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ASSESSING COMMUNITY-SCALE DAMAGE,
DISRUPTION, AND EARLY RECOVERY IN
POST-EARTHQUAKE HAITI

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Assessing Community-Scale Damage, Disruption, and Early Recovery in Post-Earthquake Haiti

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EXECUTIVE SUMMARY

This report describes research on community-scale damage and disruption in Haiti after the devastating January 12, 2010, earthquake. Data collection was undertaken with support from the National Science Foundation through RAPID grant no. CMMI-1034876. The project had three specific objectives: (1) to gather perishable data on physical damage and disruption, (2) to document and analyze post-earthquake disruption, including its relationship to damage, and (3) to test a new tool and measurement scale for documenting disruption.

The study gathered multiple types of quantitative and qualitative data to assess damage and disruption in the early recovery timeframe. Data included satellite and aerial imagery, GPS-referenced street-view video and still photography using the VIEWS™ system, and data from semi-structured interviews and community meetings. Fieldwork in Haiti was conducted by an eight-member team from 6 to 16 May, 2010, some four months after the earthquake. The study focused on seven communities in the earthquake-affected area: Bel Air, Delmas-32, and Martissant within Port-au-Prince, and Grand Goâve, Gressier, Léogâne, and Petit Goâve outside of Port-au-Prince. Information on disruption in these communities pertained to eleven sectors: drinking water, energy/fuel/utilities, sanitation, education, health care, shelter, food and food-preparation items, livelihood, safety, social networks, and clearing of earthquake debris.

Analysis of damage focused on buildings identified as being heavily damaged or collapsed by the Global Earth Observation Catastrophe Assessment Network (GEO-CAN) assessment of pre- and post-earthquake aerial imagery. Those buildings were individually assessed on a seven-point scale designed to measure physical reconstruction during early recovery. Damage rates in the seven case study communities varied from 2% to 21% of buildings being either heavily damaged or collapsed. Approximately 3-5 months after the earthquake, nearly half of these buildings (48.7%) remained unchanged. Only 1.5% had been partly or completely rebuilt, with the remainder in various states of demolition or rubble removal. Of the case communities, Delmas-32 had made the most progress, with 3.5% of damaged buildings rebuilt or under construction, and only 18.1% unchanged. Léogâne had made the least progress, with 1.0% rebuilt or under construction and 60.0% unchanged. Variations in reconstruction rates across communities did not appear related to initial damage rate, number of pre-earthquake buildings, or location in or outside of Port-au-Prince.

Analysis of disruption was based on data from interviews and meetings. In each of the seven case study communities, meetings took place in group settings with 8~22 participants, including community leaders, representatives, and residents. In these meetings, participants were asked to rate and discuss the availability (i.e., status) of each of the eleven sectors (e.g., drinking water) for their community at four different points in time: (1) prior to the earthquake, (2) immediately following the earthquake, (3)

one month after the earthquake, and (4) four months after the earthquake (i.e., at the time of the meeting/interview). Ratings followed a seven-level constructed scale. As a complement to the community perspective, 19 interviews were conducted with local and international NGO staff and community development practitioners. Interviews were also conducted with representatives of government utility agencies in charge of electric power, solid waste, and storm drainage canals and roads.

The raw data on sector ratings suggest several overall observations. First, even before the earthquake, conditions were poor. The average rating across all services and communities was 3.8 on the scale that ranged from 1 (=No availability) to 7 (=Full availability). This corresponds to slightly less than “Moderate availability,” defined as “available to some who need it, though may be inconsistent or of moderate quality.” Comparing across sectors, pre-earthquake average ratings ranged from 2.6 for health care (Minimal to Poor availability) to 5.1 for social networks (Good availability). Comparing across communities, pre-earthquake average ratings are consistently low, ranging only from 3.2 to 4.4 (Poor to Moderate).

Second, immediately after the earthquake, these already poor conditions deteriorated substantially. Across all communities and sectors, the average decline in service availability was -1.7 (on the 7-level scale). For individual communities, declines ranged from -0.9 to -1.9. The largest deteriorations were experienced in shelter (-3.1) and education (-3.0). Social networks was the exception. In four communities, residents indicated that social networks actually improved immediately after the earthquake.

Four months after the earthquake, improvements were uneven across sectors. Health care, drinking water, education, and energy were being restored in most of the study communities. Shelter and livelihood, however, had not improved significantly since the earthquake. Sanitation, food, and debris removal were also lagging. Safety and social networks had worsened compared to conditions immediately after the earthquake. Conditions four months after the earthquake were for the most part deteriorated in relation to the pre-disaster situation; however, health care had improved in 5 of the 7 communities.

Sectoral conditions can be summarized as follows:

Drinking water - Access to clean drinking water was a significant problem in Haiti prior to the earthquake. Particularly in rural areas outside the capital and in poor sections, water was not easily accessible. In the aftermath of the earthquake, there were significant changes due to the reduction in distribution infrastructure and the free provision by NGOs. By May 2010, the system had generally stabilized and returned to pre-earthquake levels of service.

Energy/fuel/utilities - In most communities, electric service was inconsistent and unpredictable before the earthquake due to an old, unreliable system, a substantial problem of stolen electricity, and low collection rates. Immediately after the earthquake, all communities in southern Haiti had no power for almost a month. By four months after the earthquake, most communities had approximately half the level of service they had had pre-earthquake. For those poorer communities that had worse service before and after the event, electricity was not a priority since the citizens did not rely on it in any case.

Sanitation - Port-au-Prince and the surrounding districts have had many historic problems with sanitation. A significant amount of waste ends up in the canals, causing flooding during the rainy season. The earthquake exacerbated the problem. Additional money coming in temporarily relieved the stress on the system, but both the systemic and earthquake-caused issues remain, leading to a decrease in levels of service by May.

Education - The biggest challenge with education in Haiti before and after the earthquake was the lack of public education and the cost of private schools. The earthquake destroyed many schools and increased the cost of attendance, leading to even fewer students being able to afford classes.

Health care - Health care was very poor prior to the earthquake and much of the infrastructure was damaged in the earthquake. However, NGOs had focused on improving health care, and as a consequence, communities noted a significant rise in service since the earthquake. It was not clear whether this would be a temporary or permanent improvement.

Shelter - Overall, the shelter situation remained significantly disrupted in May 2010. There was a need for an appropriate strategy to return homeowners to those homes that were structurally stable, and to begin acquiring land for transitional housing.

Food and food-preparation items - In general, the availability of food returned to pre-earthquake levels within four months; however, access to food, rather than availability, is the larger issue. The largest impact of the earthquake on the food system could be its long-term impacts on rural farmers. The need to feed urban migrants to rural communities after the earthquake contributed to depletion of subsistence farmers' seed stocks and capital.

Livelihood - The earthquake worsened an already fragile livelihood support system. As of May, there was a need and also opportunity for creative and new solutions to invigorate employment options and improve livelihood conditions.

Safety - Safety was not a primary concern in the communities, except for some trepidation about prisoners who had escaped during the earthquake.

Social networks - Immediately following the earthquake, social networks were described as strong—neighbors helping neighbors and taking care of each other. As time passed, resources became increasingly scarce and a sense of independence emerged. At an extreme, this independence was described as competition. The earthquake did not necessarily compromise social networks. Rather, in many cases they were tested and reinforced. However, by May the strain of the aftermath of the earthquake was fostering a “look out for yourself first” reality that challenged the social fabric of place.

Clearing of earthquake debris - In May, the problem of earthquake debris was ubiquitous throughout Port-au-Prince and its surrounding areas. The responsibility to remove the debris and the plans to do so had not been made clear, and what little had been done has been mostly to public buildings and roads. Private residences were left largely untouched as of May.

Analysis of the relationship between physical damage and disruption focused on comparing across the case study communities and over time. No clear patterns were found. The relationship between disruption and damage is not linear and appears complex. No community was found to be evidently leading in early recovery. Immediate disruption and early recovery were not correlated with levels of earthquake damage and repair.

Several general conclusions can be drawn from this study. Collectively, these observations indicate that the extent, magnitude, and duration of community-level disruption caused by an earthquake or other natural disaster depend on many other factors besides the severity of physical damage. First, poor pre-disaster conditions were critical in determining disruption in the case communities. Indeed, the concept of disaster-induced “disruption” was challenged by examples of post-earthquake improvements in health care, safety, and availability of food provided as aid.

Second, in many ways, the earthquake was not a discrete event in terms of disruptive consequences, but was rather, simply one in a sequence of events. Hurricanes in 2008 combined with political instability, environmental degradation, population pressures, and a chronic lack of public resources had established pre-existing conditions where disruption was the norm. International aid workers, for example, had a persistent presence in Haiti before the earthquake.

Third, the concept of “disruption” does not adequately capture modes of adaptation to disaster situations. Socially, a culture of coping was evident: communities were accustomed to functioning despite disruptions.

Finally, as of May, many consequences of the earthquake were being deferred and were expected to lead to continued long-term suffering. Community members, aid providers, project partners, and service providers made consistent reference to examples of difficult choices made in the immediate and prolonged aftermath of the earthquake. Decisions that addressed a challenge for a specific time in effect transferred the consequences in space from one place to another or deferred them to a later time. For example, some families kept children out of school so that they could afford food and water. In rural communities, seeds stored for future growing seasons were instead used as food for residents and migrants displaced by the earthquake, thus eroding long-term food security.

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PROJECT TEAM

This RAPID project brought together a multi-disciplinary team with experience and expertise in earthquakes and international fieldwork in the aftermath of emergencies. The diversity of experience and skill sets is a strength the project partners were able to apply to this project in Haiti.

Beverley Adams is one of the founding directors of ImageCat, Inc. and Managing Director of their European Operations, ImageCat Ltd. Dr. Adams provides strategic direction and oversight to ImageCat's UK operations to enhance the firm's efficiency and productivity. Dr. Adams holds a Ph.D. from University College London, and is a respected authority in re/insurance risk management through the use of geospatial technologies. Dr. Adams has also served as an advisor to the UK Government, and provided briefings to the US White House and NASA on post-disaster damage and loss estimation.

Paul R. Amyx is a Programmer Analyst at ImageCat, Inc., where his primary focus has been the development of software systems that incorporate GIS visualization and analysis. Mr. Amyx graduated magna cum laude in June 2002 from the University of California at Santa Barbara, receiving his B.S. in Computer Science. Joining the company in 2004, his responsibilities at ImageCat have included application development, GIS analysis, system administration, and coordination of post-disaster field response. Mr. Amyx was a key part of the system development team during ImageCat's coordination of the Global Earth Observation Catastrophe Assessment Network (GEO-CAN) remote sensing damage assessment following the January 2010 Haiti earthquake.

John S. Bevington is a Senior Research Scientist and leads ImageCat's remote sensing research team from their European operations in London, England, where projects include systematic monitoring and evaluation of long-term recovery from the 2004 Indian Ocean tsunami, the 2005 Kashmir earthquake and several US hurricane events.

These projects have integrated remotely-sensed data with information gathered from official statistics, key informants and in-field situational assessments and social survey techniques. Dr. Bevington received his Ph.D. from the University of Southampton, where he studied post-disaster urban change using remote sensing and custom modeling. He has directed field reconnaissance teams to capture in-situ situational assessments of post-disaster response and recovery efforts following disaster events in Europe, North America and the Caribbean, and he has used remote sensing observations to assess post-disaster damage following separate events spanning five continents. He also played a central role in ImageCat's coordination of the Global Earth Observation Catastrophe Assessment Network (GEO-CAN) remote sensing damage assessment following the January 2010 Haiti earthquake.

Susan Brink is a Ph.D. student and NSF graduate fellow in Civil Infrastructure Systems at the University of Delaware. Her research focuses on modeling the long-term interactions between disasters and development. She has a Bachelor's degree in mathematics from the University of Florida and a Master's degree in Civil Engineering from the University of Delaware during which she did research on post-earthquake water supply restoration. Her international experience includes working with the Peace Corps in Tanzania and teaching English in South Korea. She has traveled to Haiti twice to research the impact and recovery from the January 2010 earthquake.

Stephanie E. Chang is a Professor at the University of British Columbia, Canada, with a joint appointment in the School of Community and Regional Planning (SCARP) and the Institute for Resources, Environment, and Sustainability (IRES). She holds a Canada Research Chair in Disaster Management and Urban Sustainability. Her specialty is in the socio-economic impact of natural disasters, particularly earthquakes. She co-edited a book called *Modeling Spatial Economic Impacts of Disasters* (2004) and has published extensively on loss estimation models for critical infrastructure systems, infrastructure interdependencies, economic evaluation of disaster mitigations, and urban disaster

recovery. Prof. Chang has recently served on the editorial boards of the journals *Earthquake Spectra* and *Papers in Regional Science*, and on the U.S. National Research Council's Committee on Disaster Research in the Social Sciences. She received her B.S.E. in Civil Engineering (1989) from Princeton University and Ph.D. in Regional Science (1994) from Cornell University.

Rachel A. Davidson is an Associate Professor of Civil and Environmental Engineering at the University of Delaware and a core faculty member of the Disaster Research Center. She conducts research on natural disaster risk modeling and civil infrastructure systems. Her focus has been on regional risk (e.g., city to national scope) and lifeline risk (e.g., electric power, water). Using optimization, simulation, and statistics, she has modeled earthquakes, hurricanes, urban fire, and ice storm risk, both to better characterize risk and to identify effective risk management decisions. Prof. Davidson has been a PI or co-PI on 17 research grants totaling \$5.56 million, including a National Science Foundation (NSF) CAREER award plus 8 others from NSF. Prof. Davidson has published more than 30 peer-reviewed papers in leading journals in the field, including *Risk Analysis*, *Journal of Earthquake Engineering*, *Journal of Infrastructure Systems*, *Earthquake Spectra*, and *IEEE Transactions on Power Delivery*. She is currently President-Elect of the Society for Risk Analysis (SRA), on the Executive Committee of the American Society of Civil Engineer's Technical Council on Lifeline Earthquake Engineering (TCLEE), and a mentor for the NSF-funded *Enabling the Next Generation of Hazards and Disaster Researchers* program. She has previously served on the National Research Council's Board on Infrastructure and the Constructed Environment, and on the Board of Directors of Engineers for a Sustainable World (ESW).

Ronald T. Eguchi is President and CEO of ImageCat, Inc., a risk management company specializing in the development and use of advanced technologies for risk assessment and reduction. Mr. Eguchi has over 30 years of experience in risk analysis and risk management studies. He has directed major research and application studies in these

areas for government agencies and private industry. He currently serves or has served on several Editorial Boards including the *Natural Hazards Review*, the *Journal on Uncertainties in Engineering Mechanics*; and *Earthquake Spectra*. He is currently a member of the National Research Council's Disaster Roundtable whose mission it is to identify urgent and important issues related to the understanding and mitigation of natural, technological, and other disasters. He is a past member of the Scientific Advisory Committee of the U.S. Geological Survey, a committee that reports to Congress on recommended research directions for the USGS in the area of earthquake hazard reduction. In 2006, he accepted an ATC Award of Excellence on behalf of the ATC-61 project team for work on *An Independent Study to Assess Future Savings from Mitigation Activities* that showed that a dollar spent on hazard mitigation saves the nation about \$4 in future benefits. He was recently recognized by EERI as the 2008 Distinguished Lecturer where he discussed the topic of "*Earthquakes, Hurricanes, and other Disasters: A View from Space*." He was also invited as a keynote speaker to the 14th World Conference on Earthquake Engineering, held in Beijing, China in 2008. He has authored over 250 publications, many of them dealing with the seismic risk of utility lifeline systems and the use of remote sensing technologies for disaster response.

Arleen A. Hill is an Associate Professor of Geography in the Department of Earth Sciences at the University of Memphis in Memphis, TN. Prof. Hill's research and teaching activities focus on environmental hazards and specifically on the impacts of catastrophic events on our society and environment. She is chiefly concerned with what makes people and places vulnerable to hazards and how community resilience can be established and sustained. Her research has been funded by the United States Geological Survey, US Department of Homeland Security/Federal Emergency Management Agency, National Science Foundation, Mid-America Earthquake Center, Oak Ridge National Laboratory, private foundations and local emergency management agencies and Memphis Police Department. Prof. Hill earned her doctoral degree in the Department of Geography at the University of South Carolina in 2002 and is a 2005-

2006 University of Memphis Early Career Research Award recipient and a finalist for the 2009/2010 Alumni Association Distinguished Teaching Award.

Matthew J. Honey plays a strong operational role in ongoing scientific research projects at ImageCat, Inc, targeting decision support needs at all phases of the disaster management cycle with the use of remote sensing technology from building resilience and preparedness, to post-disaster response and recovery. Mr. Honey has been responsible for managing many recent VIEWS™ field deployments for academic and insurance purposes to disaster events including Hurricane Katrina recovery monitoring (2010), the Xynthia Floods (France, 2010), Madeira mudslides (2010), Cumbria (UK) floods (2009). Mr. Honey has been involved in complex data development studies and processes for data management and delivery into the operational work flow of ImageCat's broad client base, focusing on solutions that are unique and useful in both the public and private sectors. Mr. Honey has a bachelor's degree in Remote Sensing and GIS from Bath Spa University, UK. He played a key role in the management of the Global Earth Observation Catastrophe Assessment Network (GEO-CAN) remote sensing damage assessment following the January 2010 Haiti earthquake.

Robin Mills is a Master's student in Planning at the School of Community and Regional Planning at the University of British Columbia, Canada. She has a background in food systems, international development, and socio-economic impact assessment. Ms. Mills has worked for non-governmental organizations and environmental consulting firms to reduce environmental risks and improve community sustainability in Canada and Latin America. These experiences inform her interest in community and regional food system resilience and the connections to other infrastructure systems.

Dilnoor Panjwani is a Ph.D. student in Planning at the School of Community and Regional Planning in the University of British Columbia, Vancouver, Canada. With a background in international development management, Ms. Panjwani is exploring post-disaster community recovery and reconstruction processes in relation to long-term community development. Ms. Panjwani has previously worked for an international non-governmental organization with a mandate of disaster risk reduction in parts of South and Central Asia. She has also had involvement with various projects ranging from disaster resilient infrastructure building to gender mainstreaming to global health advocacy, along with work experience within the World Bank system.

Sarah Pyatt recently completed a M.Sc. in Remote Sensing and Spatial Analysis from the University of Southampton. For her thesis she studied how remote sensing and GIS have been used throughout disaster management. She investigated the use of remote sensing for assessing early recovery in Haiti after the 2010 earthquake, using information from GEO-CAN's damage assessment and this NSF RAPID community disruption project to develop a scale of recovery that can be assessed using satellite imagery. Ms. Pyatt read Geography for her undergraduate degree, also at the University of Southampton, where she developed a keen interest in how remote sensing and GIS technologies can be used for risk and disaster management.

1. OBJECTIVES, SCOPE AND METHODS

1.1 Project Objectives

Fieldwork and analysis conducted as part of this RAPID project work were aimed at developing an understanding of the relationship between physical damage in disasters and the socio-economic disruption at the community scale. It focuses on disruption and restoration of several sectors (e.g., food, water, shelter) in a sample of communities affected by the Haiti earthquake. Specifically, we examined the nature of the relationship between physical damage and community disruption, the possible presence of a threshold beyond which an event becomes a catastrophe, how the damage-disruption relationship changes with time, and whether building damage might be used to predict the severity of disruption to a community's social fabric and economy.

