

The Anthropogenic Variable in Hydro-meteorological Risk in the Dominican Republic

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Introduction

Climate change, disaster, and an altered environmental landscape are now at the forefront of major global challenges to be addressed by multilateral agencies and organizations throughout the world. However, since the 1980's, disaster mitigation has been a growing priority at both the Organization of American States (OAS) and The General Assembly of the United Nations (UN); so much so that the 1990's were designated as the International Decade for Natural Disaster Reduction (IDNDR). The 1994 Yokohama Conference bisected the UN-led, decade-long effort from which sprang forth a series of strategies to incorporate social vulnerability into the technology-oriented risk assessment models previously promoted to both national and sub-national governments abroad.

The International Strategy for Disaster Reduction (ISDR) has since carried on the IDNDR's work and conducted an assessment of the Yokohama framework at the World Conference on Disaster Reduction held in Hyogo in 2005. The Hyogo Conference identified five major areas to be improved and adopted the Framework for Action 2005-2015. Particular consideration was paid to less developed countries and small-island developing States.

The Yokohama and Hyogo Conferences have led to simultaneous emphases on national legislative and institutional frameworks and community participation, education, and grass-roots risk assessment strategies at the local level.

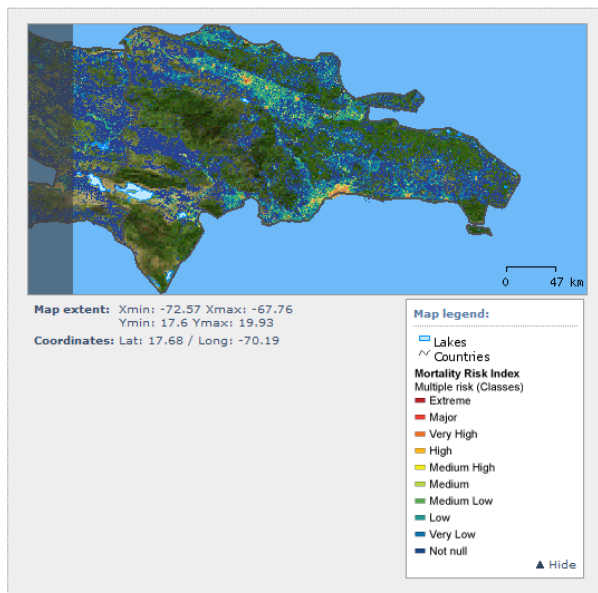
From within these contexts, this paper will examine the human role in both exacerbating and mitigating for risk and vulnerability related to hydro-meteorological events in the Dominican

Republic through research on the incorporation of disaster mitigation and reduction policies at the national, sub-national and local levels.

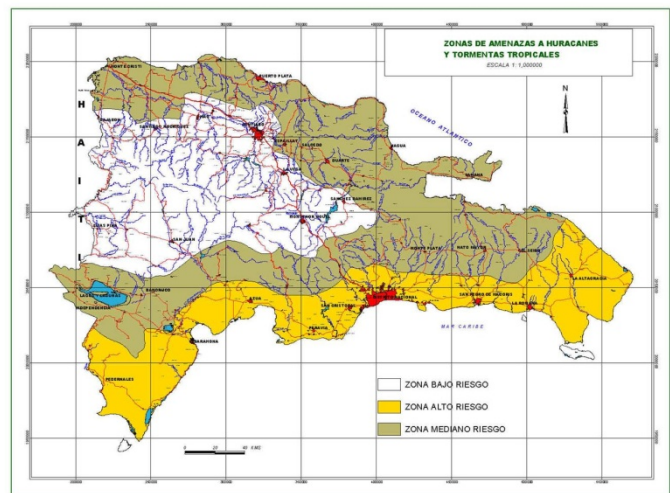
Hydro-meteorological Risk in the Dominican Republic

The Dominican Republic is located in the Caribbean Sea, occupying approximately two thirds of the Island of Hispaniola. The country has a population of approximately 10 million inhabitants, with a 69% urbanization rate (CIA Factbook). Four central mountain ranges and diminishing tropical forests create a rugged terrain; with the 3,175 meter Pico Duarte as the country's highest point, sloping down to beaches and coastal provinces. The lowest point in the country is Lake Enriquillo, which is 46 meters below sea level (Intervention). Traditional economic drivers include agricultural production and coffee and sugar exports; however, tourism has been a fast-growing industry and recently overtook agriculture as the leading employer. A 2005 World Bank Report on *Natural Disaster Hot Spots* lists the Dominican Republic as third on the global list of hot spots with 94.7% of the population and 95.6% of the Gross Domestic Product (GDP) production in areas at risk of two or more natural hazards (Pan American Development Foundation). This is not difficult to understand when considering that the country, which is roughly equivalent in size to twice the size of New Hampshire, has over 400 rivers and 60 drainage basins (Intervention). The country's location in the hurricane belt, size and topography contribute to its long history of risk to natural hazards and leaves it especially vulnerable to storms and flooding from June to October of each year (CIA Factbook).

