive eruption scenarios with volcanic centres at Morne Anglais and in the Valley of Desolation area.

These maps showed the most likely distribution of each hazard for the four scenarios and an integrated volcanic hazard map of the most devastating eruption that is possible delineated by integrated hazard zones of "H – Highest volcano hazard level", "I - Intermediate volcano hazard level " and "L - Lowest volcano hazard level." (Seismic Research Unit 2000).

Using an empirical approach based on field investigation and expert knowledge of a volcanologist, the maps were prepared using CorelDraw, where boundaries were demarcated on a scanned 1:50 000 map of Dominica.

The report is not widely circulated.

2.1.3 Multiple hazard map

In the absence of easily available hazard maps, the Dominica Red Cross introduced a practical approach to hazard mapping using Disaster Committees at the community level. A multiple hazard map was produced. The hazards mapped are: rock fall, bush fires, volcanoes, landslide, floods, sea surges and vehicular accidents. A photocopied map of a community, at a scale of 1:2500, obtained from the Lands & Surveys Division, was given to designated community members to locate, by observation in the field, and map the presence of the hazard.

2.1.4 Flood hazard map

CDERA commissioned the production of a flood hazard mapping and an alert system for the Roseau River Valley with consultants being the Caribbean Council for Science and Technology. The project produced the following maps delivered to CDERA by December 2002.

- Scaled maps delineating flood boundaries for 1:5, 1:10. 1:25, 1:50. 1:100 year return period return periods for the Roseau Basin.
- Simplified flood hazard and vulnerability maps designed for easy understanding by community target audiences.

2.2 Users and uses

The landslide risk map produced by J.deGraff is used by the Ministry of Agriculture, office of Disaster Preparedness and the Physical Planning Division of the Ministry of Communications and Works. The map was used for gaining a better understanding of the Layou landslide -dam failure and for cutting new roads.

The volcanic hazard map is used by the Office of Disaster Management for planning purposes for community disaster management for all southern communities.

The multiple hazard maps produced by the communities are used to inform remedial and preventative works to be carried out by the Local Government personnel and the community members, against the hazards mapped, at the community level.

No flood hazard maps have been received by the country. Persons interviewed were not aware of the project.

2.3 Current condition and limitations

The landslide risk map, though useful at the regional planning scale, is not detailed enough to be site-specific. It also needs to be updated.

The multiple hazards maps are being done without any scientific training in hazard mapping techniques. The maps simply identify what is already on the ground, with the use of symbols to demarcate areas with the hazard. Updated base maps for buildings are required for a more accurate mapping of hazards. The project is done purely by hand and without using GIS.

No limitations were expressed for the volcanic hazard map.

2.4 Critical success factors

Critical success factors in the preparation, maintenance, and use of the landslide risk map are not known.

The success factor in the preparation, maintenance and use of the multiple hazard maps is that there is vested interest by the communities who map the hazard to get involved in preventative and remedial measures to be undertaken. The maps produced will be framed and displayed at a community centre in each community that engaged in the mapping exercise.

The success factor in the preparation, maintenance and use of the volcanic hazard map is that the Seismic Research Unit was commissioned by the Government of Dominica to undertake a seismic and volcanic hazard assessment of the southern part of the country after the earthquake swarms in 1998. The Unit monitors Dominica very closely and as such the hazard map is likely to be revised in the light of new data received.

With respect to the flood hazard maps, no one was able to give any information on the critical success factors in its preparation, maintenance, and use.

2.5 Respondents

Respondents to the hazard map and vulnerability assessment survey questionnaire were:

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3.0 Vulnerability Assessment Studies

Table 2 shows details of vulnerability assessment studies undertaken in Dominica

Table 2 – Vulnerability Assessment Studies for Dominica

Type	***Purpose***	***Coverage***	***Date produced***	***Primary source***	***Author***
Storm	To understand the distribution, magnitude, and frequency of storm hazard	Island wide	Yet to be determined	http://www.oas.org/en/cdmp/document/Dominica_waves/top_page.htm	OFDA/USAID/ OAS
Seismic and wind hazards	To assess the vulnerability of buildings designated as shelters	Island wide	1998	http://www.oas.org/en/cdmp/schools/schlrcsc.htm.	
Seismic	Seismic Hazard Maps: Windward Islands	Island wide	Yet to be determined	http://www.oas.org/en/cdmp/document/seismap/index.htm.	OFDA/ USAID/ OAS

Wind	To estimate probable maximum loss of critical infrastructure	Island wide	Yet to be determined	http://www.oas.org/en/cdmp/document/pml/	OFDA/ USAID/ OAS
Wave	To assess wave hazard	Selected sites	Yet to be determined	http://www.oas.org/en/cdmp/document/Dominica_waves/Top_page.htm	
Multiple hazards (landslides, floods, wind, volcanic eruptions, earthquakes)	To audit the vulnerability of the hydroelectric power plant for the Dominican Electric Services (DOMLEC)	Island wide	Yet to be determined	http://www.oas.org/en/cdmp/document/domhydro/dominica.htm	
Structural	To develop national building codes	Island wide	1996	http://www.oas.org/en/cdmp/bulletin/codes.htm	
Human and structural	To assist home-owners in making their homes Hurricane-resistant	Island wide	Yet to be determined	http://www.oas.org/en/cdmp/bulletin/house.htm.	
Landslide	To assist the government in responding to flooding due to landslide occurrence	Layou River valley	1999	http://www.oas.org/en/cdmp/bulletin/layou.htm	OFDA/ USAID/ **OAS**

The relevant documents can be found at http://www.oas.org/en/cdmp/publist.htm

3.1 Methods of preparation and distribution - No information was provided.

3.2 Users and uses - No information was provided.

3.3 Current condition and limitations - No information was provided.

3.4 Critical success factors - No information was provided.

4. 0 Digital Maps

The following digital maps with a national coverage are available.