The project had three specific objectives:

1. Gather perishable data describing physical damage and disruption at the community level following the Haiti earthquake. Data were collected from:
 - a. Satellite and aerial remotely-sensed imagery.
 - b. GPS-referenced street-view video and still photography using the VIEWS™ system and GPS cameras.
 - c. Semi-structured interviews and community meetings.
2. Analyze the collected data to: (1) better understand disruption at the community-level, (2) compare disruption across communities, (3) investigate the relationship between damage and disruption, and (4) better understand restoration of sector functioning in the first four months after the earthquake.
3. Test a new data collection tool and measurement scale for documenting community disaster disruption.

1.2 Scope

The study focused on seven communities in the earthquake-affected area (Figure 1): Bel Air, Delmas-32, and Martissant within Port-au-Prince, and Grand Goâve, Gressier, Léogâne, and Petit Goâve outside of Port-au-Prince. The communities were selected for geographic diversity and to represent a range of earthquake damage levels. Across these communities, damage rates ranged from 2% to 21% of buildings being either heavily damaged or collapsed, calculated from post-disaster damage assessment data (Bevington et al. 2010) and remotely-sensed imagery collected for this study (Section 5.1). The selection of communities was also influenced by access. Communities with active Community Driven Development Councils (CDDC) were particularly accessible, willing, and able to participate in this project. Final selection of study communities and meeting arrangements was made with support from colleagues at the World Bank with local knowledge and expertise in community development and disaster reduction and recovery. Eight team members undertook the field work from 6 to 16 May 2010, four months after the earthquake.

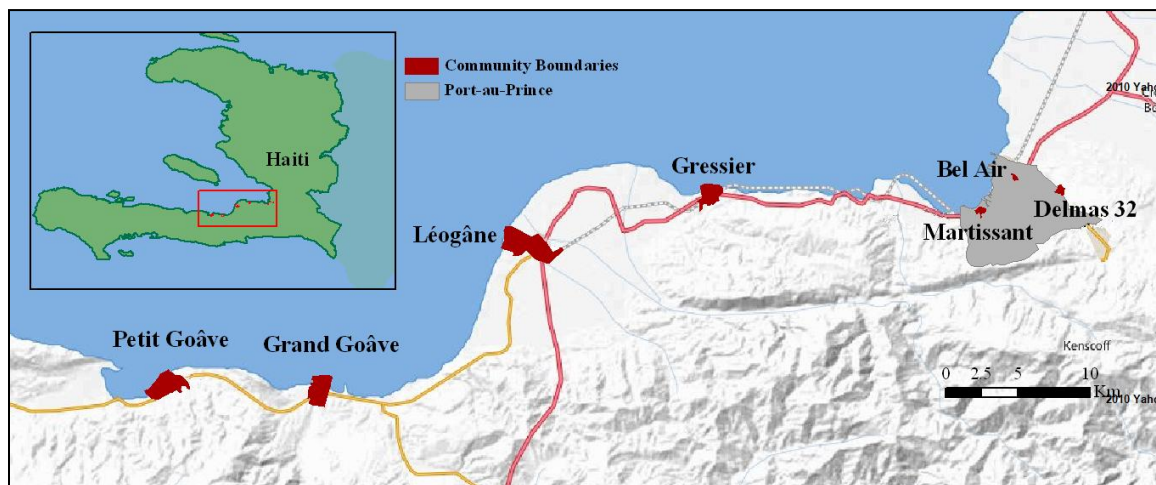


Figure 1: Locations of study communities.

Community-scale levels of function and disruption were characterized in this study in terms of eleven sectors based on core areas of humanitarian assistance as identified in the SPHERE Project (2004), with some additions:

1. drinking water,
2. energy/fuel/utilities,
3. sanitation,
4. education,
5. health care,
6. shelter,
7. food and food-preparation items,
8. livelihood,
9. safety,
10. social networks,
11. clearing of earthquake debris.

Information on the status of these sectors was used to indicate community disruption.

1.3 Methods

Three complementary types of data were used in this effort: (1) Automated, semi-automated, and visual analysis of high resolution satellite and aerial remote sensing imagery; (2) acquisition and interpretation of street-view GPS referenced photographs and video using the VIEWS™ field data collection system; and (3) interviews with NGOs; community members and leaders; service providers involved in community-scale relief, response, and recovery efforts; and representatives of government utility agencies. The remote sensing, VIEWS™, and interview data collection is discussed in Sections 2, 3, and 4, respectively.

2. REMOTE SENSING DATA

Remote sensing-based building damage data were analyzed prior to the project field deployment to identify communities that were significantly affected by the earthquake and might be the focus of the study. They were also collected and analyzed as part of this study to provide the assessment of building damage and recovery during the first four months after the earthquake.

2.1 Building Damage Data

The magnitude and extent of the earthquake required a significant effort to map the damage to physical infrastructure, and an international effort was convened for this purpose (Bevington et al. 2010). The Global Earth Observation Catastrophe Assessment Network (GEO-CAN) was initiated by the World Bank, and brought together more than 600 remote sensing scientists and structural engineers to assess over 1000 km² of 15 cm optical aerial imagery. These data were independently verified using field validation and parallel damage assessment data from the United Nations Institute for Training and Research (UNITAR), Operational Satellite Applications Programme (UNOSAT), and the European Commission Joint Research Centre (JRC), and were made available to the international community during the Post-Disaster Needs Assessment (PDNA) on building damage (Ghosh et al. 2010).

Although some buildings did sustain moderate amounts of structural damage, the term “damaged” in this report describes those buildings identified by GEO-CAN as having either sustained heavy damage, or collapsed—Level 4 or 5, respectively, on the 5-level European macroseismic building damage scale 1998 (EMS-98, Grünthal 1998). The damage data consisted of ground footprints digitized in a GIS for each of those Level 4 or 5 damaged buildings.

2.2 Building Recovery Data

Sourcing official data on community boundaries was difficult, due in part to the severe damage to governmental infrastructure and personnel. Therefore, maps of community boundaries were generated using knowledge gained in the field and from community mapping efforts such as Open Street Map (OSM 2010). These boundary maps were used to calculate the total number of buildings that existed in each community, as observed in the pre-event remotely-sensed imagery, so proportions of damage for each community could be generated and compared.

Images captured from fine spatial resolution satellite sensors were used to assess early signs of physical recovery in each community. The damaged buildings from the GEO-CAN assessment were individually assessed in the imagery, captured as close to the time of the field visit as possible. These images were collected for all communities between 22 April and 9 June (Table 1). A recovery scale was used to describe rudimentary physical changes that had taken place since the GEO-CAN damage assessment. Each damaged building was individually identified in the imagery and assigned a recovery score (Table 2). Figure 2 shows examples of Recovery Scores 1, 4, and 7 that appear in actual imagery for three of the study communities.

Table 1: Aerial and satellite imagery

Community	Pre-event data (from Google Earth)	Post-event data (GEO-CAN assessment)	Recovery data^a	Time from earthquake to recovery imagery
Léogâne	30 December 2005	15 cm aerial imagery (WB/ ImageCat/ RIT) (Google) 15-26 January 2010	WorldView-122 April 2010	+14 weeks
Bel Air	26 August 2009		GeoEye-111 May 2010	+17 weeks
Grand Goâve	31 August 2006		WorldView-1 22 April 2010	+14 weeks
Gressier	26 August 2009		WorldView-2 9 June 2010	+21 weeks
Delmas-32	26 August 2009		GeoEye-1 11 May 2010	+17 weeks
Petit Goâve	29 November 2005		WorldView-1 22 April 2010	+14 weeks
Martissant	26 August 2009		GeoEye-1 11 May 2010	+17 weeks

^a WorldView-1 has a spatial resolution of 50 cm (panchromatic), GeoEye-1 is 41 cm (multi-spectral), and WorldView-2 is 50 cm (multispectral).

Table 2: Recovery scale used for analysis of early physical recovery

Recovery Score	Description
1	Structure unchanged since the earthquake
2	Structure intentionally demolished, but not cleared
3	<50% rubble removed
4	>50% rubble removed
5	Structure under construction
6	Structure rebuilt on same footprint
7	Structure rebuilt on different footprint

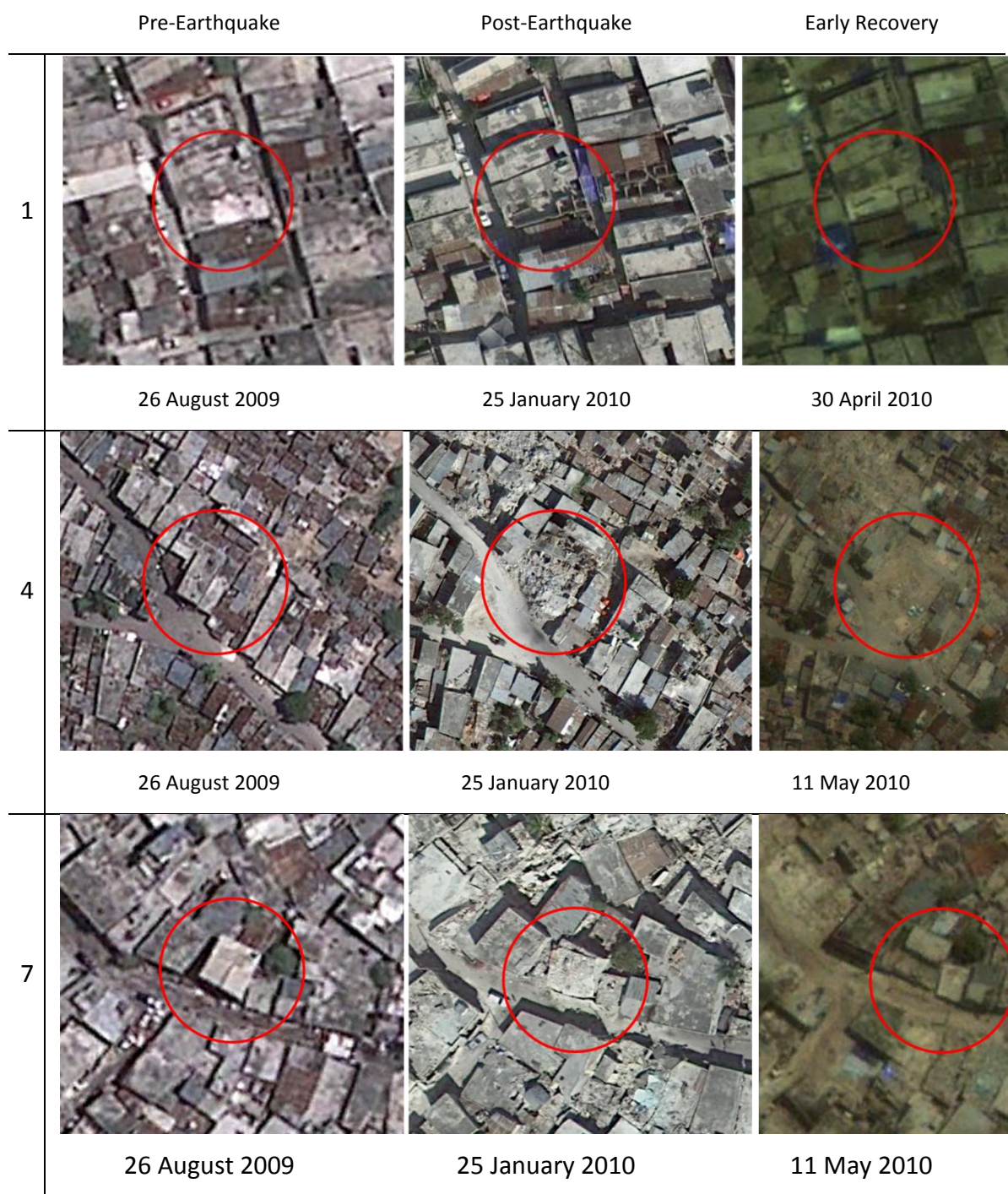


Figure 2: Examples of early recovery assessment. Top row: Recovery score 1 (Structure unchanged since the earthquake) from Martissant. Middle row: Recovery score 4 (>50% rubble removed) from Bel Air. Bottom row: Recovery score 7 (Structure rebuilt on different footprint) from Delmas-32.

3. FIELD RECONNAISSANCE DATA

During the field deployment, May 6-16, 2010, fieldwork included the collection of reconnaissance data to be used for both situation assessment and as a validation dataset for remote-sensing based assessment of early recovery. Table 3 summarizes the schedule for data collection.

Table 3: VIEWS™ field reconnaissance data collection

Community	Date				
	10 May	11 May	12 May	13 May	14 May
Léogâne ^a	✓	✓		✓	
Bel Air		✓			
Grand Goâve				✓	
Gressier	✓	✓		✓	
Delmas-32		✓			
Petit Goâve				✓	
Martissant		✓			
North of Port-au-Prince ^b					✓

^a Shaded cells designate communities outside of Port-au-Prince.

^b VIEWS™ data collected but not a formal project study community.

The proprietary VIEWS™ system developed by ImageCat Inc. was utilized to obtain field reconnaissance data in Haiti. VIEWS™ is a notebook-based data collection and visualization system, which integrates GPS-registered digital video footage, digital photographs and observations with high-resolution satellite imagery collected before and after a disaster.

VIEWS™ field reconnaissance missions were undertaken in all seven study communities. Figure 3 shows the VIEWS™ GPS photo trails covered in Haiti. Each point represents an individual ground photograph relating to that particular location, which ultimately

provides information about the physical characteristics of that area. Figure 4 shows the GPS photographs that were captured by the deployment team during the field mission.



Figure 3: VIEWS™ photo locations.

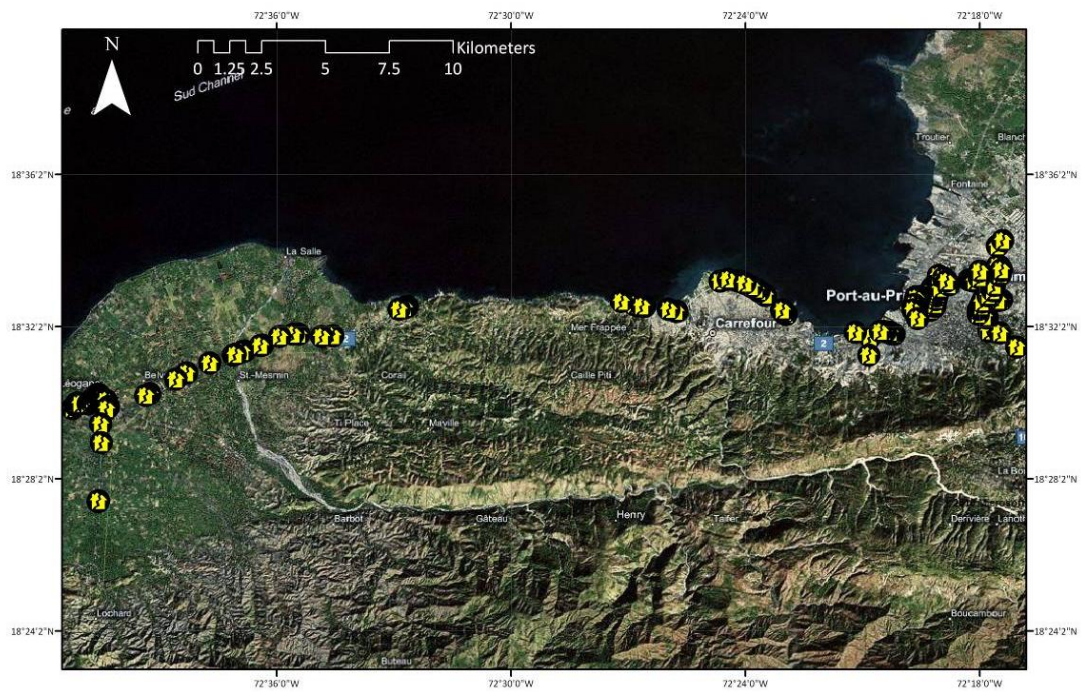


Figure 4: Location of GPS photographs.

Of the seven communities that were surveyed using VIEWS™, Petit Goâve and Grand Goâve were explored in greatest detail, not just covering main roads, but also smaller roads within residential areas. The team dedicated a whole day to capture data from these two cities outside of Port-au-Prince as travel from Port-au-Prince to these communities took approximately 2.5 hours.

3.1 Petit Goâve and Grand Goâve

Petit Goâve is situated approximately 60 km west of Port-au-Prince. The community includes both rural and urban settlement patterns and forms. The VIEWS™ survey took place in the urban center of Petit Goâve, as represented in Figure 5. An example of transitional housing typical of what we observed in this community is shown in Figure 6.

Grand Goâve is situated approximately 5 km east of Petit Goâve, (Figure 3). A high density of VIEWS™ data (Figure 7) was collected in Grand Goâve. Figure 8 provides an example VIEWS™ ground photo of a collapsed building in Grand Goâve.



Figure 5: VIEWSTMTM tracks for Petit Goave.



Figure 6: VIEWSTMTM ground photo of temporary transitional shelters in Petit Goave.

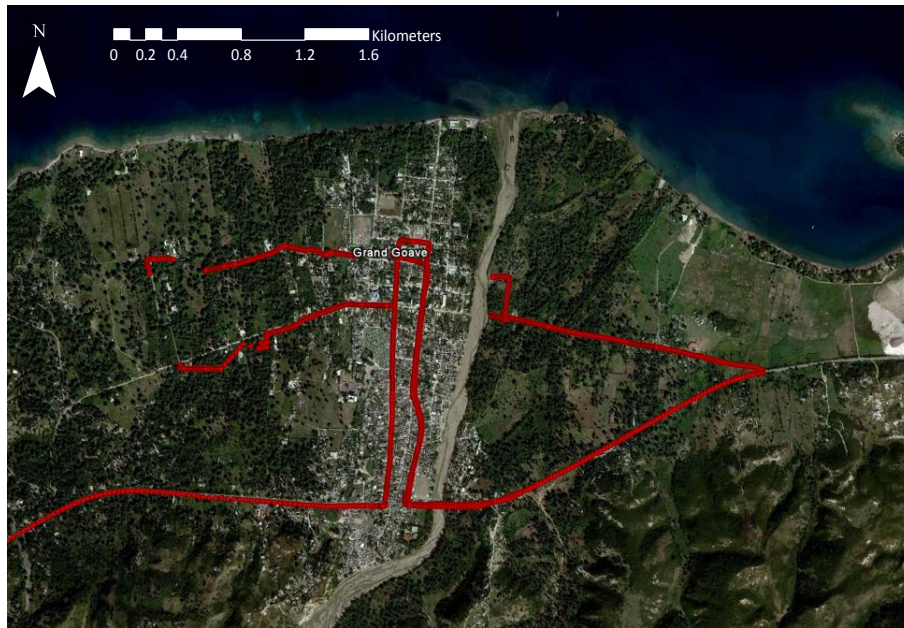


Figure 7: VIEWS™ tracks in Grand Goâve.



Figure 8: VIEWS™ ground photo of a collapsed building in Grand Goâve.

3.2 Léogâne and Gressier

Although located outside of Port-au-Prince, field reconnaissance data collection coverage for both Léogâne and Gressier was more limited than for Petit Goâve and Grand Goâve (Figures 9 and 10).



Figure 9: VIEWS™ tracks in Léogâne.