Approximately one third of the population lives in the area of Santo Domingo, the capital city. According to global risk data, Santo Domingo is also the area of greatest risk for natural disasters.



Source of data: 2009 Global Assessment Report
Data displayed does not imply national endorsement



Dominican Republic Risk Maps. Source: PREVIEW Global Risk Data. PreventionWeb and ISDR Prevention Presentation

The country was confronted with the severity of this risk approximately ten years ago when Hurricane Georges struck the Dominican Republic on September 22, 1998, killing over 200 people and leaving over half the country's population affected by the intense damage caused by the sixteen-hour long storm (Department of Commerce 2002). Hurricane winds reached 130 miles per hour, and the size of the storm at one point covered seventy percent of the country's area (Department of Commerce 2002). Landslides and flooding plagued the country and caused losses estimated at two billion US dollars. Tropical storms Olga and Noel in 2007 reminded residents once again of the nation's inextricable relationship to hydrologic events.

International and US Intervention

After the hurricane season of 1998, the United States Agency for International Development (USAID) contracted with thirteen U.S. Government Agencies for international disaster recovery efforts related to Hurricanes Mitch and Georges, with the countries of Honduras, Nicaragua, Guatemala, El Salvador, and the Dominican Republic targeted for reconstruction efforts (Department of Commerce 2002). Of these, the Department of Commerce

received \$17.1 Million for the participation of the National Oceanic and Atmospheric Administration (NOAA), the National Institute of Standards and Technology (NIST), and the International Trade Administration (ITA), which are bureaus of the Department (Department of Commerce 2002).

Some of the principle duties of the Department under this program were to improve geodetic networks, improve hydro-meteorological networks, implement training programs and improve tide stations and develop satellite capabilities, with the satellite functions based out of a central site in Costa Rica. The program also focused heavily on technology-based forecast and early warning systems, such as improving the flood warning network, establishing flood forecast systems, developing strategic plans and developing a regional climate prediction system (Department of Commerce 2002). A transnational watershed management program was even implemented. However, none of these activities took place in the Dominican Republic. Instead, activities on the island nation included disaster preparedness and response training and activities aimed at building “sustainable, resilient coastal communities” (Department of Commerce 2002).

The Office of U.S. Foreign Disaster Assistance (OFDA) within the USAID conducted a two-phased, detailed, local-level disaster mitigation project in the provinces of Barahona and San Pedro de Macoris from August 23, 2000 to July 31, 2002 (USAID 2002). The project was led in conjunction with the *Asociacion Dominicana de Mitigacion de Desastres* (ADMD) and was designed to be a “community based disaster preparedness technical assistance project” for sixteen communities that were considered to be both at high risk of disaster impact, in the form of hurricanes, and especially vulnerable due to high poverty levels and lack of Civil Defense, Red Cross and other preparedness organizations. Hurricane Georges had hit these communities

particularly hard in 1998, and mitigation intervention was a natural response as their location on the coast makes a repeat impact highly probable.

The project had several objectives, as detailed in Figure 1, however they all related to the key concepts of awareness, preparedness, and structural mitigation. Community members were trained in structural mitigation techniques for housing, such as installing hurricane straps for roofs, identification of critical infrastructure, and were even exposed to structural mitigation guidance from FEMA via the FEMA manual. Community Emergency Committees were formed in order to identify sheltering facilities, conduct hurricane simulations, and prepare emergency response plans accordingly.

These activities were born of previous long-term mitigation programs carried out in the country by external organizations. The USAID and the Organization of American States (OAS) implemented the Caribbean Disaster Mitigation Project (CDMP) from September 1993 to December 1999 in order to establish “sustainable public/private disaster mitigation mechanisms that measurably lessen loss of life, reduce potential damage, and shorten the disaster recovery period” in an eleven country area (OAS Website). Approximately \$5 million was allocated to the program.

Figure 1:

Below is a list of objectives for a USAID funded mitigation project led by the ADMD.