Table 3: Available Digital Maps

Theme[1]	***Input scale***	***Year produced***	***Datum***	***Projection***	***Primary source***
Landslide, rock fall	1:25 000	1978	NAD 27	TM[2]	OAS, Physical Planning Division
Contours	1:25 000	1988	GS8 Astro	TM[2]	Physical Planning Division
Beaches	1:25 000	1988	GS8 Astro	TM[2]	
Vegetation	1:25 000	1984	GS8 Astro	TM[2]	OAS, Physical Planning Div.
Soils	1:25 000	1972	GS8 Astro	TM[2]	David Lang, Physical Planning Div.
Roads	1:25 000	1988	GS8 Astro	TM[2]	Lands & Surveys Division and Physical Planning Division
Rivers	1:25 000	1988	GS8 Astro	TM[2]	
Rainfall	1:50 000	1978	GS8 Astro	TM[2]	Physical Planning Division
Electricity lines	1:50 000	unknown	GS8 Astro	TM[2]	DOMLEC[3] and Physical Planning Division
Schools	1:25 000	1988	GS8 Astro	TM[2]	Min of Education and Physical Planning Div.
Settlements	1:25 000	1992	GS8 Astro	TM[2]	Physical Planning Division
Ports	1:25 000	1988	GS8 Astro	TM[2]	Min. of Agriculture and Physical Planning Division
Quarries	1:25 000	1988	GS8 Astro	TM[2]	Physical Planning Division

Note 1: Data themes have the following file formats: .vec and .veh formats are from SPANS software and .shp format is from ArcView software
Note 2: TM: Transverse Mercator
Note 3: DOMLEC: Dominica Electricity Company

5.0 Conclusions and Remarks

The survey revealed that hazard maps have been prepared for landslides, but that the map needs updating and should be at a more detailed scale than 1:50 000. The volcanic hazard maps are being used for community disaster

management for all communities in southern Dominica. The multiple hazard map is used by the communities that produced them. There is no knowledge or use of the flood hazard maps for the Roseau River Valley, though they were produced in 2002.

A search on the Internet indicated that a project on *Wave Hazard Assessment for Selected Sites on the West Coast of Dominica* was done by Ross Wagenseil and Charles C. Watson Jr. (Watson Technical Consulting, Inc.) in 1996 for Caribbean Disaster Mitigation Project (CDMP) implemented by the Organization of American States Unit of Sustainable Development and Environment for the USAID Office of Foreign Disaster Assistance and the Caribbean Regional Program. Persons interviewed did not mention these projects.

Also, Dr. Rogers of UWI prepared a GIS model for the analysis of the flood hazard posed by the landslide in the Layou River valley in 1999 as part of CDMP's post-disaster mitigation project. A report of this project could not be located. However, an officer from the Office of Disaster Management will be forwarding to the National Document Centre a copy of the report when it is located.

The existing Geographic Information System/Environmental Planning project in Dominica has also been refocused, where possible, to support response to the landslides and landslide dams in the Layou River valley (CDMP Progress Bulletin, December, 1999). In discussion with the GIS Officer at the Physical Planning Division, there was no follow-up work on landslides in the Layou River valley at the Division.

A request for any documents on Hazard mapping was placed with the National Document Centre, which forwarded a link to the report *Wave Hazard Assessment for Selected Sites on the West Coast of Dominica* at http://www.oas.org/en/cdmp/publist.htm

The Centre also forwarded a link to the report on the *Vulnerability Assessment to Sea-Level Rise resulting from Climate Change* in a document entitled ***"****Commonwealth of Dominica Initial National Communication Under the United Nations Framework Convention on Climate Change"* submitted by Dominica's Environmental Coordinating Unit, Ministry of Agriculture and the Environment. The entire document is available at http://unfccc.int. Under the section: http://unfccc.int/resource/docs/natc/domnc1.pdf

Additional information found on the Internet revealed that seismic hazard maps were done for the Windward Islands. Also a pilot project was undertaken for vulnerability reduction of schools in Dominica by the CDMP. The relevant documents can be found at http://www.oas.org/en/cdmp/publist.htm

References

Caribbean Disaster Mitigation Project(CDMP) 1996. Wave Hazard Assessment for Selected Sites on the West Coast of Dominica, West Indies.

CIA Fact Book, 2003. http://www.cia.gov/cia/publications/factbook/

Seismic Research Unit, 2000. Volcanic Hazard Report for Southern Dominica: Interpretation of 1998-2000 earthquakes and Hazard Mapping Results. Report submitted to the government of Dominica.

Electronic References

http://www.oas.org/en/cdmp/publist.htm
http://unfccc.int/resource/docs/natc/domnc1.pdf
http://www.cia.gov/cia/publications/factbook/
http://www.oas.org/en/cdmp/publist.htm

Appendix 1: List of Persons interviewed on 13-14 August 2003

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