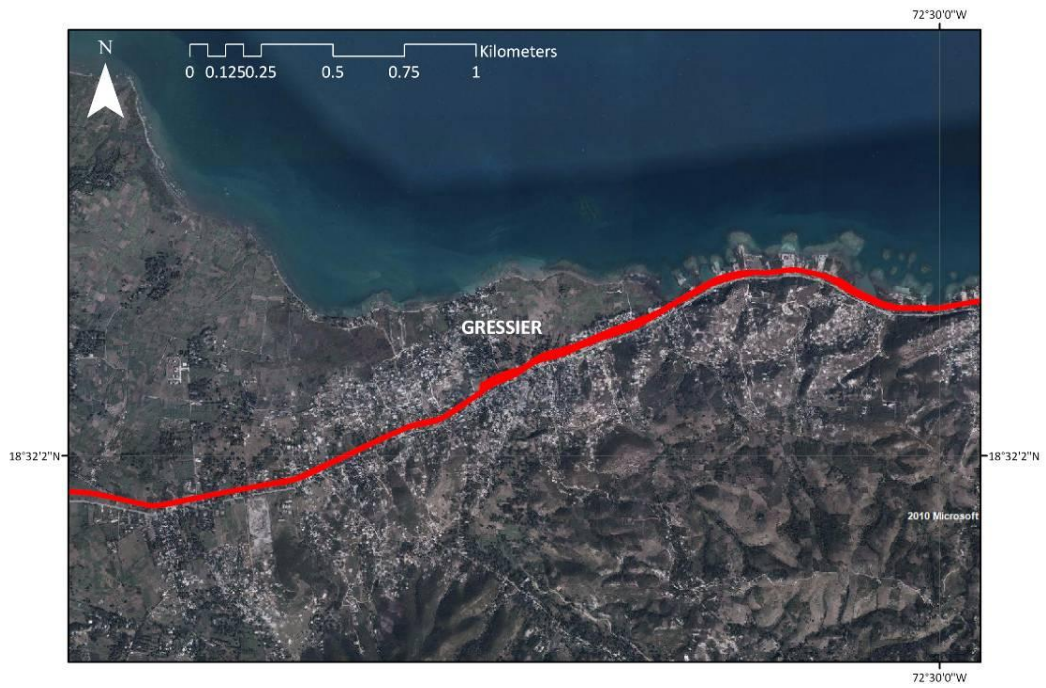


Figure 10: VIEWS™ tracks in Gressier.

3.3 Port-au-Prince

Within Port-au-Prince, VIEWS™ data were captured within three communities. However, the density of the urban landscape and of the urban population limited data collection. Neighborhood streets were often congested with debris, temporary shelters, and residents, to the point that they were impassable. In-country partners cautioned the team against VIEWS™ deployment on foot. Images from each community were captured, but are somewhat limited to large roads with better access. The coverage of this reconnaissance data collection within the capital city is displayed in Figure 11.



Figure 11: VIEWS™ track inside Port-au-Prince with study communities highlighted.

4. INTERVIEW AND COMMUNITY MEETING DATA

4.1 Overview

Community-level disruption was assessed based on interviews with: (1) community leaders, (2) non-governmental organizations (NGO) and community development professionals, and (3) representatives of government utility agencies. These three perspectives were used to gain a holistic understanding of community disruption. Twenty-nine meetings and interviews were conducted during the fieldwork. Table 4 provides a schedule of all meetings. Community meetings were conducted in French, and other interviews were conducted in English or French. Interview and survey materials were made available in French, Haitian Creole, and English.

The 7 community meetings took place in group settings with approximately 8 to 22 participants, plus 2 to 4 members of the field team, and 1 or 2 representatives from Community Driven Development Councils (CDDC) partners, the World Bank, and/or Bureau de Monétisation et Programme d'Aide au Développement. In some cases, community elected officials, such as the mayor and mayoral staff, participated in meetings. In all cases, engaged residents in community leadership positions participated. Some residents who were active in the CDDCs represented a geographic area within the community, while others represented a specific thematic area (such as education or women's businesses). Meetings took place in CDDC meeting spaces or public spaces that were available and selected by each community (e.g., classrooms, church meeting rooms, and tents). In general, community participants discussed each question as a group and a consensus emerged. Where consensus did not emerge, the diverse opinions were noted by the field team. The seven community meetings typically lasted approximately two hours and involved intense discussion.

Table 4: Schedule of meetings/Interviews and data collection, all in 2010

Friday, 7 May	Bel Air Community Meeting (Port-au-Prince)
	Delmas-32 Community Meeting (Port-au-Prince)
Saturday, 8 May	Martissant Community Meeting (Port-au-Prince)
Sunday, 9 May	Health Cluster Coordinator – Interview (UN Log Base)
	GPS-camera reconnaissance in Port-au-Prince
Monday, 10 May	Léogâne Community Meeting and VIEWS™ data collection
	Gressier Community Meeting and VIEWS™ data collection
	Nutrition Cluster – Interview (UN Log Base)
	WFP Interview (UN Log Base) – logistics
	FAO Interview (UN Log Base)
Tuesday, 11 May	Petit Goâve Community Meeting
	Grand Goâve Community Meeting
	VIEWS™ data collection – from Grand Goâve to Port-au-Prince
	VIEWS™ data collection – Port-au-Prince
	Shelter Cluster meeting
	Red Cross interview
	Shelter Cluster coordinator interview
	Camp Management Operations Meeting
	Local NGO – Aging NGO
Wednesday, 12 May	Early Recovery Cluster Meeting
	Health NGO meeting
	SEEUR (canals) Port-au-Prince
	Housing Issue Meeting - invited to observe (UN Log Base)
	EDH – electric utility of the entire country
	Housing meeting at UN – invited to observe
Thursday, 13 May	CNIGS meeting, ImageCat, Inc.
	VIEWS™ data collection: Petit Goâve, Grand Goâve, Léogâne, Gressier
	SMCRS (waste) Port-au-Prince
	Landfill visit/tour
	Windshield survey of industrial area
	Oxfam – interview
	UNEP Working Group meeting
	OHCA Assessment Coordination Working Group Meeting
Friday, 14 May	Disabilities Assessment – interview
	NGO (IOM) in Port-au-Prince
	Windshield survey - St. Marc Community Meeting
	VIEWS™ data collection - North of Port-au-Prince

As a complement to the community perspective, 19 scheduled and impromptu interviews were conducted with local and international NGO staff and community development practitioners. Field team members participated in or observed UN Cluster meetings, interviewed cluster leaders and coordinators, and attended several issue-

specific meetings at the invitation of organizers. These meetings took place primarily at the UN Logistics Base in Port-au-Prince, but also at in-community locations. In seeking interviews, the field team particularly sought out NGOs that had been active in Haiti for a significant period prior to the earthquake. In some cases, representatives clarified that their views did not necessarily represent the views of their organization. The perspective of NGO leaders and staff who had been in Haiti for weeks to decades provided insight into some of the situational challenges in Haiti and also some of the ways that this event differed from other disasters around the world. Their cross-community and international, multiple-event perspectives complemented the community-specific perspective expressed at the CDDC hosted community meetings. Finally, interviews were conducted with representatives of government utility agencies in charge of electric power, solid waste, and storm drainage canals and roads. These meetings took place in the agency offices with one primary interviewee for each agency. The interviewees often responded after consulting with colleagues, however.

4.2 Survey Instrument

The survey instrument used to collect disruption data is presented in full in Appendix A, and is summarized here. The survey instrument was pre-tested on a long-term employee of an international NGO experienced in post-disaster situations. It was comprised of two sections. The first established the participants' familiarity with the community. For NGO representatives, this included establishing the length of time the community organization or NGO had been working in Haiti, as well as its specific roles and geographic extent of activity. This section also included questions on the immediate impacts of the earthquake, including loss of lives, percentage of residents displaced, reasons for displacement or relocation, where displaced people went, and reasons people returned to their homes, if they had.

In the second section, participants were asked to rate the availability (i.e., status) of each of the eleven sectors (e.g., drinking water, see Section 1.2) for their community at four different points in time: (1) prior to the earthquake, (2) immediately following the earthquake, (3) one month after the earthquake, and (4) four months after the earthquake (i.e., at the time of the meeting/interview). Ratings followed a 7-level constructed scale (Figure 12). Laminated cards showing the scale were used to facilitate discussions and assessments.

Constructed
Disruption Scale

1 = **No availability**
Not available at even the lowest quality

2 = **Minimal availability**
Very unreliable, very poor quality, very insufficient, or inaccessible to most

3 = **Poor availability**

4 = **Moderate availability**
Available to some people who need it, though it may be inconsistent or of moderate quality

5 = **Good availability**

6 = **Almost full availability**

7 = **Full availability**
Available at consistent, high quality to everyone who needs it

AVAILABILITY OF BASIC NEEDS

	Time Period Relative to 1/12/10 Earthquake			
	Prior to	Immediately following	1 month after	May 2010
Drinking water				
Food – stuffs and prep. equip.				
Shelter				
Sanitation				
Debris removal				
Fuel/energy/utilities				
Health care				
Education/schools				
Safety				
Livelihood				
Social networks				
Other				

4 Time periods

11 Sectors

Figure 12: Disruption data collection scheme and show card example

The survey instrument was not used in the meetings with government utility agency representatives. Instead, interviewees were asked to describe: (1) how the system/agency operated and how service was provided before the earthquake, (2) how the system/agency/operations were impacted by the earthquake, and (3) how the system/agency had operated since the earthquake and what had been done during that time to restore service.

5. RESULTS

5.1 Building Damage

Building damage rate was defined as the number of heavily damaged or collapsed buildings divided by the total number of buildings that existed before the earthquake. The pre-earthquake numbers of buildings and damage rates were: Léogâne (2630 buildings before the earthquake, 21% damage), Bel Air (1716, 15%), Grand Goâve (2518, 9%), Gressier (857, 9%), Delmas-32 (3018, 8%), Petit Goâve (4543, 7%), and Martissant (1154, 2%). Figure 13 shows the percentage of buildings in damage level 4 and 5 for each community. Figure 14 shows the percentage of buildings heavily damaged or collapsed vs. pre-earthquake number of buildings. These damage data show the range of damage experienced, and highlight the variability in damage levels across communities. No relationships between damage rates, number of pre-earthquake buildings, or location in or out of Port-au-Prince are apparent.

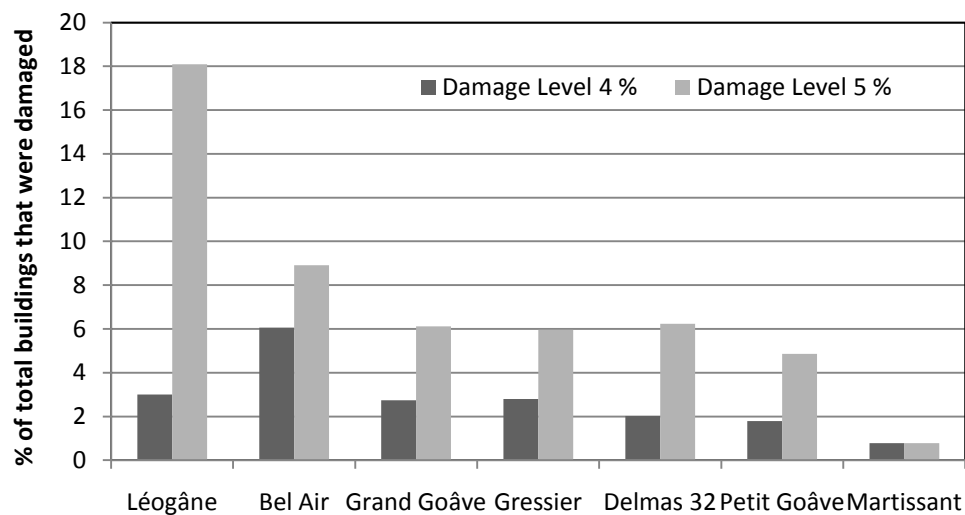


Figure 13: Damage levels 4 and 5 for study communities.

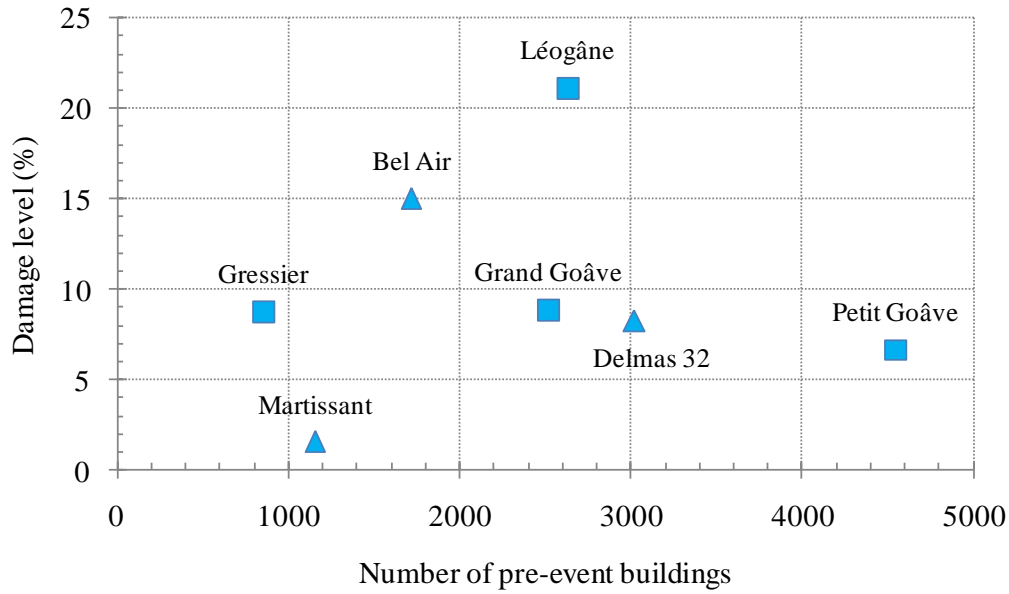


Figure 14: Community damage levels (percentage of heavily damaged or collapsed buildings) vs. Pre-earthquake numbers of buildings. Communities in Port-au-Prince are depicted by a triangle.

5.2 Building Recovery

Figure 15 and Table 5 summarize the status of building recovery across communities as of spring 2010. They show how much work remained to be done in the process of clearing debris and reconstructing buildings. Considering all seven communities together (the rightmost column), 48.7% of damaged buildings were unchanged since the earthquake, 5.8% had been intentionally demolished but not cleared, 27.8% had had some (< 50%) of the rubble removed, 13.7% had had most or all (> 50%) of the rubble removed, 0.2% were under construction, 1.0% had been rebuilt on the same footprint, and 0.3% had been rebuilt on a different footprint. For comparison, the community of Ban Nam Khem, Thailand, was severely impacted by the 2004 Indian Ocean Tsunami, and five months later, over 600 destroyed structures had been rebuilt out of ~1,200 pre-event structures (Saito et al. 2009).

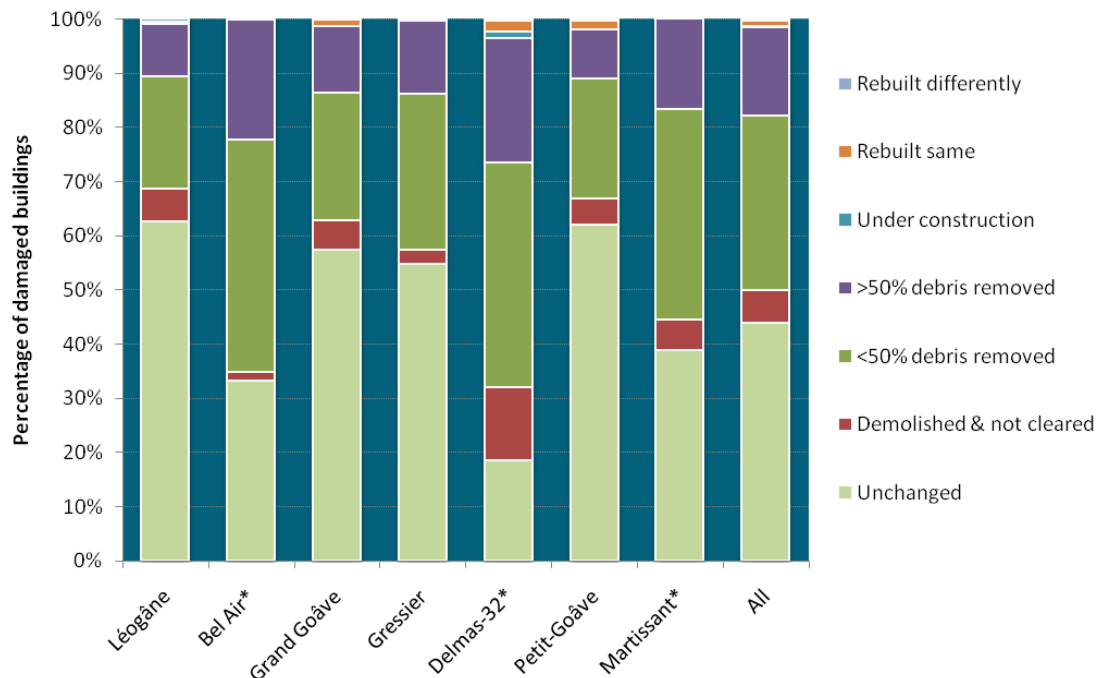


Figure 15: Percentage of heavily damaged or collapsed buildings in each stage of recovery as of spring 2010. Communities are ordered from most to least damaged. Those in Port-au-Prince are identified with an asterisk (*).

Table 5: Recovery status by community

Community	% Damage Levels 4 & 5	% Unchanged	% Rebuilt or under construction
Léogâne ^a	21.1	60.0	1.0
Bel Air	15.0	33.1	0.2
Grand Goâve	8.9	57.0	1.5
Gressier	8.8	53.3	0.3
Delmas-32	8.3	18.1	3.5
Petit Goâve	6.6	59.9	2.0
Martissant	1.6	38.9	0.0

^a Shaded cells designate communities outside of Port-au-Prince.

Figure 15 and Table 5 also highlight the differences between communities. Delmas-32 had made the most progress, with 3.5% of damaged buildings rebuilt or under construction, and only 18.1% unchanged (the rest in some phase of debris removal). Léogâne had only 1% rebuilt or under construction, with 60% unchanged. More generally, the communities within Port-au-Prince (Bel Air, Delmas-32, and Martissant)

had made greater progress than the others. Four months after the earthquake, 26% of damaged buildings in the Port-au-Prince communities remained unchanged; in contrast, 59% were unchanged in the communities outside Port-au-Prince.

5.3 Disruption

In Sections 5.3.1 to 5.3.11, disruption in each of the eleven sectors is discussed in turn, including the basic service provision and the community perspective on the sector. Each discussion is based on both the qualitative and quantitative data from the community meetings. In addition, where cluster meetings, NGO interviews or service provider interviews were available and related to the service, the information is noted and informs the discussion. Section 5.3.12 provides a summary analysis of disruption across all sectors and communities.

5.3.1 Drinking water

Overall Service Provision. Drinking water was not completely accessible before the earthquake in Haiti. In general, piped water systems existed, but distribution lines did not extend to all areas of the communities. Most poor people did not receive piped water and instead purchased it from middle- or upper-class households which are part of the distribution system. This made water expensive for the poorest members of the communities. In addition, this water service was often intermittent.

The earthquake damaged much of the water infrastructure, leading to an immediate decline in service, but NGOs generally provided tanker trucks with free water for the communities. As the focus was changing from relief to reconstruction, by May these services were being reduced and water service was again based on ability to pay.

Community Perspective. In May 2010, water service availability in Port-au-Prince was poor to moderate. It had largely returned to pre-earthquake levels of service after some

significant drops in service due to infrastructure damage and increase in service due to NGOs.

Outside of Port-au-Prince, the levels of service were much lower, with no or minimal service provision. In Léogâne the water system was never repaired following the 2008 hurricane season. Within the communities, there was significant variability in service with some more urbanized areas receiving higher levels of service. In addition, the price of water increased after the earthquake, making access to purchased water more difficult for vulnerable poor people.

