



STATUS OF HAZARD MAPS VULNERABILITY ASSESSMENTS AND DIGITAL MAPS

TURKS AND CAICOS ISLANDS 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: Turks & Caicos Islands

1.0 Introduction

1.1 Physical and socio-economic background

Turks and Caicos are two island groups in the North Atlantic Ocean, southeast of The Bahamas, north of Haiti. Their geographic coordinates are 21°45"N, 71°35" W. The highest point is the Blue Hills, 49 m. The islands' total area is 430 sq km. There are 40 islands of which, only 8 are inhabited.

The climate of the islands is tropical marine, moderated by trade winds, sunny and relatively dry. The terrain, however, is low, covered with flat limestone, extensive marshes and mangrove swamps. Natural resources consist of spiny lobster and conch.

Approximately 98% of the land is used for other purposes while 2.33% is considered to be arable land. The main contributors to GDP are the fisheries, tourism and offshore financial services industries. The fisheries industry is to some extent constrained due to the Conference on International Trade in Endangered Species (**CITES**) quota which limits the export of conch. This was done to ensure that the resource is used in a sustainable manner.

According to 1990 estimates, 4,848 persons make up the islands labour force. About 33% are employed by the government; 20% in agriculture and fishing and there are significant numbers in tourism, financial, and other services. In 1997, it was estimated that 10% of the labour force was unemployed.

Estimates for July 2003 show that 19,350 persons occupy the island. Ninety-eight percent of the population is literate. Estimates for the same year show a population growth of 3.14%. The definition used for literacy is those persons aged 15 and over has ever attended school.

1.2 Major Disaster Issues Confronting the Country

The major hazard faced by the Turks and Caicos Islands (TCI) is hurricanes. The islands are located within the hurricane belt and their low lying nature make them very vulnerable to the effects of hurricanes and tropical storms such as wind damage, inland flooding and coastal surge. The islands also have to address the issue of overuse of natural resources. Growth in tourism, sports fishing, scuba diving and boating are endangering coral reefs and the seafood industry.

2.0 Hazard Mapping Initiatives

Even though hazard mapping has not been undertaken in a large scale in TCI, the awareness of its importance is growing. A flood hazard map has been prepared in Turks and Caicos Islands (TCI). Table 1 shows the details of hazard map. Seismic and storm hazard maps have been prepared for TCI at the regional scale.

Table 1 – Hazard Maps in TCI

Type	Purpose	Coverage	Scale	Date produced	Primary sources	Authors
Flood	To inform all development planning.	Grand Turk	1:5,000 1:10,000	1999	PD & DDME	PD & DDME
Seismic	To map general level of earthquake hazard in the Caribbean in the terms of the Modified Mercalli Scale and PGA and SGA values	Island wide; as part of the Windward Islands	0.25° grid resolution	1999	Seismic Research Unit	Seismic Research Unit
Seismic	To map Horizontal Ground Acceleration; Expected Maximum Mercalli Intensity; and Horizontal Ground Velocity	Island wide; as part of the Windward Islands	0.25° grid resolution	1999	OAS/US DE/CDMP	Seismic Research Unit

PD: Planning Department

DDME: The Department of Disaster Management and Emergencies.

2.1 Methods of preparation and distribution

2.1.1 Seismic Hazard Maps

A search on the Internet revealed that two sets of seismic hazard maps were prepared for TCI, 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. TCI falls into Moderate Hazard category of earthquake intensity on the MM scale. The Seismic Research Unit will update the MM maps, and the PGA and SGA maps in the near future.

The methodology for arriving at the *Eastern Caribbean Seismicity* seismic hazard maps for TCI, 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 TCI. 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 TCI, 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>

2.2 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.

Table 2, provides the list of users and uses of the flood hazard map.

Table 2 – Hazard Maps in TCI

<i>Users</i>	<i>Uses</i>
Planning Department	Identification of vulnerable areas, zoning, granting of development permissions, distribution of services and facilities.
DDME	Identification of vulnerable areas; prioritising preparedness planning, community awareness, informing the national mitigation/risk reduction strategy.
Public works	Protective infrastructure and physical mitigation (drainage, Sea-walls, culverts, location and design of infrastructure).
Public Health Department	Location, type, size and location of facilities. Capacity development
Red Cross/NGO	Preparedness and response planning; prioritisation of assistance (emergency and developmental)
Emergency services	Preparedness planning and response
DCENR	Sensitive areas, development impacts
Private Sector	Investment vulnerability, design, resilience
General Public	Risk awareness, protection, preparedness, safety standards
All Government agencies	Risk awareness, protection, preparedness, safety standards

DCENR: Department of Conservation, the Environment and Natural Resources

2.3 Current condition and limitations

No information was provided on the current condition and limitations of the flood hazard study.