The objectives were:

- “a) Identification and marking of structures suitable for use as temporary shelters;*
 - b) Identification and marking of structures suitable for use as temporary storage of assistance items;*
 - c) Identification and marking of flood levels and/or unstable slopes;*
 - d) Structural Mitigation and Retrofit Techniques to reduce the vulnerability of roofs, doors and windows*
 - e) Awareness campaigns in the communities integrating existing social, professional, business and other groups, as well as the schools.*
 - f) Hold a practice hurricane simulation to practice and improve the Community Disaster Mitigation Plan.*
 - g) Coordinate and supervise the community's identification and implementation of a retrofit project for at least one structure suitable as a community shelter {in} each of the two pilot areas.*
 - h) Coordinate and assist community access to food rations and building materials available through agencies such as the World Food Program and the Presidential Commission to Support Neighborhood Development.”*
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The program goals were:

- 1) Conduct pilot activities with collaborating public and private sector partners to promote acquisition and application of disaster mitigation skills, techniques, and methodologies.
- 2) Increase the pool of public and private sector professionals in the Caribbean region with disaster mitigation skills.
- 3) Incorporate mitigation activities in post-disaster reconstruction and recovery programs.

Of the six project measures linked to the achievement of the program goals, only one of them relates to community participation. The other five were weather-based technology or development sector related. Within each of these primary areas, activities were further broken down into “activity streams.”

These were:

- Mitigation Policy and Planning
- Community Based Preparedness and Prevention
- Vulnerability and Risk Audits
- Building Standards and Housing Retrofits
- Hazard Assessments and Risk Mapping
- The Insurance Industry

Figure 2:

Department of Commerce objectives in Hurricane Mitch and Hurricane Georges Reconstruction Program: (lettering and capitalization by author)

“a) Provide key infrastructure elements;

b) Develop much needed hydro-meteorological forecasting and early warning systems;

c) Help promote more sustainable, resilient uses of coastal resources;

d) Help build local and regional capacity for coastal hazards and mitigation;

e) Develop guidance for improving the construction of houses and assessing construction of critical facilities;

f) Encourage disaster-resilient economic revitalization”

- Post-Disaster Recovery Mitigation
- Development Finance Institutions, and
- Training and Information Dissemination

The vulnerability and risk audits, building standards and retrofits, and hazard assessment and risk mapping streams were met with limited success and the program review team estimated that they would likely not be continued, or only be continued with external donor assistance, by the governmental institutions in the various participating countries. The risk audits had greater success with the hotel industry than with governments, purportedly due to lack of governmental resources. In fact, the program strove to incorporate private business interests in efforts to compensate for weak governmental institutions and create a driving force for mitigation efforts within the national context. The national context was used for the majority of the program countries due to their small size, however an examination of the role of local governments was recommended as countries grow in population and decentralize.

Because of the limited governmental resources, the program was structured in efforts to augment governmental activities. Driving forces external to the government structure were sought in order to foment a political commitment to mitigation processes. Participatory programs and community involvement were seen as a relatively new, key angle towards achieving this. In its review of the program lessons learned, the community based preparedness and prevention activities in the Dominican Republic were touted as amongst the most successful of the regional program and were recommended as an area of emphasis for future USAID programming.

To perform the activities in the Dominican Republic, the CDMP created the Dominican Disaster Mitigation Association (DDMA) (in Spanish, *Asociación Dominicana de Mitigación de Desastres* (ADMD)). Aside from the CDMP, the Disaster Mitigation Program of the Humanitarian Aid Department of the European Community (DIPECHO) and Plan International also provided funding. The DDMA functions as a non-governmental organization (NGO) based on coordination, information provision, community education, community initiatives, and training activities aimed at disaster mitigation.

The Association is comprised of the following five major organizations: Food For the Hungry International, World Vision International, the Dominican Society of Seismology and Seismic Engineering (SODOSISMICA), the Dominican Association of Free Zones (ADOZONA) and Participación Ciudadana. Several companies also participated, as well as institutions such as UNICEF, ASONAHORES, the International Federation of the Red Cross and Red Crescent Societies, ADRA, the Dominican Red Cross, the Dominican Civil Defense and the Dominican Armed Forces (OAS website). This assortment of participating institutions and public and private interests necessitates a strong emphasis on coordination.

The community education activities focused on the formulation of Community Emergency Committees and Community Emergency Plans, led by the Red Cross through workshops in over 700 communities, which were credited with successful evacuation and recovery efforts during Hurricane Georges. The community infrastructure initiatives are of particular interest, however, because they focus on a combination of education, community building, and self-help infrastructure improvements. These small-scale infrastructure improvements are mostly aimed at reducing water-related hazards through mitigation. They are heavily oriented towards drainage improvements such as cement ditches, containment walls, and embankments. The DDMA

purchased construction materials and provided technical assistance while the communities provided voluntary labor to implement the project.