Summary. Access to clean drinking water was a significant problem in Haiti prior to the earthquake. Particularly in rural areas outside the capital and in poor sections, water was not easily accessible. In the aftermath of the earthquake, there were significant changes due to the reduction in distribution infrastructure and the free provision by NGOs. By May 2010, the system had generally stabilized and returned to pre-earthquake levels of service.

5.3.2 Fuel, energy and utilities

Overall Service Provision. Electricité d'Haiti (EdH) is an autonomous government agency providing electricity to Port-au-Prince and surrounding areas. It charges customers for power, but collection rates are low and prior to the earthquake, losses due to illegal stealing of power were reportedly over 50%. There are 7 power plants serving Port-au-Prince and lines are all overhead. The system is old and was not in good condition even prior to the earthquake, when Port-au-Prince received only up to approximately 16 hours of electricity per day.

The earthquake damaged transformers in substations and power plants. Walls collapsed on some transformers, and others fell over. Only one power plant worked immediately

after the earthquake. The main transmission line to Port-au-Prince had a couple of breaks that had to be repaired immediately, but they were not major. All of the distribution system was affected. Poles fell over and lines came down. Immediately after the earthquake, all power was out in Port-au-Prince, Jacmel, Petit Goâve, and everywhere in Southern Haiti.

After the earthquake, EdH first assessed the entire system. Restoration priority was given to hospitals, to streetlights to minimize looting, and to police and other emergency services. The next priority was for paying customers (e.g., Petionville). They tended to be less affected and more easily restored as well. They also tried to quickly get power to the industrial park to get people back to work. Delmas was the last area to have power restored. For one month there was no electricity at all in the Port-au-Prince metropolitan area and Jacmel (Cap-Haïtien still had power). As of May 2010, the amount of available power was still increasing, but at that time there were only small areas without power. In May 2010 this availability had increased to about 10 hours per day, but it is available at irregular and unplanned times. The company tries to keep it on in the daytime for the industrial areas, and at nighttime in residential areas.

In May, the key challenge was that even previously paying customers could not pay and there was less demand because so many houses were destroyed. The tent camps are lit by lamps and solar panels that NGOs provided. The EdH did not have additional lines to serve them. NRECA International (www.nrecainternational.coop), an international NGO, was working with EdH to help with earthquake repair and improving the system.

Community Perspective. The interviews with the community groups suggest that in Bel Air, Delmas-32, Martissant, Gressier, and Léogâne the electricity before the earthquake was poor (Level 2 to 4). It was intermittent and sporadic, approximately 1-6 hours/day depending on the community and available at unpredictable times, which made it difficult to make good use of it even when it was available. Immediately after the

earthquake, these communities had no electricity (Level 1), and by May 2010, the situation had improved a little, but still with fewer hours of service per day than pre-earthquake (approximately Level 2). In at least Gressier and Léogâne, the community representatives said restoration of electricity was not a priority because it was not reliable before the earthquake, so there was no expectation of good service.

In Petit Goâve and Grand Goâve, on the other hand, reliable electricity was available 24 hours/day, 7 days/week (Level 7) before the earthquake. Immediately after the earthquake, they had no electricity at all for almost a month (Level 1). In May 2010, service had improved to about 8 to 12 hours/day (Level 4).

Summary. In most communities (except Petit Goâve and Grand Goâve), electric service was inconsistent and unpredictable before the earthquake due to an old, unreliable system, a substantial problem of stolen electricity, and low collection rates. Immediately after the earthquake, all communities in southern Haiti had no power for almost a month. By four months after the earthquake, most communities had approximately half the level of service they had had pre-earthquake. For those poorer communities that had worse service before and after the event, electricity was not a priority since the citizens did not rely on it in any case.

5.3.3 Sanitation

Overall Service Provision. Sanitation has historically been a problem within Port-au-Prince. Prior to the earthquake, in addition to the sanitation issues in the streets, the canals designed to carry water efficiently out of the city are used as trash receptacles by many residents. As a consequence of this, the canals are often clogged with trash and, during the rainy season, cause flooding in the city.

The municipal solid waste utility, Service Metropolitain de Collecte des Residus Solides (SMCRS), places dumpsters throughout the city and trucks run a circuit to pick up both trash from the dumpsters and trash left on the main roads. In addition, private companies extend the service into other areas and provide door-to-door service for some communities that can afford the service. Service d'Entretien des Equipements Urbains et Ruraux (SEEUR), the agency in charge of canals (storm drainage) and roads, regularly cleans the canals in an attempt to ensure flow and reduce the risk of flooding.

The earthquake significantly affected sanitation service provision. As the population had moved, the waste collection agency had to relocate their dumpsters. In addition, the debris and the tents had blocked some roads, which limited access for cleaning teams to some streets and canals. As the rainy season started in the spring, cleaning the canals became a high priority because of the risk of flooding in the city. Finally, residents often do not distinguish between earthquake debris and waste, leading to debris entering the waste removal system and increasing the pressure on an already stretched system.

On the other hand, the earthquake also brought additional resources. By May, multiple NGOs had started Cash-for-Work programs to clean the canals, which had allowed the canals to be completely cleaned without using the city's resources. The waste management company had received additional trucks and dumpsters to relieve the agency. However, neither SMCRS nor SEEUR has the resources to maintain the levels of service or to educate residents about placing trash in the dumpsters rather than the streets or canals. One manager stated that minutes after cleaning, the problem would be back again.

Community Perspective. The sanitation in Haiti is highly variable by community. Port-au-Prince communities generally ranked their service higher than the communities outside of the city. Most communities noted the increase in service due to the NGOs, but also

mentioned that they had since left and the level of service in May was lower than prior to the earthquake.

Summary. Port-au-Prince and the surrounding districts have had many historic problems with sanitation. A significant amount of waste ends up in the canals, causing flooding during the rainy season. The earthquake exacerbated the problem. Additional money coming in temporarily relieved the stress on the system, but both the systemic and earthquake-caused issues remain, leading to a decrease in levels of service by May.

5.3.4 Education

Overall Service Provision. Education in Haiti was an underserved sector before the earthquake. There are very few public schools and most students had to pay for an education. Because of the levels of poverty, many people simply could not afford to send their children to school.

The earthquake destroyed many schools, killing students and teachers. The government closed all schools until 7 April 2010. Since then, many schools have opened, but due to the lack of infrastructure, many classes were being held in tents as of May. Some people also mentioned that many teachers had died and others are too scarred by the experience to be good teachers. In addition to infrastructure, basic educational needs such as books and tables were lacking, and the inflation in the aftermath of the earthquake and the lack of employment for parents made school fees a barrier to even more students than before.

Community Perspective. Communities outside of Port-au-Prince stressed that most of the schools had attempted to reopen, even though they were being held in tents as of May. Both in Port-au-Prince and communities outside the capital, the main complaint about education in the meetings was about the cost. There was significant variability in

education access and availability with some areas not having enough schools to meet demand, but many others having a supply problem because not enough students can afford the fees and hence the schools remain empty.

Summary. The biggest challenge with education in Haiti before and after the earthquake was the lack of public education and the cost of private schools. The earthquake destroyed many schools and increased the cost of attendance, leading to even fewer students being able to afford classes.

5.3.5 Health care

Overall Service Provision. NGOs working in health care service mentioned many difficulties working in Haiti, including access to rural communities, difficulty working with the government, protectionism of health care by communities, expired medicines, and a lack of coordination among NGOs. Another important problem that service providers noted was that the provision of free health services after the earthquake had impacted private clinics and in some cases put them out of business.

Health care was generally considered to be quite poor in Haiti before the earthquake. The earthquake destroyed a lot of the health care infrastructure, but the level of service across many communities had risen dramatically at least for the short-term because of the presence of NGOs. By May, most health care visits were for problems unrelated to the earthquake and the focus of health care work was trying to improve the system rather than providing temporary aid.

Community Perspective. Community members generally cited a large improvement in service after the earthquake, but there was significant variability across areas. Rural areas generally did not receive good service and people often had to travel long distances either into Port-au-Prince or a local town to get any access to health care. In

some areas, infrastructure has been rebuilt, but communities complained that they were not consulted during the process.

Summary. Health care was very poor prior to the earthquake and much of the infrastructure was damaged in the earthquake. However, NGOs had focused on improving health care, and as a consequence, communities noted a significant rise in service since the earthquake. It was not clear whether this would be a temporary or permanent improvement, as much of the service is still being provided by many NGOs and not by the private or public sector. Although the long-term impact of this effort has not yet been determined, as of May this was the sector with the most and longest-lasting positive impact of recovery.

5.3.6 Shelter

Overall Service Provision. The disruption to shelter was a concern across sectors due to the vast numbers of people who were without homes and still being sheltered at tent cities as of May 2010. Land and tenure issues were posing barriers to advancing transitional shelter plans. A unified strategy for transitional shelter provision was hindered by the weak government involvement. Even prior to the earthquake, shelter was generally poor, with overcrowded housing and high rates of homelessness. In some cases, tent provision had been a step up in terms of quality of housing. Additionally, some beneficiaries were reluctant to return to homes or agree on transitional housing in hopes of acquiring permanent housing through aid schemes.

Community Perspective. The main reasons for leaving homes were consistent across all of the community meetings. The most prominent reason was fear. Residents were afraid to return to their homes due to risks related to collapsed roofs, insecure structures, trauma, and apprehension related to aftershocks. Other reasons for leaving homes included damaged property, inability to clear debris, inability of renters to repair homes,

uncertainty of help, and lack of incentives to leave tent cities due to elaborate aid provision at sites.

Through discussion, it appeared that for the very small percentage of the population who had returned to their homes as of May, the primary motivation related largely to land ownership and health concerns. Homeowners were concerned that the government would take the land and that it would no longer be available to them. Health concerns from living in tent cities included sickness due to exposure to the elements, tarp leakages, increased spread of disease in tent communities and an overall lack of comfort in tents.

It was evident that shelter provision prior to the earthquake was also inadequate, with high levels of homelessness, multiple families living in the same household, and a lack of affordable housing. In some cases, community members pointed to better shelter conditions in May compared to prior to the earthquake due to the distribution of tents.

Problems with shelter are highly associated with household disruption. While collection of detailed statistics related to household disruption in the communities was difficult, Table 6 provides examples of community-estimated data on shelter problems and household disruption.

Summary. Overall, the shelter situation remained significantly disrupted in May 2010. There was a need for an appropriate strategy to return homeowners to those homes that were structurally stable, and to begin acquiring land for transitional housing.

Table 6: Summary of household disruption experiences expressed by community members in May 2010

Community	Examples of Household Impact
Léogâne	<ul style="list-style-type: none"> • 2% of population living in pre-disaster homes • 87 tent cities in area, housing 300-500 families each
Bel Air	<ul style="list-style-type: none"> • 40% of households lost at least one family member • 25% or less are residing in pre-earthquake homes
Grand Goâve	<ul style="list-style-type: none"> • Previous population 12,000; lost 203 people; 3000 handicapped • 3% of population have returned to pre-disaster homes
Gressier	<ul style="list-style-type: none"> • Previous population 80,000—90,000; approx 3000 lost, 5000 injured • Homes completely destroyed for 90% of population
Delmas-32	<ul style="list-style-type: none"> • 2500 community residents killed by earthquake • 25% or less are residing in pre-earthquake homes
Petit Goâve	<ul style="list-style-type: none"> • 30% of population have returned to pre-disaster homes
Martissant	<ul style="list-style-type: none"> • 360 men lost; 468 women lost; 167 injured

5.3.7 Food

Overall Service Provision. Community and NGO representatives defined service provision as both access and availability of food. Availability was based on the quantity of food and distribution points (stores and markets in which to purchase food) as well as subsistence production in rural areas. Access was based on financial resources allowing the ability to obtain food. This sector included both processed and unprocessed foodstuff.

Community Perspective. Community representatives commented that availability prior to the earthquake was not a problem. There were a sufficient number of stores with geographical proximity that had enough food. The difficulty prior to the earthquake was the access to food. Financial means was a barrier to having sufficient quantity and quality of food.

The earthquake negatively affected availability of food. Participants commented that the food supply in Haiti is dependent upon import sources. The external food supply was impacted by the destruction of the port. Still, the impact on availability that residents highlighted was not due to the disruption of trade, but rather, hoarding by storeowners

and physical destruction of food stores. The decreased availability of food from hoarding and loss of stock increased food prices. In addition, income from employment generally decreased after the earthquake with the loss of jobs. Thus, peoples' purchasing power was decreased and this affected their ability to access food.

Migration from more severely hit urban areas immediately after the earthquake increased the number of dependents and pressure on rural farmers. The farmers, already living on a subsistence basis, took in and fed displaced residents. This has short-term and long-term impacts on Haitian farmers. It decreased the immediate quantity of food for the farming family and in addition depleted the farmers' capital, including seed stocks and animals, which could increase vulnerability and food insecurity over the long term.

Summary. The seven communities varied in availability and access before and after the earthquake. In general, the availability of food returned to pre-earthquake levels within four months. Haiti faces disruption on a continual basis and access, rather than availability, is the larger issue when discussing food. The largest impact of the earthquake on the food system could be its long-term impacts on rural farmers. The migration from urban areas to rural communities after the earthquake could both affect availability and accessibility to food for subsistence farmers due to the depletion of seed stock and capital.

5.3.8 Livelihood

Overall Service Provision. Livelihood concerns were widespread, across sectors and across communities. The lack of employment opportunities has been a long-standing concern and the earthquake appears to have further exacerbated the issues. The majority of the population works outside of the formal sector. Post-earthquake

conditions such as food insecurity, hoarding, and aid provision disrupted normal market activities.

Within the NGO community, there was an underlying theme of developing efficient and expanded programs for sustainable livelihood enhancement. For example, at a round table discussion at the United Nations Environmental Protection (UNEP), there was talk of exploring recycling schemes that would involve local residents at various levels of the recycling process. Some new ideas on expanding Cash-for-Work options were discussed within many of the sectors.

Community Perspective. Community meetings emphasized the importance of Cash-for-Work programs for their communities. In some cases, such as Bel Air, 20% of the population was benefitting from Cash-for-Work programs. There was a desire for more Cash-for-Work programs across communities, but also evidence of many levels of politics within the programs available in a community. For example, in conversation with community members in Bel Air, it was explained that a person could only attain a Cash-for-Work opportunity if they knew the right person in the community. This person who connected the employee with the project would take a cut of the pay. The person who was hired for the position would not actually do the work but would hire someone else and keep half the pay. The person at the bottom of the cycle who completed the work would receive a very small portion of the amount allotted for the specific job.

In many communities, the damage to economic centers had impacted employment opportunities. For example, in Gressier, the earthquake had destroyed the local public market, the main source of livelihood for many residents. Ratings of availability and accessibility of various sector-specific needs were related to livelihood conditions. That is, it was not so much that food, water, shelter, education, and health care were not available, but rather that community members did not have the funds to access the

services. Additionally, many of the small enterprises were severely impacted by the disaster and as a consequence were shut down, placing greater strains on families.

Summary. The earthquake worsened an already fragile livelihood support system. As of May, there was a need and also opportunity for creative and new solutions to invigorate employment options and improve livelihood conditions.

5.3.9 Safety

Overall Service Provision. The topic of safety was not one of vital concern or conversation at any of the interviews or meetings. However, some of the trends that were documented at the community meetings are included here.

Community Perspective. In Delmas-32, it was noted that accessibility and availability of police officers had increased since the earthquake. Community members indicated that prior to the earthquake, residents had to travel to various different districts in order to find police presence.

In Delmas-32, the community spoke of its solidarity as an indicator of high safety in the community. They stressed that though the population suffered from great misery, they remained civilized in their actions. There was a total absence of state presence in the community even prior to the earthquake, and it was up to community members to take action to reinforce security. There was mention of slight fear because prisoners had escaped at the time of the earthquake and there was a lack of awareness of their whereabouts. In Martissant, the community spoke of lack of safety concerns prior to the earthquake, but increased safety threats immediately following the earthquake. Safety concerns were currently noted to be back at previous levels (i.e., minimal safety problems).

In Léogâne and Gressier, safety was not a concern worth much attention. The community spoke of their community as being “calm” and “peaceful”. The situation was similar for Grand Goâve and Petit Goâve. Both Grand Goâve and Petit Goâve did point to deterioration in safety immediately following the earthquake, primarily due to desperation and food insecurity concerns with problems of theft and muggings. The situation has since eased, but as of May there was concern among residents of the threat posed by escaped prisoners who were then entering rural areas surrounding Port-au-Prince.

Summary. Safety was not a primary concern in the communities, except for some trepidation about prisoners who had escaped during the earthquake.

5.3.10 Social networks

Overall Service Provision. There are several social networks in action in Haiti—those within a community, between communities, linking communities with service providers, and the social networks that act between the service providers (NGOs and other relief and development supporters).

Social networks as an aspect of community functioning were discussed in several NGO meetings and interviews. This discussion occurred particularly when relief service providers discussed community. Several said that the concept of community either was not present or seemed to mean something different and manifest itself differently in Haiti. This observation—a lack of sense of community—made by non-Haitians seemed inconsistent with the comments of Haitians. Potentially, social networks and a sense of community do exist, as residents describe, but that existence manifests itself differently in Haiti than in other places. A common example described was the situation in camps, where very distinct boundaries could be observed within the camp. Residents did not

cross this socially constructed boundary to receive health care, but instead wanted services provided within each bounded area.

Community Perspective. Social networks increased in strength and presence in the aftermath of the earthquake. Residents describe working together immediately following the event to make the situation better (Table 7). Solidarity, sense of community and commitment to the community and support were strong. Residents learned to rely on each other and themselves to meet basic needs. This sense of resourcefulness and coping that exists in the normal situation continued throughout the disaster situation. In some locations, that initial strength in social networks had diminished or eroded by May, specifically as resource limitations became apparent and competition emerged. This competition driven by resource scarcity (as a consequence of both availability and accessibility) strained and in some cases threatened to compromise the functioning of social networks within communities. Regardless, by May, residents stayed close to home, temporary shelters were preferentially located in the streets and yards immediately adjacent to damaged homes, and social networks associated with place served as strong links and foundations of resourcefulness.

Summary. Reconciling the service provider and community perceptions related to this sense of community requires further study. In general, there seemed to be a strong place identity associated with urban areas where little mingling across community divisions was described, while in rural areas, support and social networks seemed more pervasive and any internal boundaries were weak and defined by site and situation (plain/valley versus mountains) rather than socio-political divisions. Immediately following the earthquake, social networks were described as strong—neighbors helping neighbors and taking care of each other. As time passed, resources became increasingly scarce and a sense of independence emerged. At an extreme, this independence was described as competition. The earthquake did not necessarily compromise social networks. Rather, in many cases they were tested and reinforced. However, by May the

strain of the aftermath of the earthquake was fostering a “look out for yourself first” reality that challenged the social fabric of place.

Table 7: Summary of social network scoring across communities

Community	Time Period Relative to 01/12/10 Earthquake			
	Prior to the earthquake	Immediately after	1 month after	May 2010
Léogâne		Anecdotal – sharing of food rations, housing. Increased solidarity in community.		
Bel Air	4.5 ^a 1	7	4	3
Grand Goâve	Solidarity existed; everyone knew everyone	Very strong - strongest	More community - stronger	Strong – not diminished
Gressier	Good, calm.	Pulled together out of necessity. Hosted relatives, friends and other families on their property.		
Delmas-32	5	7	6	6
Petit Goâve (Rural sections)	Very strong community spirit – help available if needed.	Higher than prior to earthquake.	Increasing competition for resources – food.	2
	5	5	5	5
Martissant	6	7	4 - \$ for help	3

^a Values are measured on 7-level scale defined in Figure 12, from 1 (no availability) to 7 (full availability).