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

2.4 Critical success factors

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

2.5 Respondents

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3.0 Vulnerability assessment studies

The visit was informed of the first vulnerability assessment being initiated. There is an ongoing negotiation with Smith Warner International for the conduct of a comprehensive Hazard and Vulnerability Analysis. The following hazards will be analysed: hurricane winds, storm surge, and inland flooding. This project is expected to be completed by the end of this year.

The first vulnerability assessment is currently being initiated. There is an ongoing negotiation with Smith Warner International for the conduct of a comprehensive Hazard and Vulnerability Analysis. The following hazards will be analysed: hurricane winds, storm surge, and inland flooding. Negotiation for the project is been concluded and it is expected to be completed by the end of this year.

3.1 Methods of preparation and distribution

TCI 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. A brochure entitled *Wise Practices for Coping with Beach Erosion: Turks and Caicos Islands* can be found URL:

<http://www.unesco.org/csi/act/cosalc/brochtur.htm>

3.2 Users and uses

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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

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

4.0 Digital Maps

Table 3 provides the list of digital map data available at TCI.

Table 3: Digital maps Available

<i>Theme</i>	<i>Input scale</i>	<i>Year produced</i>	<i>Coverage</i>	<i>Primary source</i>	<i>Format</i>
Census	unknown	2001	Territory wide	PD	Shapefile
Flood	1:5,000	1999	Grand Turk	PD	AutoCAD
Contours	unknown	unknown	Grand Turk	LSD	AutoCAD
Land use		unknown	Grand Turk	PD	AutoCAD
Vegetation		1987	Grand Turk	UNDP	AutoCAD
Roads		unknown	Grand Turk	LSD/PD	AutoCAD
Buildings		2002	Grand Turk	LSD	AutoCAD
Bridges/Culverts		unknown	Grand Turk	PWD/LSD	AutoCAD
Electricity lines		2003	Grand Turk	TCIU	AutoCAD
Telephone lines		2003	Grand Turk	C&W	AutoCAD
*Social facilities		2001	Grand Turk	PD	AutoCAD
Economic facilities		unknown	2001	Grand Turk	PD
Water lines	2002		Grand Turk	PWD	AutoCAD
Aerial photographs	2001		Grand Turk	LSD	GeoTIFF
Contours	1:10,000	unknown	Grand Turk, South Caicos, Providenciales, North Caicos, West Caicos, partial Salt Cay, partial Middle Caicos	PD	Shapefile
Buildings	1:10,000	unknown		PD	Shapefile
Water features	1:10,000	unknown		PD	Shapefile
Cadastral parcels	1:10,000	unknown		PD	Shapefile
Land Uses	1:10,000	unknown		PD	Shapefile

List of Abbreviations:

- PD: Planning Department
- LSD: Land and Surveys Department
- PWD: Public Works Department
- TCIU: Turks and Caicos Utilities
- C&W: Cable and Wireless
- UNDP: United Nations Development Programme

Datum: Clark 1866

Map projection: Transverse Mercator

5.0 Conclusion and Remarks

TCI is at its infancy with regards to hazard mapping, vulnerability assessment, and production of GIS digital map. The need for these tools is being realised and efforts are being made to improve the current situation.

Seismic and storm hazard maps have been produced for the island as part of the Caribbean region. Vulnerability and mitigative assessments were done for beach erosion on selected sites the islands of TCI.

Appendix

Below is the list of members of the partnership committee who attended a meeting organised for this survey by the Director of Disaster Management and Emergencies.

Name	Agency	Position	Telephone
Ms. Mahala Wynns	Disaster Management & Emergencies	Director	1-649-946-2702 ext. 10313
Dorothy Clarke		Deputy Director	1-649-946-4521
Alpheus Smith		Assistant Deputy Director	1-649-946-2061
Roger Bellers	Dept. for International Development, Overseas Territories Unit	Adviser	1-649-946-1425
Lisa Lightbourne	Economic Planning & Statistics, DEPS	GIS technician	1-649-946-2801
Demarco Williams	Lands and Survey Dept.	LIS Officer	1-649-946-2801
Dainer Lightbourne	Dept. of Planning	Assistant Planning Officer	1-649-946-2801, ext 11404
Arlene Dixion		Director	1-649-946-2801, ext 11402
Elizabeth Mwakosya		Assistant Director	1-649-946-2801, ext 11403
Silvia Erin		Land Use Planner	1-649-946-2801, ext 11406
Leon Edwards	Dept. of Public Works	Principal Engineer	1-649-946-2526