After and before pictures of community led mitigation projects in Santo Domingo. Source: OAS CDMP

National Response Framework

The national response framework is led by the Civil Defense (*Defensa Civil*) of the Dominican Republic. The Civil Defense, created in 1966, functions as the primary agency for civil protection and risk reduction. They are the first responders in terms of

evacuation and rescue in times of emergencies and also serve to coordinate disaster recovery efforts, including those that may involve the armed forces.

The National Commission for Emergency Planning (*Comision Nacional para el Plan Nacional de Emergencia*) was created in 1981 in order to establish the National Emergency Plan. The Commission, led by the Director of the Civil Defense, also has the legislative authority to create and submit proposals, budget requests, and relevant standards for emergency and mitigation activities.

Local Knowledge and Community-Based Mitigation

A 1982 article by Susan Jeffrey pointed out particular areas of concern in the Santo Domingo area, specifically mentioning the lowlands along the Ozama River and the “steep ravines at the northern extremity of the city” (Jeffrey). Agricultural workers had begun to be

forced out of the sugar and coffee growing areas by deforestation caused in part by the large scale cattle ranching legacy of the Trujillo period and the aggregation of land under market forces post-Trujillo. As in many other countries with similar histories, landless farmworkers began their migration to the city in search of economic opportunity, and Jeffrey noted that these risky vulnerable areas had begun to be occupied.



Santo Domingo. Source: Ayuntamiento del Distrito Nacional

slopes are also densely populated with informal settlements built on unstable land, often in or along creeks and drainage basins.

The Technical Secretary of the Council for the National District of Santo Domingo has begun efforts at implementing lasting participatory planning processes in the areas of the Ozama and Isabel Rivers (Ayuntamiento del Distrito Nacional). These plans focus on an integrated approach to improvement in living conditions, and include mitigation efforts such as conversion to park space, but also address contributing risk factors such as solid waste disposal issues that

A large portion of the land along the Ozama, known as La Cienaga, now consists of densely populated informal settlements that have been the focus of countless mitigation efforts led by a variety of the programs listed in this paper. The northern slopes that Jeffrey mentioned are now part of the new municipality of Santo Domingo Norte, recently formed in order to address the outsized footprint of Santo Domingo proper. Those

plague the region. The inclusion of a solid waste focus is incorporated as a quality of life improvement, yet it is also critical to reducing risk of flooding as much of the existing drainage ditches and natural waterways often clog with poorly disposed of waste.

What Does the Future Hold?

In a June 2009 presentation to the Global Platform for Risk Reduction in Geneva, Dominican Vice President Rafael Albuquerque stated, “...*hemos podido confirmar el hecho de que los efectos de los desastres son al mismo tiempo la causa y la consecuencia de la pobreza...*” (“...we have been able to confirm the fact that the effects of disasters are at the same time the cause and consequence of poverty”) (Albuquerque).

Because of this, recovery after tropical storms Olga and Noel included the formation of paid work brigades to perform debris removal, road clearance, and vector control. Affected families participating in the work program became temporary beneficiaries of a larger social welfare program called *Solidaridad* (Solidarity) which provides conditional cash transfers to families living in poverty in return for meeting educational and health benchmarks in order to encourage the formation of long-term social capital. The Solidarity program has been replicated from Mexico and Brazil, where it has been highly incorporated into the national development framework. After the six-month temporary recovery period had passed, over 90% of the families were incorporated into the program as regular beneficiaries (Albuquerque).

Albuquerque also stated that the National Council for Disaster Prevention, Mitigation and Response and its component functions such as the National Emergency Commission are in support of the Hyogo Framework and working to achieve the goals pursuant to it. The Council and its twenty-two senior level members represent the different government ministries and heads

of state and form the National Platform on under which the Hyogo goals are housed. In addition to the efforts of the Council, Decree Number 601-08 created the National Counsel for Climate Change and Clean Development Mechanisms which aims to create public policy limiting greenhouse gas emissions (Albuquerque).

Appendix

Dominican Republic Natural Disasters from 1980 - 2008

Overview

No of events:	40
No of people killed:	1,446
Average killed per year:	50
No of people affected:	2,655,426
Average affected per year:	91,566
Economic Damage (US\$ X 1,000):	2,557,130
Economic Damage per year (US\$ X 1,000):	88,177

Top 10 Natural Disasters Reported

Affected People

Disaster	Date	Affected (no. 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

Source: Prevention Web. Source of data: "EM-DAT: The OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels, Bel."

Data version: v11.08

Killed People

Disaster	Date	Killed (no. of people)
Flood	2004	688
Storm	1998	347
Storm	2007	129
Storm	2007	33
Storm	1996	24
Flood	1981	20
Epidemic	1992	20
Flood	1993	18
Epidemic	1999	16
Flood	1985	12

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

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