5.3.11 Earthquake debris removal

Overall Service Provision. Debris removal is one of the least successful sectors discussed in the interviews. Among service providers, there seemed to be substantial confusion about how to accomplish this goal. As of May, there had been no clear assignment of responsibility within the government and those who discussed the topic seem daunted by the quantity of debris, the difficulty of negotiating traffic and the health hazards involved in working with the debris.

Much of the early work on debris removal focused on removing debris from the main roads. The next focus has been public buildings, which have in some cases been

demolished and the debris removed. Private homes were the least served part of the sector both in the city and outside.

Community Perspective. No community inside or outside of Port-au-Prince felt that debris removal was anything better than poor, with most saying that it was completely unavailable. Within the city, some people complained that debris removal was based on who you know and others complained that people put their debris in the streets when they demolished their houses and that no one was picking up the debris that have continued to block the roads. Communities outside of Port-au-Prince mentioned Cash-for-Work programs, but generally stated that not very much was being accomplished.

Summary. In May, the problem of earthquake debris was ubiquitous throughout Port-au-Prince and its surrounding areas. The responsibility to remove the debris and the plans to do so had not been made clear and what little had been done has been mostly to public buildings and roads. Private residences were left largely untouched as of May.

5.3.12 Disruption summary

Disruption ratings data from the community meetings are summarized in Tables 8 to 11. Table 8 presents the assessments of sector conditions prior to the earthquake. Tables 9, 10, and 11, respectively, summarize the changes in rating levels of status from before to immediately after the earthquake (the direct impact), from immediately after to four months after the earthquake (the early recovery), and from before to four months after the earthquake (the total event to date). Note that data for one month after the earthquake are omitted. Meeting participants had difficulty recalling the specifics of that time period, so those data were deemed unreliable, and they were not critical for the analysis of early recovery in any case.

Examining the raw data suggests several conclusions. First, pre-earthquake conditions were poor for all sectors (Table 8). The average rating across all services and communities was 3.8 out of 7. This corresponds to slightly less than “Moderate Availability”, defined as “available to some who need it, though may be inconsistent or of moderate quality.” The sector averages range from 2.6 for health care (minimal to poor availability) to 5.1 for social networks (good availability). The community averages are consistently low, ranging only from 3.2 to 4.4 (poor to moderate).

Second, substantial deterioration of already poor conditions occurred immediately after the earthquake (Table 9). Across all communities and sectors, the average decline in service availability from before to immediately after the earthquake was -1.7 (on the 7-level scale). For individual communities, the declines ranged from -0.9 to -1.9. The largest deteriorations were in shelter (-3.1) and education (-3.0). Social networks was the exception. In four communities, residents indicated that social networks actually improved immediately after the earthquake. Four months after the earthquake, health care, drinking water, education, and energy were being restored in most communities studied (Table 10). Shelter and livelihood had not improved significantly; sanitation, food, and debris removal were also lagging; and safety and social networks had worsened compared to conditions immediately after the earthquake (Table 10). Interestingly, the overall change from before the earthquake until four months after (the combination of the initial impact and the early recovery) suggests a mixed effect across sectors and communities (Table 11). While most (61%) of the 77 assessments show an overall negative change from before the earthquake until four months after, 17% demonstrate no change, and 22% show an improvement. Shelter and education show a decline across all communities, but health care has improved in five of the seven communities (Table 11).

Table 8: Community-estimated levels of availability^a: Prior to the earthquake.

Community	Drinking water	Energy	Sanitation	Education	Health care	Shelter	Food	Livelihood	Safety	Social networks	Average
Léogâne	2	2	2	4	3	5	4	4	5	5	3.6
Bel Air	3.5	4	3	4	2.5	6	6	3	2.25	4.5	3.9
Grand Goâve	3	6	3	5	3	4	3	4	5	5	4.1
Gressier	3	2	3	4	3	5	3	5	5	5	3.8
Delmas-32	4	2	4	4	3	4	2	2	5	5	3.5
Petit Goâve	4	6	5	5	3	4	5	2	5	5	4.4
Martissant	4	4	1	4	1	4	5	1	1.5	6	3.2
Average	3.4	3.7	3.0	4.3	2.6	4.6	4.0	3.0	4.1	5.1	3.8

^a Availability is measured using the 7-level scale defined in Figure 12, from 1 (no availability) to 7 (full availability).

Table 9: Change in levels of availability^a due to the earthquake: Immediately post-earthquake levels – pre-earthquake levels.

Community	Damage	Drinking water	Energy	Sanitation	Education	Health care	Shelter	Food	Livelihood	Safety	Social networks	Average
Léogâne	21.1%	▼ 1	▼ 1	▼ 1	▼ 3	▼ 2	▼ 4	▼ 3	▼ 3	► 0	► 0	-1.8
Bel Air	15.0%	▼ 0.5	▼ 3	▼ 2	▼ 3	▼ 1.5	▼ 5	▼ 3	▼ 1.5	▲ 0.75	▲ 2.5	-1.6
Grand Goâve	8.9%	▼ 2	▼ 5	▼ 2	▼ 4	▼ 1	▼ 2	▼ 2	▼ 2	▼ 3	▲ 1	-2.2
Gressier	8.8%	▼ 2	▼ 1	▼ 1	▼ 3	▼ 3	▼ 3	▼ 1	▼ 3	► 0	► 0	-1.7
Delmas-32	8.3%	▼ 2	▼ 1	▼ 3	▼ 3	▼ 2	▼ 3	▼ 1	▼ 1	▼ 1	▲ 2	-1.5
Petit Goâve	6.6%	▼ 3	▼ 3	▼ 3	▼ 2	▼ 2	▼ 2	▲ 1	▼ 1	▼ 2	▼ 2	-1.9
Martissant	1.6%	▼ 3	▼ 3	► 0	▼ 3	▲ 2	▼ 3	▼ 2	► 0	▲ 2.5	▲ 1	-0.9
Average		-1.9	-2.4	-1.7	-3.0	-1.4	-3.1	-1.6	-1.6	-0.4	0.6	-1.7

^a Availability is measured using the 7-level scale defined in Figure 12, from 1 (no availability) to 7 (full availability).

Table 10: Change in levels of availability^a due to the recovery: May levels – immediately post-earthquake levels.

Community	Damage	Drinking water	Energy	Sanitation	Education	Health care	Shelter	Food	Livelihood	Safety	Social networks	Debris	Average
Léogâne	21.1%	► 0	▲ 1	► 0	▲ 2	▲ 3	► 0	▲ 1	► 0	► 0	▲ 1	► 0	0.7
Bel Air	15.0%	▲ 1.5	▲ 2	▲ 3	▲ 2	▲ 4.5	▲ 3	▲ 1	▲ 0.75	▼ 1.5	▼ 4	▲ 2	1.3
Grand Goâve	8.9%	▲ 1	▲ 3	▲ 1	▲ 2	▲ 2	► 0	► 0	▲ 2	▲ 3	▼ 1	▲ 2	1.4
Gressier	8.8%	▲ 3	► 0	► 0	▲ 1	▲ 3	► 0	▲ 1	► 0	▼ 1	► 0	▲ 3	0.9
Delmas-32	8.3%	► 0	▲ 0.5	▲ 1	▲ 1	▼ 1	► 0	▲ 3	► 0	▼ 2	▼ 1	► 0	0.1
Petit Goâve	6.6%	▲ 2	▲ 1	▼ 1	▲ 1	▲ 3	► 0	▼ 1	► 0	▲ 2	► 0	► 0	0.6
Martissant	1.6%	▲ 2	▲ 2	► 0	▲ 1	► 0	► 0	▲ 1	► 0	▼ 3	▼ 4	► 0	-0.1
Average		1.4	1.4	0.6	1.4	2.1	0.4	0.9	0.4	-0.4	-1.3	1.0	0.7

^a Availability is measured using the 7-level scale defined in Figure 12, from 1 (no availability) to 7 (full availability)

Table 11: Overall changes in levels of availability^a: May levels – pre-earthquake levels.

Community	Damage	Drinking water	Energy	Sanitation	Education	Health care	Shelter	Food	Livelihood	Safety	Social networks		Average
Léogâne	21.1%	▼ 1	► 0	▼ 1	▼ 1	▲ 1	▼ 4	▼ 2	▼ 3	► 0	▲ 1		-1.0
Bel Air	15.0%	▲ 1	▼ 1	▲ 1	▼ 1	▲ 3	▼ 2	▼ 2	▼ 0.75	▼ 0.75	▼ 1.5		-0.4
Grand Goâve	8.9%	▼ 1	▼ 2	▼ 1	▼ 2	▲ 1	▼ 2	▼ 2	► 0	► 0	► 0		-0.9
Gressier	8.8%	▲ 1	▼ 1	▼ 1	▼ 2	► 0	▼ 3	► 0	▼ 3	▼ 1	► 0		-1.0
Delmas-32	8.3%	▼ 2	▼ 0.5	▼ 2	▼ 2	▼ 3	▼ 3	▲ 2	▼ 1	▼ 3	▲ 1		-1.4
Petit Goâve	6.6%	▼ 1	▼ 2	▼ 4	▼ 1	▲ 1	▼ 2	► 0	▼ 1	► 0	▼ 2		-1.2
Martissant	1.6%	▼ 1	▼ 1	► 0	▼ 2	▲ 2	▼ 3	▼ 1	► 0	▼ 0.5	▼ 3		-1.0
Average		-0.6	-1.1	-1.1	-1.6	0.7	-2.7	-0.7	-1.3	-0.8	-0.6		-1.0

^a Availability is measured using the 7-level scale defined in Figure 12, from 1 (no availability) to 7 (full availability).

5.4 Relationship between Damage and Disruption

A composite disruption score was calculated for each community to summarize disruption, as experienced, perceived, and reported by members of the seven study communities. This allowed comparison of disruption with remote sensing-based measures of building damage and early recovery. While weighting of factors and investigation of the interaction among the eleven sectors is warranted, for the purpose of this exploratory study report, the composite was constructed as an unweighted average of ratings (Tables 8 to 11), allowing for the fact that removal of earthquake debris only was relevant following for three time periods. These sector availability composites are summarized in Table 12 where they are highlighted in gray. As indicated in the table, the study communities were functioning in what might be considered a disrupted state even prior to the event, as sector availability composites fall in the poor availability to moderate availability categories. These composites are provided as a baseline for charting the change in sector availability (or disruption) with time. Immediately following the earthquake, sector availability composite scores dropped significantly, as expected. Four months after the earthquake, the composite scores remained notably below pre-disaster levels in all communities. However, the relationship between disruption and damage is not linear and appears complex. These nonlinear and complex interactions persist through the early recovery period, where the percent of structures unchanged or rebuilt does not necessarily predict the level of disruption that residents experience. In part this may be an artifact of considering change only to structures evaluated as damaged severely or collapsed, since residents did not always feel comfortable occupying structures that had been approved for occupancy by engineers. We observed that conditions of disruption are dictated by even those structures where damage is minor to the structure but significant to the population.

Table 12: Integrating evidence of damage, disruption, and early recovery

Community	Prior to event	Immediately after event (January 2010)		Early recovery (April-June 2010)		
	Sector Composite (max. = 7)	Damage (% of structures)	Sector Composite (max. = 7)	Recovery Status		Sector Composite (max. = 7)
				% Unchanged	% Rebuilt (same or different)	
Léogâne	3.6	21.1	1.7	60.0	1.0	2.5
Bel Air	3.9	15.0	2.1	33.1	0.2	3.4
Grand Goâve	4.1	8.9	1.8	57.0	1.4	3.2
Gressier	3.8	8.8	2.1	53.3	0.3	2.8
Delmas-32	3.5	8.3	1.9	18.1	2.3	2.0
Petite Goâve	4.4	6.6	2.5	59.9	2.1	3.2
Martissant	3.2	1.6	2.2	38.9	0.0	2.1

5.5 Discussion

This study has developed data on physical damage and disruption for a sample of communities affected by the 2010 Haitian earthquake. Findings indicate that, with the exception of social networks, all basic sectors of community function were significantly disrupted by the earthquake. Four months afterwards, restoration of these sectors was uneven, with shelter and livelihoods in particular making little progress and remaining significantly below pre-disaster conditions. No community was found to be evidently leading in early recovery. Moreover, immediate disruption and early recovery were not correlated with levels of earthquake damage.

Methodologically, the study is innovative in integrating multiple data sources—specifically, remote sensing, visual field data, and information from interviews and community meetings—to develop multi-dimensional information on community-scale impacts and early recovery. It has developed and tested a method for acquiring systematic rating data on disruption. The research process also yielded additional observations into the effects of the earthquake, methods for study impacts, limitations of the current approach, and priorities for future study.

Based on the combination of community data described in Section 5, field observations, and insights from NGO and other interviews providing a broader perspective, several general conclusions can be drawn. Collectively, these observations indicate that the extent, magnitude, and duration of community-level disruption caused by an earthquake or other natural disaster depend on many other factors besides the severity of physical damage.

First, pre-disaster conditions are critical in determining disruption. Prior to the earthquake, all of the study communities had low to moderate levels of services in sectors such as potable water and sanitation. Further, the concept of disaster-induced “disruption” was challenged by the experience of an improvement in the availability of services such as health care, attributed to mobile clinics frequently in close proximity to communities; increased safety described as greater police presence and responsiveness in Martissant and Bel Air; and the availability of food provided as aid that could not have been afforded in the pre-earthquake situation.

Second, in many ways, the earthquake was not a discrete event in terms of disruptive consequences. Rather, it was simply one in a sequence of events. Hurricanes in 2008 combined with political instability, environmental degradation, population pressures, and a chronic lack of public resources had established pre-existing conditions where disruption was the norm. International aid workers, for example, had a persistent presence in Haiti before the earthquake. Many participants and interviewees made repeated reference to hurricane events and the hurricane and rainy season as markers of time in their disaster memory, while the earthquake did not appear to hold the same reference. Notably, in community meetings, the timeframe relative to the earthquake often did not resonate with meeting participants. Essentially, the disruptions associated with this earthquake were superimposed onto chronic disruption and not perceived as a unique event.

Third, the concept of “disruption” does not adequately capture modes of adaptation to disaster situations. Socially, a culture of coping was evident from community meetings and was alluded to from other perspectives. Communities were accustomed to functioning despite disruptions. Ways to either work around or work within the realities of disruption were evident. This was indicated in the increased availability or strengthening of social networks in the immediate aftermath of the earthquake and mentioned by members of all the communities who repeatedly explained that “this is Haiti, that service was not available before the earthquake; we take care of ourselves.” Self-reliance and resourcefulness developed in the absence of public delivery of services. For example, residents purchased potable water if they wanted access to potable water. After the earthquake, many set up stands to sell goods directly on top of piles of earthquake debris.

Fourth, as of May, many consequences of the earthquake were being deferred and were expected to lead to continued long-term suffering. Community members, aid providers, project partners, and service providers made consistent reference to examples of difficult choices made in the immediate and prolonged aftermath of the earthquake. Decisions that addressed a challenge for a specific time in effect transferred the consequences in space from one place to another or deferred them to a later time. In Martissant and Delmas-32, teachers and parents shared that families were forced to keep children out of school as a result of inflation and rising costs of food and water. Meeting the immediate need for food and water displaced educational needs.

Another profound example of deferred consequences relates to food security. NGO interviews and community meetings described an acute awareness that rural communities made a difficult compromise early in the response phase of the emergency. Seeds stored for future growing seasons were instead used as food for residents and displaced Haitians who sought refuge in rural communities. While

meeting the immediate need, this choice erodes long-term food security. Similarly, concerns were expressed regarding pressure on lands outside of Port-au-Prince associated with temporary and permanent migration.

Relationships between damage, disruption, and recovery are complex and warrant further exploration. What does recovery mean? In a place where some degree of disruption has been the norm, what does recovery look like and how is it achieved? Pre-earthquake levels of community functioning were moderate to poor for the study communities (Table 8), suggesting that recovery, development, and sustainability are inextricably linked. Restoration and recovery become challenging both from conceptual planning and implementation standpoints. Restoring to pre-event levels of service provision in some cases would represent a diminished level, which challenges principles of vulnerability reduction.

5.4 Study Limitations

This section highlights some of the key challenges and lessons learned by the research team, broadly grouped into two categories: context-specific and methodology-related.

5.4.1 Context-specific

Concept of community. As highlighted in Section 5.3.10, the notion of community either was not present or represented something different in Haiti. This observation, a lack of sense of community, made by non-Haitians seemed inconsistent with the comments of Haitians. This poses some questions on the appropriateness of a framework that approaches disruption at a community-scale. An understanding of how the concept of community operates in the Haitian context is something that can be further explored.

Notion of disruption. During many of the interviews and community meetings it became evident that many of the sectors were already in a state of disruption prior to the January earthquake. In some sectors, pre-earthquake levels of disruption were quite

significant, indicating that in some respects the earthquake itself was not as much a critical reference point as our research design suggests. In addition, the concept of “availability” (used in the 7-point scale of disruption) conflated issues of availability and access, which in the Haitian context can be very different conditions.

5.4.2 Methodology-related

Numerical scale. The survey tool used to gather quantitative information from subjects posed significant challenges when used with community group members. People had a hard time rating levels of disruption numerically. Many found a 7-point scale too detailed to pinpoint their ratings. In some cases, respondents were only able to distinguish minimal, moderate and full availability. Subjects were keen to rate service provision at level 0 (Our scale was defined 1-7). In some cases, the researchers documented numerical estimates based on discussion taking place. Subjects and interviewees indicated that the “1 month after” time scale was unnecessary. Due to time restrictions, at times we had to eliminate the “1 month after” category in the meetings. At times, other such on-the-spot modifications to the survey tool were made based on the situation at hand.

Language. It is likely that valuable information, particularly from community meetings, was lost in translation. Though we had translators, it was not always possible to capture the full essence of what was being said. At times, certain questions triggered heated discussion, with many subjects speaking at the same time, and not everything was translated to researchers.

Logistics. Port-au-Prince and surrounding areas remained in a state of emergency response during our fieldwork, bringing about expected challenges in accessing communities and interviewees. The number of interviews and community visits possible and length of visits in any given day was limited by access and the length of time it took to get to the various locations.

Biases. Several of the interviews gave one person's biased opinion of the situation. It is difficult to evaluate how accurately they reflect "objective" reality. Supplementing with multiple opinions and with data when possible is very important, but not always possible due to lack of information.

Members of the World Bank and local development organizations were present with us at some of the community meetings due to their role in arranging logistics and familiarity with community groups. It was evident that some community members hoped further World Bank involvement would result from the meeting, in spite of clear indication that the study would have no direct impact on programming in the community. This points to potential bias in responses by community members, perhaps based on strategic needs that the community is looking to address through funding.

5.5 Future Research Opportunities

This work was exploratory in nature and suggested several avenues of future investigation. Extending the work to additional communities could help establish and develop insights into variability across communities and factors in differential impact and recovery. Extending the timeframe into the long-term recovery phase and subsequent stabilization of community functioning would be important for tracing the ultimate outcomes of the earthquake damage and short-term disruption. The perspective of officials of the Haitian government could be captured more fully. A sequence of events leading to what might be considered chronic disruption rather than disruption associated with a discrete event seems to invite revisiting the concepts of disaster and catastrophe (e.g., as defined in Fritz 1961 and Quarantelli 1996), particularly with attention focused on the pre-event volatility that contributes to the conditions of catastrophe. Finally, disruption in locations not impacted directly by strong ground motion, but rather by population pressure as residents migrate in response to

earthquake consequences, is an area of the damage-disruption relationship that deserves attention. Ultimately, establishing which lessons learned in the Haiti experience are specific to Haiti and which lessons are related to catastrophes more generally is an area of focus that would help responders, policy makers, and scientists to place this event in the larger context of community resilience-building.

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APPENDIX A: SURVEY INSTRUMENT

Interview Questions (available in French, Haitian Creole and English)

The following set of questions is designed for interviewees who are field staff of NGOs located in Haiti. These questions would need to be tailored slightly for other types of interviewees, such as NGO staff who have returned to the US or Canada from Haiti, or school principals and other professionals located in Haiti. The core information being sought would remain the same. *Note:* Participants may be provided with a written version of the questions and/or scales for reference during the interviews. Written versions would be available in English, French, and potentially Haitian Creole.

- Since when have you been working in Haiti for *[NGO]*? What is your job title? What was your role in the organization before the earthquake? After the earthquake?
- We are interested in understanding loss and disruption at the level of communities, such as urban neighborhoods or small towns. Which local communities here are you most familiar with, in terms of conditions prior to and after the earthquake? On this map, please indicate the approximate boundaries of these communities *[map provided]*. Please briefly tell us why you consider each of these to represent a “community”. *[prompt: e.g., politically/bureaucratically defined, geographically defined, distinct ethnic/ religious/other identity, concentration of particular social or economic groups, etc.?]*
- How familiar are you with pre-earthquake conditions in these communities -- “very familiar,” “somewhat familiar,” or “slightly familiar”? How familiar are you with post-earthquake conditions?
- [Repeat the numbered questions for each community identified.]

(1) Approximately what percentage of households in this community would you say lost a household member in the earthquake? *[prompt: about 1 in 10 households, 2*

in 10,...?]

(2) Approximately what percentage of people in this community were living in their pre-disaster homes (buildings)...

(i) ...immediately after the earthquake?

(ii) ...1 month after?

(iii) ...now?

(3) Please describe the main reasons for people leaving their homes. *[prompts: damage to homes and boundary walls, loss of services at homes and communities, fear of aftershocks, returned to rural areas of origin, government policy, forced to leave, etc.]*

(4) Please describe the main reasons for people returning to their homes. *[prompts: damage repaired, fear abated, services restored, to reclaim land or property, nowhere else to go, seasonal weather, psycho-social trauma, neighborhood security, etc.]*

(5) When people left, where did they go? *[prompts: moved to temporary shelter such as tents on their land, temporary shelter near their homes, temporary shelter away from their homes; to homes of friends, relatives, or host families; to camps run by NGOs; to spontaneous camps; moved out of city, etc.]*

(6) We are interested in the loss and restoration of different types of basic needs. Please consider first the situation of (a) drinking water.

(i) Please describe the situation of *[(a) drinking water]* availability prior to the earthquake. Please consider both the quantity and quality of *[drinking water]*. How did people access *[drinking water]*? *[prompt: from wells, stored rainwater, network system]*

(ii) On the following scale of 1 to 7 (Figure A-1), where 1="no availability" and 7="full availability," how would you rate the availability of *[drinking water]* for this community prior to the earthquake?

SCALE: 1 = No availability (Not available at even the lowest quality)

2 = Minimal availability (For example: very unreliable, very

poor quality, very insufficient, or inaccessible to most)

3 = Poor availability

4 = Moderate availability (Available to some people who need it, though it may be inconsistent or of moderate quality)

5 = Good availability

6 = Almost full availability

7 = Full availability (Available at consistent, high quality to everyone who needs it)

(iii) ...immediately after the earthquake?

(iv) ...1 month after the earthquake?

(v) ...now?

(vi) To help us understand your ratings, please describe how the *[drinking water]* situation has changed over the last few months.

- *[Repeat questions 6(i)~(vi) for each of the following categories of basic needs]*
 - (b) food and food-preparation items *[prompt: pots, stoves, bug nets]*
 - (c) shelter *[prompt: tents, sheets, tarps; consider size per family]*
 - (d) sanitation *[prompt: latrines, water-based, communal, toilet, sewage, drainage, solid waste management/garbage collection]*
 - (e) clearing of earthquake debris *[prompt: who was/is responsible?]*
 - (f) fuel/energy/utilities *[prompt: electricity, batteries, etc.]*
 - (g) health care *[prompt: clinics, nurses, doctors, medicines]*
 - (h) education *[prompt: schools open, school enrolments]*
 - (i) safety *[prompt: personal safety from crime and violence]*
 - (j) livelihood *[prompt: e.g., employment, income, informal economic activities. To what extent are people engaged in productive modes of livelihood? To what extent are people engaged in the same livelihoods as before the earthquake?]*
 - (k) social networks *[prompt: schools, community organizations, family networks, etc.]*

(I) any other need that we have not already covered?

- Can you provide any reports or other documents that would provide further information on these questions? *[prompt: e.g., school enrolment data, weekly situation reports]*
- Overall, how would you describe the internal capacity of the community to cope with the disruption caused by the earthquake? *[prompt: what are the greatest sources of strength or resilience in the community?]*
- *[If respondent answered Questions 1~5 for more than one community]* Of the communities you discussed, which would you consider to be the most disrupted? The least? Why do you say that?
- Are there other people that you would recommend we contact regarding these questions?

AVAILABILITY OF BASIC NEEDS

Time Period Relative to
1/12/10 Earthquake

SCALE	Time Period Relative to 1/12/10 Earthquake				
	Prior to	Immediately following	1 month after	May 2010	
SCALE 1 = No availability <i>Not available at even the lowest quality</i> 2 = Minimal availability <i>Very unreliable, very poor quality, very insufficient, or inaccessible to most</i> 3 = Poor availability 4 = Moderate availability <i>Available to some people who need it, though it may be inconsistent or of moderate quality</i> 5 = Good availability 6 = Almost full availability 7 = Full availability <i>Available at consistent, high quality to everyone who needs it</i>					Drinking water
					Food – stuffs and prep. equip.
					Shelter
					Sanitation
					Debris removal
					Fuel/energy/utilities
					Health care
					Education/schools
					Safety
					Livelihood
					Social networks
					Other

Figure A-1: Show card (available in French, Haitian Creole, and English)

APPENDIX B: FOOD SECTOR REPORT [DIRECTED STUDIES PAPER BY R. MILLS]

What is the disruption to basic needs in Haiti due to the earthquake on January 12, 2010 and how do they recover over time? This is what the research team wanted to learn about when conducting interviews in Haiti. This paper focuses on food – one of the eleven identified socio-economic research areas. First, the context of the overall project and the working concept of food are presented. Second, the quantitative and qualitative findings on food before and after the earthquake are examined. Lastly, possible factors contributing to the resiliency of the food system in Haiti are discussed.

Project Context

The research project '*Assessing Community-Scale Disruption and Restoration of Basic Needs in Post-earthquake Haiti*' took place in Haiti from May 4 – May 16. During this period there were thirty meetings. Meetings were held with service representatives, nongovernmental organization (NGO) representatives, community leaders and UN cluster representatives. Interviews took the form of either ranking the spectrum of socio-economic services/needs in one community or gaining deeper understanding of one of the eleven socio-economic factors included in the research scope (drinking water, food, shelter, sanitation, debris clearing, electricity, health care, education, safety, livelihood, and social networks). This spectrum of interviewees provided a city-scale and community-scale perspective as well as the perspective of the service provider and the consumer.

Food was discussed most thoroughly in the community meetings and with a representative from the Food and Agriculture Organization. The community leaders from seven communities were actively involved in their local community development efforts before and after the earthquake. Interviews were held with Port-au-Prince communities (Delmas-32, Bel Air, and Martissant) and rural communities (Petit Goâve, Grand Goâve, Léogâne and Gressier). The community participants were asked to rate

the availability from no availability to full availability at four different time periods relative to the earthquake: prior, immediately after, 1 month after and now.

The Definition of Food

Food, as an essential need, was somewhat defined by the survey but more so defined by the interviewees in their response to the question regarding the disruption of food. By the survey food was defined as “food and food-preparation items [*prompt: pots, stoves, bug nets*].” After the first couple of interviews this definition was not focused on, as participants did not find it relevant to the food situation they were facing. When discussing food, the community and NGO representatives defined it as access and availability of food. Food was both processed and un-processed foodstuff. Access referred to financial access and availability was the quantity of food and distribution points (stores and markets in which to purchase food) as well as subsistence production in rural areas.

Ranking of Food Availability and Access

The rural communities of Petit Goâve, Grand Goâve, Léogâne and Gressier often differentiated between the peripheral (more rural) and central zones of their community when providing rankings. The peripheral areas were generally given lower rankings than the urban, central zones of the community.

Within some communities participants found it important to define between availability and access when ranking the socio-economic needs/services. Participants ranked the availability and access of food and where not differentiated the ranking assigned is meant to reflect availability (see Table B.1). Given the importance of access to participants and the degree to which the participants discussed access, the single number ranking is likely representative of a mix between availability and access. Still, for the purpose of the discussion below, the ranking when not differentiated will refer to the availability of food.

The seven communities varied in availability and access before and after the earthquake. Food availability ranking prior to the earthquake ranged from two to seven. Immediately after, the range was reduced from one to six. In all communities, food availability was reduced after the earthquake. Very little change was seen one month later. Four months later, in May 2010, the level of food availability varied by communities. Delmas-32 and Petit Goâve were the only communities that saw an increase relative to before the earthquake. In Delmas-32 prior to the earthquake, food had one of the lowest level ranks when compared to the other basic needs (two other socio-economic needs also had a level of 2) and now it has one of the highest level of availability. This change in availability was attributed to food aid. Grand Goâve, Gressier, Martissant and Léogâne experienced a decrease in food availability when compared to before the earthquake.

In Bel Air the large group was randomly split in two for ease of conducting the interview. The community gave different rankings, both a decrease and return to the same level of food availability as seen prior to the earthquake. This may show the difference in access to food aid distribution or show the variance in access due to income. Bel Air (group B) indicated that food availability was less severely affected in the short term than other services. But, at the four-month mark food (and safety) are ranked the lowest of all basic services.

In the communities that differentiated between availability and access to food, an increase, decrease and maintenance of pre-earthquake levels of food access are shown. Participants linked food access to employment (livelihood). In the rankings, though livelihood suffered immediately after the earthquake, it was generally rated slightly lower or at the same level at one month and four months after the earthquake. In Bel Air (group A) there was a sharp increase in access due to free food distribution but a decrease in access outside of food distribution. When the food distribution stopped,

access returned to the same level of access as before the earthquake. This was true for Petit Goâve as well. Martissant has experienced a decrease in access since the earthquake even though availability has almost returned to pre-earthquake levels.

Table B.1: Food Ranking By Community

Community	Time Period Relative to 01/12/10 Earthquake			
	Prior to	Immediately after	1 month after	May 2010
Bel Air Group A	7 Avail; 2 Access	2 Avail; 7 Access		7 Avail; 2 Access
Bel Air Group B	5	4	4	1
Delmas-32	2	1	1	4
Petit Goâve	4-5 Avail; 2-3 Access	6 Avail; 4-5 Access	6 Avail; 4-5 Access	6 Avail; 2-3 Access
Grand Goâve	2-3		1-2	1
Martissant	5 Avail; 2 Access	3 Avail; 1 Access	4 Avail; 1 Access	4 Avail; 0-1 Access
Léogâne	4	1, rural worse		2 Central; 1 Rural
Gressier	3-4	1-2		2-3

Some representatives from the urban communities linked the availability of sanitation services to the household's proximity to arterial roads. The service provision decreased with the distance from the road arteries. This was not mentioned as the case for food availability. Though not presented in this paper, it would be beneficial to analyze the correlation between the other socio-economic factors and food. It was clearly indicated by the participants that for them there is a strong link between livelihood and food.

Discussion of the Food Situation

Food Situation Before

Community representatives commented that availability prior to the earthquake was not a problem. There were a sufficient number of stores with geographical proximity that had enough food. The difficulty prior to the earthquake was the access to food. Financial means was a barrier to having sufficient quantity and quality of food. Access

for them means monetary access. Participants commented that they had greater purchasing power before the earthquake.

The Bel Air community highlighted that the population that could not afford food were dependent upon the population that could. This was true both before and after the earthquake. Prior to the earthquake, they expressed that it was easier for those who depended on others' generosity for food. Participants expressed that after the earthquake, people became more selfish and it was harder for the most impoverished to access food.

Food Situation After

Food availability after the earthquake was negatively affected. Participants commented that the food supply in Haiti is dependent upon external sources. The external food supply was impacted by the destruction of the port. Still, the impact on availability that was highlighted by residents was not due to the disruption of trade but by that of the hoarding by storeowners and physical destruction of food stores. The decreased availability of food from hoarding and loss of stock increased food prices. Income from employment generally decreased after the earthquake. People's purchasing power was decreased and this affected their ability to access food.

Within a short period of time, there was an increase in food distribution points due to the provision of food aid. People in camps and in communities received food aid. The free distribution of food did not always create equitable access. Families would often disperse to multiple camps in order to benefit from the food distribution. There were also the occasions where a family would pay people or give them a portion of the food to stay at additional shelters in order to receive a larger amount of food. It was commented that it was easier for men (due to physical stature) to get food. Within one community, the decision was taken that women would be the ones allowed to access food from distribution points.

Bel Air discussed how the system of distributing food aid was important in equitable food distribution. In this community, food was first distributed through the community association. Participants commented that when the NGOs began distributing food within the community, they did not follow the same system as the community organization; this led to problems and disputes. The whole population did not have access to the food coupons. Obtaining food coupons largely depended upon personal connections. The peripheral communities and marginal population did not have access to food coupons.

Migration from more severely hit urban areas immediately after the earthquake increased the number of dependents and pressure on rural farmers. The farmers, already living on a subsistence basis, took-in and fed displaced residents. This has short-term and long-term impacts on farmers. It decreases the immediate quantity of food for the farming family and depletes the farmer's capital.

A feeling of uncertainty of the future food availability and access was expressed. Participants were aware that food aid from NGOs was a short-term solution. Representatives from Grand Goâve mentioned that after food aid stopped, there was a return to personal food cultivation. This was a visible but minimal help to the food situation.

Resilience of the Food System

The Gressier community representatives commented that because they were a rural farming community, the food availability and access had not become as dire; many were already living on subsistence agriculture. At the same time, they rated the food situation as precarious before the earthquake. Representatives from the rural communities of Léogâne and Grand Goâve noted that the peripheral zones in the community had worse food availability both before and after the earthquake than the central zones. This was

attributed to the subsistent farmers being reliant on their land for food and income and therefore having no income to buy food that wasn't produced on their land. This is a potential illustration that personal income is a better predictor of food resilience than personal land ownership or cultivation/production.

Participants commented on the fragile and confused nature of land-ownership in Haiti. This could be a reason that land cultivation does not seem to increase personal food security in Haiti. Land parcels were described as very small with a lack of secure title. Some drew a link between the land-title system and the lack of investment in land. This indicates that the land-title system is an important factor in the resiliency of the food system.

The food availability in the rural zones was also more severely affected due to the migration and increased pressure on resources. With the increase number of dependents, farming families were eating their animals at an expedited rate, thereby decreasing their capital resource for the future. The seed stocks were also being consumed, which will decrease the resiliency of local farmers. It creates not only temporary pressure on subsistence farmers but also increases the vulnerability of farmers to disasters in the future. Rural areas may need to be resilient not only to the disaster but to the migration from urban areas after the earthquake. Also, the rural communities in Léogâne that cannot be reached by vehicle did not receive food aid and were worse off than those in the centre. The lack of transportation infrastructure and access were included as limiting factors in providing aid to affected communities and reduced food availability and access.

Léogâne representatives highlighted that having a good level of food stocks is a contributing factor to food system resilience. This would be more important or less depending on the season in which the earthquake occurred. As the January 12 earthquake occurred in the dry season and it was not harvesting season, the food stock

was at a low and unable to support the local agriculturalists. Seed saving by local agriculturalists contributes to their resiliency by being independent from large companies and not purchasing seeds each year. However, when consumed as a foodstuff prior to planting, it decreases their long-term resiliency.

While subsistence agriculture can be a factor of resilience for rural communities, it does not contribute to the resilience of the larger centres. Port-Au-Prince cannot rely on food production from within the country as agriculture is largely subsistent farming, and is therefore highly reliant on the global food market. Urban Haiti is vulnerable to fluctuations in the global food market. When there are increases in price on the international market this impacts food prices within Haiti. The accessibility of food within Haiti is affected by changes in food prices. Given the large percentage that is unemployed, an increase in food prices is felt strongly in Haiti.

The long-term food projects are being disrupted for short-term projects. This is an issue for Haiti and other communities that face continual disruption while trying to develop/improve their food system. With the long-term projects being pushed to the side the communities are kept in the cycle of survival.

Conclusion

The earthquake on January 12, 2010 disrupted the food system in Haiti. In general, the availability of food returned to levels before the earthquake within 4 months. Haiti faces disruption on a consistent basis and access, not availability, is the larger issue when discussing food. The food system in Haiti is both resilient and vulnerable to disasters. The largest impact of the earthquake on the food-system could be its long-term impacts on rural farmers. The migration from urban areas to rural communities after the earthquake could both affect availability and accessibility to food for subsistent farmers due to the depletion of seed stock and capital.

APPENDIX C: WHY IS HAITI VULNERABLE? [DIRECTED STUDIES PAPER BY S. BRINK]

1. Introduction and Country Context

1.1 Introduction

On January 12th, 2010 a fault in southern Haiti ruptured, causing hundreds of thousands of deaths and billions of dollars of damage. This disaster crippled the political and economic center thus causing ripples through the entire country. Before the earthquake, Haiti was the least developed country in the western hemisphere and suffered from severe poverty, violence and political instability. The earthquake has highlighted the country's vulnerability to natural disasters and added one more difficulty for Haitians to deal with. The severity of this disaster is a function of the highly vulnerable infrastructure and social systems in the country that have been caused by years of instability, corruption, intervention and violence.

The earthquake has encouraged a flood of interest, funding and literature on the potential and methods for restoration and development and brought in additional aid and international intervention. In a country already accused of being run by NGOs, this offers a frightening potential for further weakening of the social and political systems. The initial restoration and relief efforts indicate that the role of international organizations in Haiti's internal affairs is likely to increase due to the earthquake. Despite hope that this could be a focusing event that turns the country around, precedent indicates that international intervention in Haiti has not helped to reduce vulnerability in the past. Care must be taken to ensure that the restoration strengthens the infrastructure and the social and political systems that ultimately will ensure a reduction in vulnerability to future earthquakes. My experience in the field has indicated that the initial recovery process in Haiti has shown many of the flaws of previous international relief efforts and has been viewed as a failure by many of the recipients of the aid.

1.2 Social and political context

Haiti has a long history of political turmoil which has affected both its development and ability to mitigate and respond to natural disasters. The country gained independence from France in 1804 and has endured frequent governmental changes throughout its history (see Table C-1 for some of the important events in Haitian history). Recently, President Jean-Bertrand Aristide was exiled in February 2004 which was followed by an interim period that has been described as worse than the violence leading up to the exile (Schuller 2008). In May 2006, Rene Preval became the president and has remained in power until the present. These two men have dominated the Haitian government since the end of the Duvalier regime in 1986 and have built up a vast amount of animosity and favoritism with the government and cooperating agencies, leading to suspicion of all governmental activities. This is illustrated by the ubiquitous graffiti in Port-au-Prince criticizing all parts of the country's governance. The importance of the political changes in the development and vulnerability of Haitians must be recognized. The violence and political uncertainty have repressed the economy and increased corruption which in turn has increased poverty and vulnerability in the country.

Table C-1: Significant events in Haitian history (Source: BBC 2010)

Date	Event
1804	Haiti becomes independent
1915-1934	US control of Haiti
1956-1971	Francois "Papa Doc" Duvalier president-for-life
1971-1986	Jean-Claude "Baby Doc" Duvalier president-for-life
1990-1991	Jean-Bertrand Aristide president
1991-1994	Coup leading to military rule
1995-1999	Rene Preval president
2000-2004	Jean-Bertrand Aristide president
2004-2006	Aristide exiled, UN peacekeepers start security duties, interim government
2006-present	Rene Preval president

In June 2004, as a consequence of the departure of President Aristide and the increase in violence surrounding the end of the presidency, the UN established the United Nations Stabilization Mission in Haiti (MINUSTAH) which has remained in Haiti "to

restore a secure and stable environment, to promote the political process, to strengthen Haiti's Government institutions and rule-of-law-structures, as well as to promote and to protect human rights" (MINUSTAH 2010).

For many reasons, including the political turmoil, role of international organizations, brain drain and corruption, the government of Haiti is widely viewed as weak and ineffectual both by international observers and Haitian citizens. During my recent trip to Haiti, a young man went so far as to advocate the annexation of Haiti as a protectorate of America. This lack of faith in the government predates the earthquake and is associated with the governing role provided by NGOs in the country. The government has very little institutional capacity and the Haitian state provides few public services which has led it to be viewed as "more concerned with maintaining power and extracting rent from the citizenry than providing services" (Maguire 2009). Hospitals are mostly run by volunteers or NGOs and 81% of Haitian schools are private. These services are inadequate for the population and mostly charge fees that hinder the vast majority of people from access. In addition, only three fifths of children attend school (Maguire 2009). These problems extend to most government services as, for example, 78.3% of Haitians do not have piped water (de Bustillos et al. 2002). In addition to being responsible for a lack of accountability and faith in the government, the lack of public services has reduced the resiliency of the Haitian people. The lack of services is an obvious cause for the very low (52.9%) literacy rate and the poor health indicators such as the 61 year life expectancy at birth and the 2.2% HIV/AIDS prevalence rate (CIA 2010). These social and political details are particularly important as uneducated, poor citizens are often less resilient to disasters and weak governments can lack the resources and credibility to respond effectively.

1.3 Economic context

The dire economic situation is one of the most significant causes of Haitian vulnerability. Haiti is the poorest country in the western hemisphere with a 2009 GDP per capita of

\$1300 (CIA 2010). Impacted by political changes, crime, inequality and international trade, GDP has shown a recent negative trend (Figure C-1).

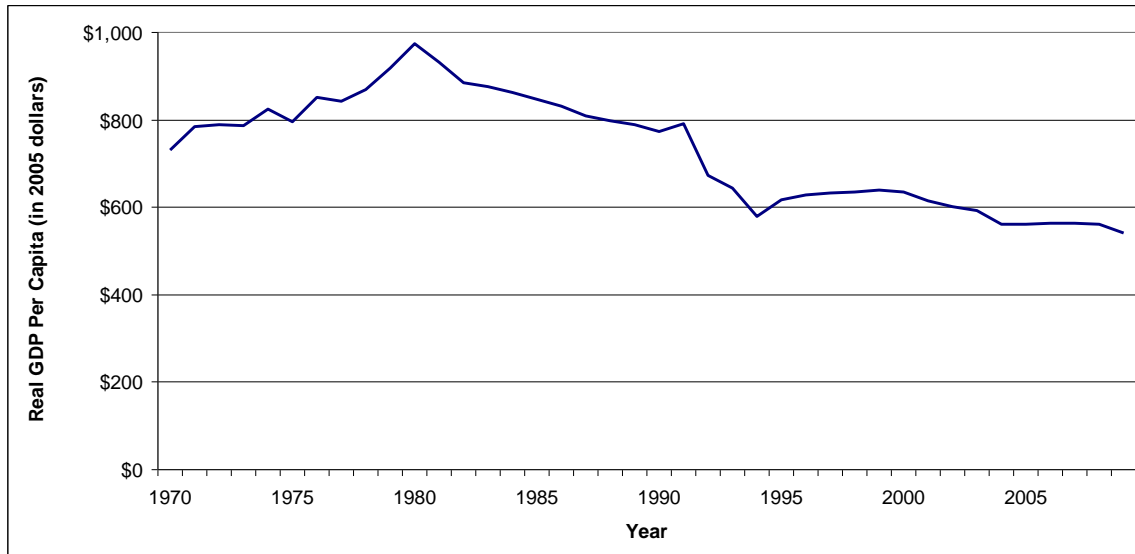


Figure C-1: Haitian real GDP per capita (in 2005 dollars). Graph made with data from USDA.

Even these low numbers mask the severe economic problems in Haiti, as the country has the eighth largest Gini index, indicating that the distribution of income is one of the most unequal in the world (CIA 2010). A large majority of the country is poor with 72.1% of the population living on less than \$2 a day and 54.9% of the country living in abject poverty on less than \$1.25 a day (UNDP 2009).

Part of the cause for this poverty is the weakness of the economic system. The formal economy is very small, with only 5-15% of the population employed (Schuller 2008) and these workers do not always receive a livable income as the minimum wage is approximately \$1.80 a day (Maguire 2009). In addition, the economy has been notoriously variable as a result of changes in US trade laws and other international factors.

One important example of the weak economy is the apparel industry which at its historic peak in the 1980's employed 60,000 - 100,000 Haitians. This number dropped to almost zero in the 1991-1994 US trade embargo (Hornbeck 2009). This embargo had a devastating impact on the Haitian economy as evidenced by the dip in GDP shown in Figure C-1. In 2006 and 2008 America attempted to increase investment in the economy by passing the Hemispheric Opportunity through Partnership Encouragement (HOPE) I and II acts which offer duty free imports of various Haitian apparel products to the United States. As a consequence of this, by 2009 the number of Haitians employed in the garment industry had begun to recover, reaching approximately 25,000 employees (Hornbeck 2009). This is still only a fraction of the previous employment and despite the HOPE acts, the Haitian trade deficit still remains severe at \$2.203 billion in imports and only \$524 million in exports in 2009 (CIA 2010). Some scholars have argued that the low value added garment industry which offers "minimum opportunities for upgrading, few linkages to domestic manufactures or suppliers and strong incentives to keep labor costs low" has not lead to endogenous growth and sustainable development in other countries (Blair and Peters 2006). Despite the more generous terms of the HOPE acts, these problems are seen in Haiti as well. Wages at the factories have not increased and the workers describe a climate of fear due to targeting of union members and other human rights abuses (Schuller 2008). The apparel industry is an important example in the Haitian economy because it provides two-thirds of Haitian exports (CIA 2010) and shows how dependency on exports to a single country has made Haiti particularly vulnerable to US policy and economic changes.

The weakness of the Haitian economy has caused many organizations to suggest prescriptions for improvement. One of the most disastrous occurred in the 1990s when the IMF and the World Bank encouraged trade liberalization, which led to a reduction in rice tariffs. Before this change, Haiti produced the majority of the rice it consumed, but cheap American subsidized food flooded in and now the country produces only 45% of the food it consumes (Mazzeo 2009). This has reduced agricultural employment and

encouraged urbanization. This in turn has increased environmental destruction and increased the pressure on Port-au-Prince services and land. The government and international organizations have only recently recognized the destruction caused by weakening of the agricultural sector and improving rural livelihoods is now one of the top development priorities.

In addition to the direct consequences of a move toward industrialization, the global rise in food and fuel prices tested Haiti's resiliency. This has had a significant impact on the cost of living and lead to an increase in rural hunger (Mazzeo 2009). The Haitian economy was hit especially hard because of the trade imbalance and the importation of necessary items such as food.

As the formal sector is so small, the informal sector provides employment for most Haitians. Common informal industries include cooking on the streets and buying and transporting bulk goods for sale in local markets. However, as food and fuel prices have risen, local sellers have circumvented middlemen to cut costs, and that has led to a shrinking of the informal sector and an increase in unemployment. The economic costs associated with these changes have been credited for the crime wave during the interim government (Schuller 2008).

Haiti is an extreme case of underdevelopment with some of the worst economic indicators in the world and a long term negative economic trend (Figure C-1). International efforts to improve the economic situation have in many cases backfired, leading to increased dependence on unstable industries. The economic instability and inequality have increased social and political tensions (Maguire 2009) as well as increased vulnerability to poverty, hunger, disease and natural disasters.

1.4 Infrastructure

Haitian infrastructure is both weak and inadequate. Land ownership is not clear and most people live on rented land in Port-au-Prince. This provides a disincentive to upgrade or maintain infrastructure. Poverty has also had a significant impact on the quality of infrastructure. Low quality materials and shortcuts to save on costs are standard practice. For example, many buildings have limited rebar and crossties and these are often created using smooth bar. In addition, where upgrades are made, they have been generally focused on improvements to hurricane risk. Seismic design has been largely ignored as the last severe earthquake was more than 200 years ago.

Due to scarcity as a result of deforestation, wood is not commonly used as a building material in Haiti. Most ordinary one-story houses in Port-au-Prince have walls made of concrete, block or stone (76%) and sheet metal roofs (82%). Multi-story homes and apartment complexes are also mostly concrete, block or stone walled (97%), but have concrete roofs (71%). Most non residential multi-story buildings consist of reinforced concrete frames with reinforced concrete floors and roofs with masonry infill walls (Eberhard et al. 2010).

In rural areas, the majority of people (61.4%) live in ordinary one-story houses similar to the ones found in Port-au-Prince. In addition a significant number of people live in houses made of straw, thatch and palm leaves (8.7%) and waste materials (19%) (Eberhard et al. 2010). These houses are in many cases less vulnerable to ground shaking, but are open to the elements making residents extremely vulnerable to floods, hurricanes and diseases such as diarrheal diseases and malaria.

1.5 Previous disasters and vulnerability

It is important to recognize that the earthquake is only the most recent of a long string of difficulties that Haiti has faced. The country is no stranger to turbulence and vulnerability and has been through the process of donor conferences and relief efforts

in the past. Most notably, Haiti had not even finished the recovery process from the 2008 hurricanes before the earthquake brought another disaster to recover from, extending many of the contracts already in place.

One of the most common causes for instability and violence in Haiti has been political changes which in many cases have involved coups (Table C-1). A single hospital treated 2,500 gunshot wounds in a 16-month period during the interim government in 2004-2006 (Schuller 2008) which illustrates the levels of violence during the periodic political instability. In addition to political turmoil, there has also been economic turmoil as a function of embargos (Hornbeck 2009) and global price rises (Mazzeo 2009) and Haiti has been badly hit by the HIV pandemic. The negative impacts of these small scale regular events are often overlooked in disaster literature and can have a large cumulative effect (Lavell 1999).

Haiti is also prone to multiple natural hazards. The two major fault lines running through the country had been dormant for years prior to 2010, but historically the country has suffered large and devastating earthquakes, most notably in 1751 and in 1770, when the city of Port-au-Prince was destroyed and then after reconstruction, destroyed again (Bilham 2010).

Haiti's most recent experience with natural disasters has been due to hurricanes. In 2008, four strong storms hit the country and cost 14.6% of the country's GDP. The president termed the storms, "Haiti's Katrina" and the country set about to try to recover. A report about the recovery stated that, "The key to success in Haiti will come not simply from allocating urgently needed resources, but by ensuring that they are used effectively to strengthen security and improve public safety, relieve poverty, and promote sustained growth, particularly in ways that focus on the pressing need for the country to become more resilient to external shocks that leave it reeling" (Maguire 2009).

In the aftermath of these hurricanes, and with a relatively stable new government, the country appeared to be starting on the path to development and there was significant optimism in the international community about Haiti's chances to break free from the cycle of poverty and vulnerability. During 2009, a drop in violent crime caused the US State Department to revise its travel advisory against the country, the annual economic growth rate turned positive and the country appeared to be on a path towards stability (Perito 2010). These changes were fragile and had only begun to have an impact on the life of ordinary Haitians when in January 2010, the country was thrown into upheaval by one of the most destructive events in its history.

2. Earthquake

2.1 Geology

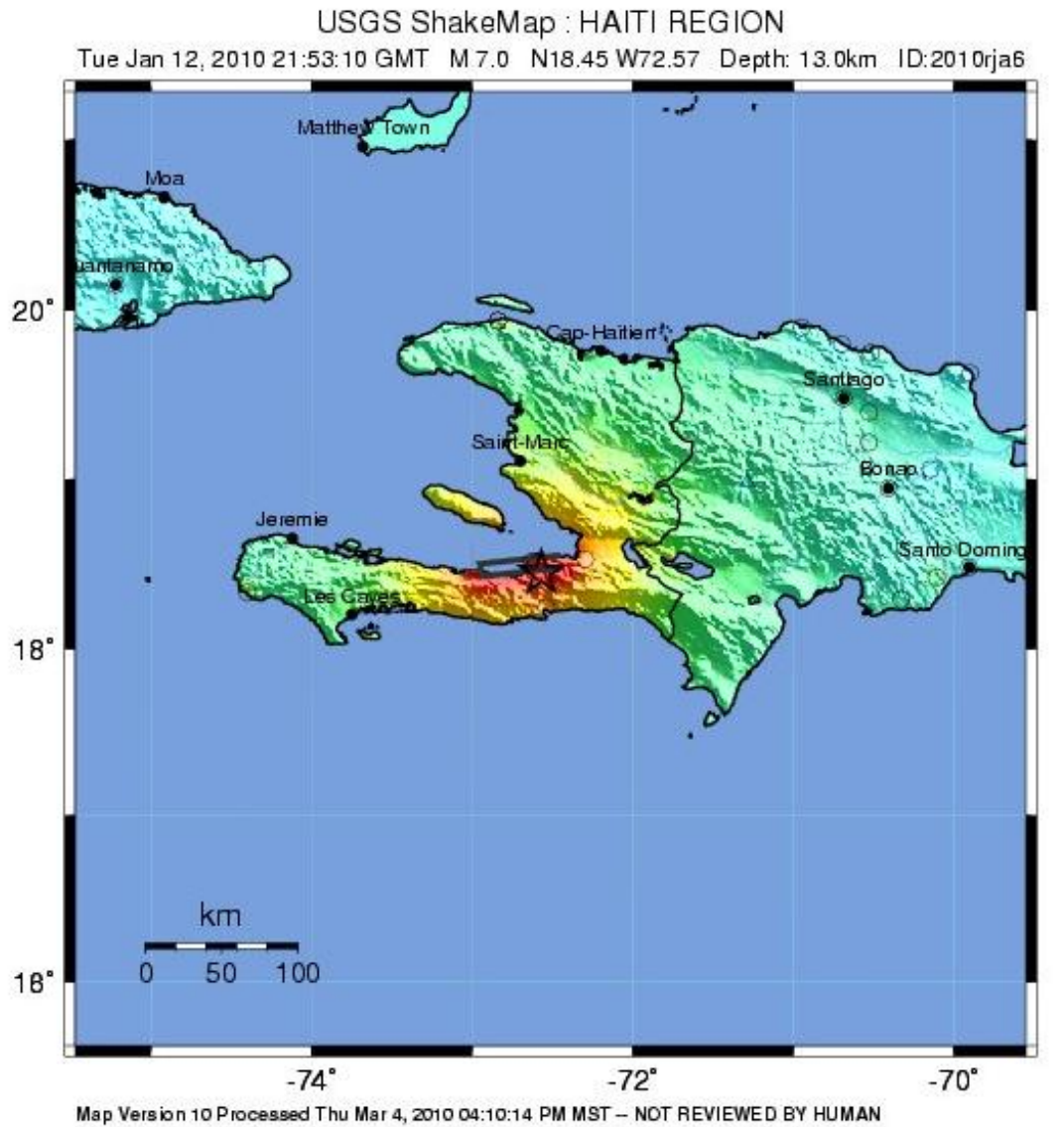
On January 12th, 2010 a 7.0 magnitude earthquake struck southern Haiti. The country is on the border between the Caribbean tectonic plate and the North American tectonic plate and has two large faults running east-west through the north and south of the country. The January earthquake is believed to have been on the Enriquillo-Plantain Garden fault in southern Haiti (USGS 2010) although there is some disagreement about the causative fault and the released energy based on geological observations in the region (Rathje et al. 2010, Bilham 2010).

The earthquake epicenter was located close to Léogâne and the shaking was intense through much of the southern portion of the country (Figure C-2). During the following months there have been many aftershocks (Figure C-3), sixteen of which were larger than 5.0 (USGS 2010). These aftershocks have contributed to the impact of the initial earthquake, causing additional physical damage and instilling paralysis in the country as individuals delay a return to normality in fear of another large quake.

The earthquake caused significant geological changes including coastal uplift, liquefaction, lateral spreading and landslides (Rathje et al. 2010). In addition to the ground shaking and the infrastructure damage that resulted from it, these geological changes affected Haitian society. I observed a spring that had been relocated from the outskirts of Carrefour into the center of the main street, leading to significant changes in availability of transportation and water in that community. Although anecdotal, this story shows how diverse the impacts of the earthquake were on Haitian society. Although loss of shelter and deaths in the family were widespread, some Haitians lost everything while others were barely impacted by the physical event.

2.2 Physical damage

There was a significant amount of infrastructure damage, although the failure rate varies from area to area based partially on soil quality and building practices, and estimates have only just begun to quantify the damage. Imagery from the air has been used to approximate damages and one estimate is that a minimum of 30% of the buildings in Port-au-Prince have suffered severe damage (Rathje et al. 2010). Not all damage is visible from the air and limited ground level surveys have been conducted, leading to fear that damage is even more widespread than estimated. Downtown Port-au-Prince was one of the most severely devastated areas, with one walking survey concluding that 28% of the structures collapsed and 61% collapsed or were damaged enough to require repairs (Eberhard et al. 2010). Table C-2 shows an evaluation of the number of damaged houses in the areas around Port-au-Prince and gives an indication of both the severity and variability in the infrastructure damage.



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Figure C-2: Map of shaking associated with January 12th earthquake (from USGS)

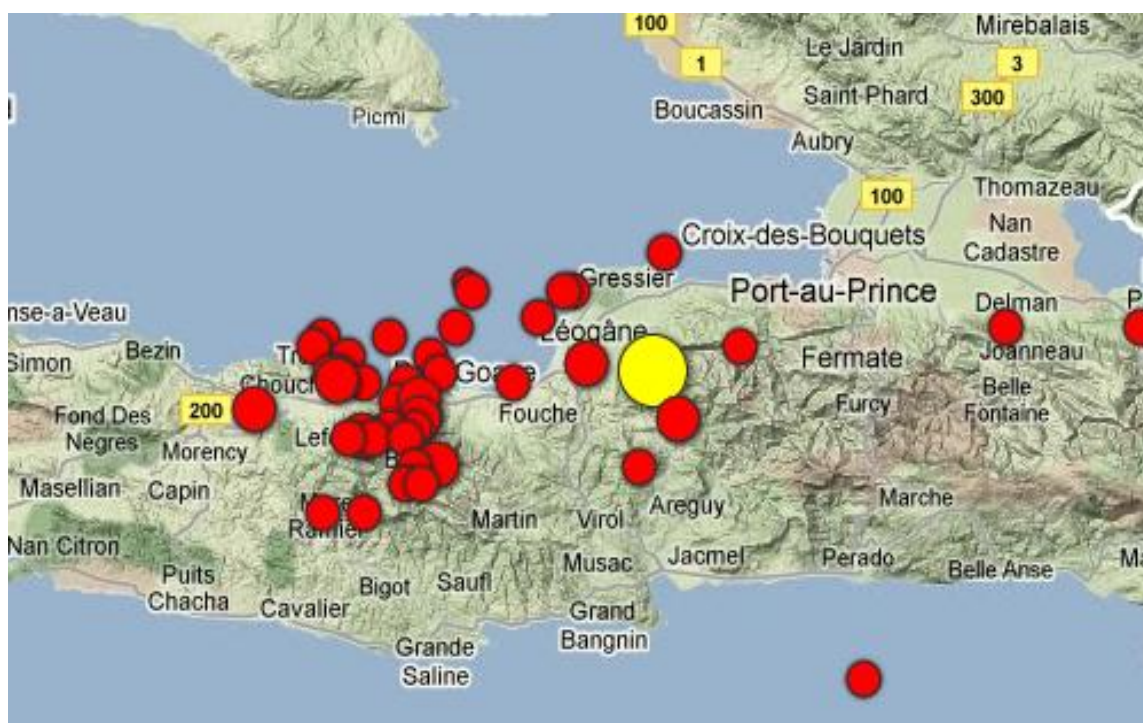


Figure C-3: Aftershock map—Main shock and 42 aftershocks (from USGS March 4th update)

Table C-2: Number of damaged houses grouped in the five European Macroseismic scale (Source: European Commissions Joint Research Center et al. 2010)

Commune	5	4	3	2	1
	Destruction	Very Heavy Damage	Substantial to Heavy Damage	Moderate Damage	Negligible to Slight Damage
Carrefour	2,763	5,905	5,920	3,220	35,219
Cite Soleil	1,012	549	1,073	576	6,403
Delmas	5,012	2,814	5,064	2,881	29,478
Grand-Goâve	148	541	421	276	2,175
Gressier	565	289	567	319	3,436
Jacmel	214	1,785	1,489	857	8,799
Léogâne	2,220	5,985	4,139	2,360	24,736
Petion-Ville	2,027	906	1,693	708	10,614
Petit-Goâve	173	104	167	116	770
Port-Au-Prince	9,902	15,257	12,351	6,699	62,693
Tabarre	532	365	663	383	3,914
Total	24,062	34,500	33,546	18,395	188,236

In addition to the sheer numbers of damaged and collapsed structures, there was also a significant loss of vital government infrastructure. One of the most iconic images of the Haitian earthquake is that of the collapsed presidential palace. In addition, many other government buildings collapsed or suffered significant damage including the Legislative Palace, the Palace of Justice, the Ministry of Health, the Ministry of the Interior, the Ministry of Finance and Economics and the headquarters for the MINUSTAH forces (Eberhard et al. 2010). In addition to the loss of the buildings, many experienced government workers and a lot of public records were lost in the collapse of these buildings.

Many important public buildings collapsed, including schools, churches and hospitals. The failure of these buildings is responsible for many deaths as well as a further reduction in the already deficient availability of public services. In addition, the lack of available services has hindered the recovery most notably through the lack of health care available to treat those injured in the quake.

In addition to the damage in Port-au-Prince, significant ground shaking ground shaking has caused damage throughout the region (Figure C-2). Léogâne is a poor, but urban area close to the epicenter that has been described as “totally flattened, demolished: Devastation and death beyond compare” (Morris 2010). Another badly damaged area is Jacmel which is a resort town with historic buildings lining the streets. On my trip through the area, it was apparent that damage has occurred not only in the large urban communities that have been noticed by the media and relief efforts, but also in the small villages and towns in the area. As mentioned above, rural Haiti has significant poverty associated with the reduction in agriculture. Despite the focus of large development agencies in attempting to support these areas, I noticed that very little relief or damage assessment efforts have arrived in these areas. In addition, the exodus of people from the city has increased pressure on these rural communities to absorb

additional members. This has in turn increased rural hunger and put the agriculture system in jeopardy as seed stocks are eaten and farm animals sold for cash.

2.3 Social, political and economic Impacts

The socio-economic systems in the country were fragile even before the earthquake. Because of the loss of both infrastructure and human resources, many of these systems were disrupted, causing increased difficulty in the lives of Haitians attempting to recover from the earthquake.

The already low public opinion of the government did not improve due to the perceived lack of government response. People have criticized the government for being absent and not communicating with the public in the crisis. The prime minister admitted “we are overwhelmed” (Wilson 2010). This criticism is not limited to international observers. During my trip to Haiti, one person I asked about the role of the government in the recovery just laughed and said he expects nothing from the government. Any recovery will come from international help or the Haitian people themselves.

Because of the destruction of schools across the country and uncertainty about the safety of those remaining buildings as well as the procedures of reopening, the government prevented any schools from opening before April 1st, 2010 when many schools opened successfully. This caused a glut of unemployed teachers and due to a lack of communication about opening procedures and which schools would reopen, increased uncertainty about future employment. In addition, the collapse of 80% of the Port-au-Prince schools (Bilham 2010) left many students wondering whether they will be able to complete their education at all. Both teachers and students I spoke to in Port-au-Prince mentioned looking for work in other fields because they needed to get by in the interim and they doubted that many of the schools would open at all. This was cited as a problem in recovery because the sudden drop in income further limited resources to rebuild damaged infrastructure.

Although some church buildings survived, people were generally afraid to enter them. Religious services continue in Haiti, but many are held on the streets and in tents. Similarly, many people are afraid to enter their houses and have erected tents in their yards, streets and in some cases on their roofs. In many cases, daily activities continue in buildings, but at night people feel safer sleeping without concrete above them. Many retail businesses relocated their operations into the street in front of their building, with the building sometimes serving as storage or office space. During my second trip to Haiti, I noted that people are gradually returning indoors.

A common complaint in Haiti is the rise in costs after the earthquake. I was told that the standard price of a ride in a taptap (a form of public transportation) had risen from 7 gourdes to 10 gourdes in the aftermath of the quake and that some journeys increased by even higher percentages. A merchant told me that people generally come to buy the same things that they did before, but they can simply afford less of them now. Historically, similar price rises in Haiti have been associated with increases in poverty, crime and hunger (Schuller 2008, Mazzeo 2009).

These changes, taken in context, in many cases overwhelm the physical devastation of the earthquake. Because of the many people living in or on the edge of poverty, most people did not have a buffer of resources to support their recovery. As the economy, both formal and informal, collapsed in the aftermath of the earthquake, the indirect damages of the earthquake have affected all the citizens of the affected areas. Although people are trying to get back to a normal state of affairs, the rise in costs and reduction in services have hindered recovery efforts and caused many additional people to fall below the poverty line.

Overall, the earthquake has had a devastating impact on the Haitian state. According to the Haitian Government website, 217,366 people died in the quake and an additional

300,572 people were wounded (Gouvernement de la République d'Haïti 2010b). This is more than twice the death toll of any previous magnitude 7.0 event (Bilham 2010). An initial rough estimate of the direct damage caused by the earthquake is 8.1 billion dollars, but the authors caution that 13.9 billion dollars is within the statistical error (Cavallo et al. 2010). These figures are especially devastating when considering that the GDP of Haiti in 2009 was 11.61 billion dollars (CIA 2010). Although the uncertainty surrounding these numbers is significant, we know that the earthquake struck at the most densely inhabited part of Haiti and destroyed much of the significant social, political and economic infrastructure that supports the country in addition to killing and dislocating hundreds of thousands of Haitians.

3. Recovery

3.1 International recommendations

The international community has been quick to offer suggestions on how to rebuild Haiti and how to set it on a track towards development and a reduction in vulnerability to future disasters. This process is complex, involving not just the engineering involved in ensuring buildings are less vulnerable to future earthquakes, but also reducing the corruption, social inequality, illiteracy, crime and poverty that continue to increase Haitian vulnerability to natural disasters and other external shocks.

One of the first sets of suggestions was testimony before the United States Senate Foreign relations committee in which James Dobbins from the RAND Corporation offered eight guidelines for future aid to Haiti.

- America should support the UN peacekeeping force.
- The UN peacekeeping force should expect to remain in Haiti for 8-10 more years.
- Poverty reduction programs will ensure that the entire population is behind the recovery plan.
- Aid should be oriented to enhancing the Haitian government capacity.

- Assistance should be provided to rural communities to ensure that people do not return to the shanty towns in the capital.
- Aid should not be encumbered with earmarks.
- Aid should be contributed to the UN and the World Bank rather than given unilaterally in order to ensure coordination.
- America should extend HOPE legislation and increase immigration opportunities for Haitians (Dobbins 2010).

Other published suggestions include focusing on rebuilding the Haitian police force, budgetary support to the Haitian government, identification of the roles of the government, people and international community in reducing disaster vulnerability (Perito 2010), better coordination, use of grants rather than loans (Zoellick 2010) and channeling of funds directly to communities (von Amsberg 2010). The Inter-American Development bank plans to narrow their focus to three main domains of economic infrastructure, agriculture and education as well as increasing their focus on rural areas, and disaster risk management while trying to increase government capacity (Interview with Giles Damais March 3, 2010).

Engineers have offered more specific ideas to improve the infrastructure stock in the country starting with the need for a building code and proper enforcement (Bilham 2010), providing education to professionals on seismic design and providing free training on construction techniques in public venues, tying aid money to seismic resistant construction and creating methods for exchanges of ideas between engineers in developed countries and Haiti (Fierro and Perry 2010). There have also been calls for use of more innovative building materials to cheaply build seismically sound buildings using tires for isolators or straw bales for walls (Kean 2010).

Despite much hope about the possibility to build Haiti back stronger and more resilient than before, there has been concern that reconstruction work could further weaken the country if it inadvertently increases the country's dependence on foreign aid, weakens the state or allows some individuals to profit off the recovery efforts (Blake 2010). Unfortunately Haiti has been offered suggestions and aid for disaster recovery before and has not managed to break the cycle of poverty and vulnerability that caused this disaster. The renewed interest in the country may produce helpful improvements, but also could be too little, too late or simply the wrong thing. It is important to consider the big picture when evaluating the effectiveness of aid and restoration efforts. Recovery alone will leave a Haitian state that is still the least developed country in the western hemisphere, vulnerable to additional shocks.

3.2 Reconstruction plan

On February 18th, 2010 the Post Disaster Needs Assessment (PDNA) started in Port-au-Prince with the goal of creating a reconstruction plan. This was organized by the Haitian government with support from international organizations involved in Haitian development culminated in an international donors conference March 31st in New York (Gouvernement de la République d'Haïti 2010a).

The first draft of the Reconstruction Plan was published in March on the Haitian Government website. The plan states that the causes for the high death toll are the population density, lack of building standards, state of the environment, unregulated land use and the imbalance in economic activity towards Port-au-Prince and offers 7 principles for a return to a path of development. These are:

1. preparedness for the 2010 rains and hurricane season,
2. inclusion of environment in recovery and development,
3. inclusion of risk and disaster management in reconstruction,
4. an active economic policy,
5. strengthening and decentralization of the state,

6. incentives for population settlement around regional growth poles, and
7. support for victims and recovery from the disaster.

The plan has four basic programs:

1. infrastructure,
2. governance,
3. reduction in vulnerability and increase in services, and
4. economic growth.

The government requests \$11.5 billion in aid of which 50% will go to the social sector, 17% to infrastructure, and 15% for environment and disaster management. The plan asks the international community to give budgetary support to the Haitian government and requests that funds be distributed promptly in the first 12 months.

The plan calls for the formation of two new organizations. La Commission Intérimaire pour la Reconstruction d'Haïti (CIRH) will manage the restoration during the first 18 months of the restoration and L'Autorité pour le Développement d'Haïti (ADH) will implement the government development plan.

The plan appears to contain many of the recommendations made by international groups and contains language insisting that the plan is Haitian and that the recovery must include all of Haitian society and provide local employment. However, the voting composition of the CIRH includes 7 Haitians (of which a minority are independent of the political system) and 10 international representatives (Gouvernement de la République d'Haïti 2010b). Two criticisms of previous development and disaster restoration in developing countries are the management role of the international community at the expense of the local government and community and the underrepresentation of civil society (Jackson 2005). This plan sets forth a reconstruction plan subject to the same criticism. In addition, the plan specifically addresses that there will be funds managed by

NGOS, and bilateral funds in addition to the coordinated multi donor fund without presenting any method to coordinate these reconstruction efforts (Gouvernement de la République d'Haïti 2010b).

On March 31st, 2010 the donor's conference was held. The restoration plan was submitted and international donors pledged almost 10 billion dollars in reconstruction funds (Government of Haiti 2010c). Figure C-4 shows the new pledges in millions of US dollars.

3.3 Haitian recovery in context

Haiti and the January 2010 earthquake are a devastating example of underdevelopment, poverty, vulnerability and disaster. However, it is important to consider this event in context. Disasters in undeveloped countries are not a rare phenomenon and recovery efforts and methods have been well studied. The success or failure of the Haitian recovery will be a function of the earthquake and the historic situation, but also of the effectiveness of domestic and international reconstruction and development efforts.

Many scholars have noted the vulnerability of developing countries to disasters. Although some poor countries may have additional resiliency through traditional cultures, the social and environmental processes in developing countries can significantly increase vulnerability. Examples of these are environmental degradation and rapid urbanization (Rodriguez and Russell 2006) both of which are very important in explaining Haitian vulnerability.

Although there are many similarities between disasters in developing countries, it is important to note that Haiti is unique even amongst developing countries. The 2004 tsunami is often compared to the Haitian earthquake because of the large death tolls from both events. In Sri Lanka both the government and NGOs were found to be lacking in responding to the tsunami (Fritz Institute 2005). However, during my recent trip to

Haiti, a Red Cross employee said that the response was incomparable and that the Haitian recovery is nowhere near where Sri Lanka was at the same point.

Responding to disasters is a complicated process and each event brings criticism and suggestions on improvement. It is necessary to provide relief in a timely and appropriate manner. In addition, recovery brings further complications including national sovereignty, aid dependency, corruption and human rights. As a member of group traveling to Haiti to consider Haitian recovery, I noticed that Haiti provided many examples of what not to do in international disaster relief and recovery. Observing cluster meetings, I saw examples of corruption, lack of concern for Haitian needs, catering to donors, attempts to interfere with government business and duplication of services. Government workers appreciated the additional funding, but in many cases suggested that it was not focused on the most important needs. One particular example of the difficulties being faced by the Haitian recovery is in the shelters. NGOs have provided medical services and education to improve life in the tent cities and initially provided food and provisions. However, as summer approaches, the rains have begun to cause flooding and it is clearly necessary to move people into better quality housing out of the flood plains. Because it is the only place to receive free medical care and schooling, many people prefer to live in the tent cities than in housing that has been determined safe by government engineers. In addition to increasing risk, this has had a terrible impact on local fee based hospitals and schools which can't compete with the free services offered in the tent cities. This is only one example of the difficulties being faced by international organizations in Haiti, but shows how well intentioned procedures have caused unintended consequences. Although the cluster system appears to fix many of the coordination problems that have plagued past relief efforts, there are still many problems with the way that NGOs and the government are working on the recovery.

4. Conclusion

The January 2010 earthquake in Haiti was an unprecedented disaster in the country's history and will likely be evaluated for lessons in disaster vulnerability, resilience and recovery for years. The underdevelopment of the country, evident in the weak government, economic system and infrastructure, ultimately led to hundreds of thousands of deaths and billions of dollars in economic damage. Many domestic and international organizations have offered support and funding for the reconstruction and development of Haiti. The reconstruction plan provided for the government offers hope that recovery and reconstruction efforts can mitigate future disasters, but the plan also leaves room for a continuation of the international management of the country at the expense of the Haitian state. Ronald Ajenor states, "We're not a country anymore. It doesn't seem like we have a government. We're a place where people go to give money" (Blake 2010). Ultimately the reconstruction will be judged by its ability to give a stronger and less vulnerable Haiti back to the Haitians.

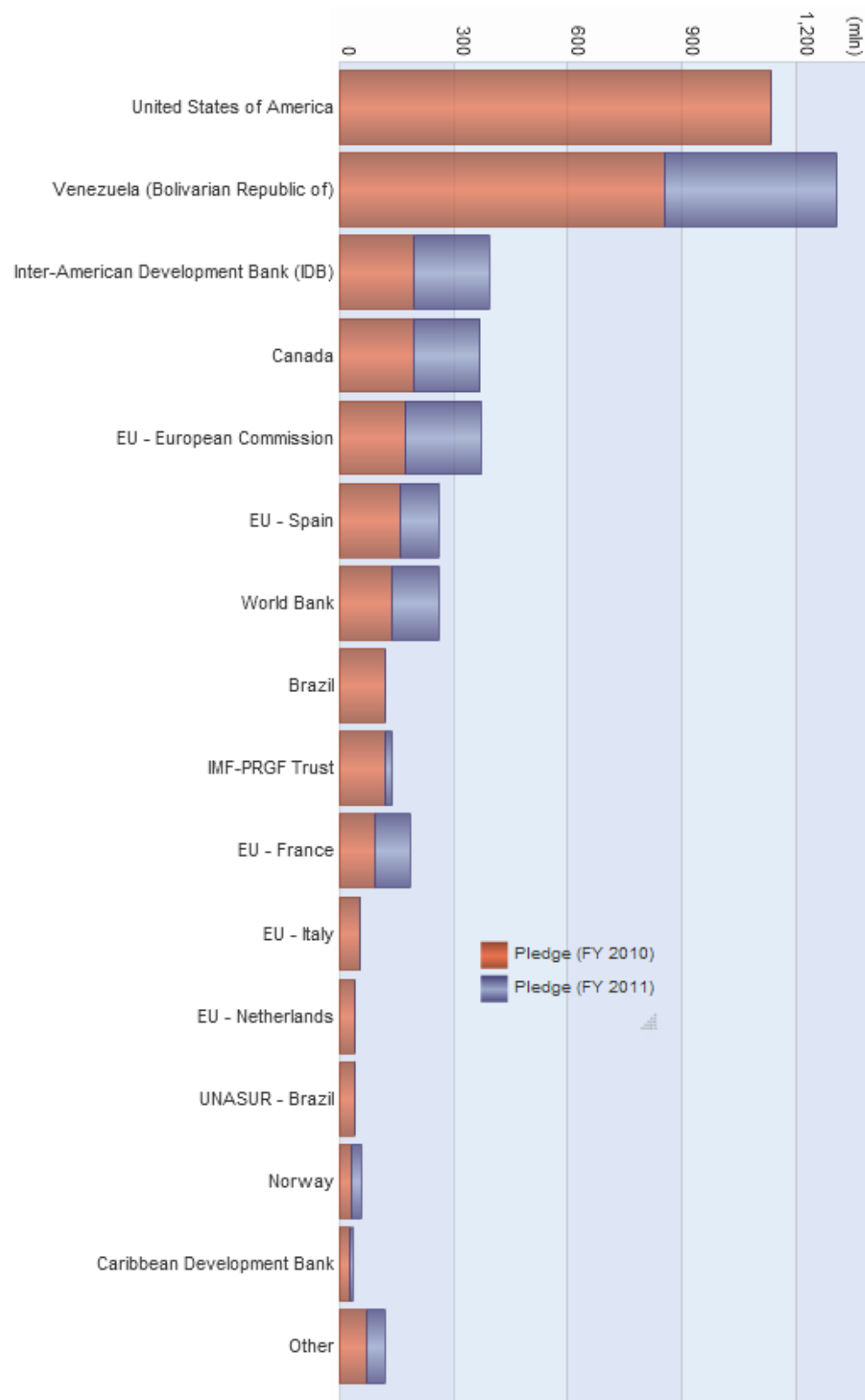


Figure C-4: New pledges following donor conference (Source: Haitian Government 2010)

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