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“THE NEED OBLIGED US”: CULTURE AS CAPACITY DURING THE
HURRICANE STAN EMERGENCY RESPONSE.
A CASE STUDY FROM TECTITÁN, HUEHUETENANGO, GUATEMALA

By:
Jesse Silverman

A THESIS
Submitted in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE
GEOLOGY

Michigan Technological University
2011

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This thesis ““The Need Obligated Us”: Culture as Capacity during the Hurricane Stan Emergency Response. A Case Study from Tectitán, Huehuetenango, Guatemala”, is hereby approved in partial fulfillment of the requirements for the Degree of MASTER OF SCIENCE IN GEOLOGY.

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Abstract

A major deficiency in disaster management plans is the assumption that pre-disaster civil-society does not have the capacity to respond effectively during crises. Following from this assumption a dominant emergency management strategy is to replace weak civil-society organizations with specialized disaster organizations that are often either military or Para-military and seek to centralize decision-making. Many criticisms have been made of this approach, but few specifically addresses disasters in the developing world. Disasters in the developing world present unique problems not seen in the developed world because they often occur in the context of compromised governments, and marginalized populations. In this context it is often community members themselves who possess the greatest capacity to respond to disasters. This paper focuses on the capacity of community groups to respond to disaster in a small town in rural Guatemala. Key informant interviews and ethnographic observations are used to reconstruct the community response to the disaster instigated by Hurricane Stan (2005) in the municipality of Tectitán in the Huehuetenango department. The interviews were analyzed using techniques adapted from grounded theory to construct a narrative of the events, and identify themes in the community's disaster behavior. These themes are used to critique the emergency management plans advocated by the Guatemalan National Coordination for the Reduction of Disasters (CONRED). This paper argues that CONRED uncritically adopts emergency management strategies that do not account for the local realities in communities throughout Guatemala. The response in Tectitán was characterized by the formation of new organizations, whose actions and leadership structure were derived from "normal" or routine life. It was found that pre-existing social networks were resilient and easily re-oriented meet the novel needs of a crisis. New or emergent groups that formed during the disaster utilized social capital accrued by routine collective behavior, and employed organizational strategies derived from "normal" community relations. Based on the effectiveness of this response CONRED could improve its emergency planning on the local-level by utilizing the pre-existing community organizations rather than insisting that new disaster-specific organizations be formed.

Introduction

This paper uses qualitative ethnographic methods to investigate the social organizations that occurred in response to a natural disaster in a small town in western Guatemala. The event that precipitated the social and physical phenomena described in this paper was Hurricane Stan, which passed over Central American and southern Mexico in early October 2005. The site of this study is the municipality of Tectitán (15° 18' 25.5" N; 92° 03' 36.1" W), in the department of Huehuetenango Guatemala (see figure 1).

This paper documents the untrained and spontaneous citizen response to the disaster that occurred in Tectitán related to Hurricane Stan. The social phenomena investigated in this paper are strategies adopted by Tektiteko society to meet unique challenges presented during a disaster. The predominant disaster-coping strategy that evolved in Tectitán was formation of citizen groups to respond to proliferating needs of neighbors. A characterization of those emergent groups based upon an analysis of unstructured interviews conducted in 2010 with participants from a variety of the different groups is presented in this study. Relying on data from ethnographic observations during a 27-month residence in Tectitán, disaster-time behavior demonstrates recurrent cultural traits from "normal" cultural life. These cultural traits are shown to enhance community-level resiliency to adverse conditions.

Examples from the response are isolated that exemplify conflicts between a culturally intuitive approach to disaster response and response models imposed upon Tektitekos by outside disaster response organizations. The conflicts identified center around incompatibility between the leadership structures adopted by Tektiteko responders and those expected by outside organizations. This conflict is explored within the context of a debate in the emergency management literature concerning effective models of emergency management. These models of emergency response provide comparisons to classify the recorded response in Tectitán and the response plan advocated by the Guatemalan National Coordination for Disaster Reduction (CONRED).

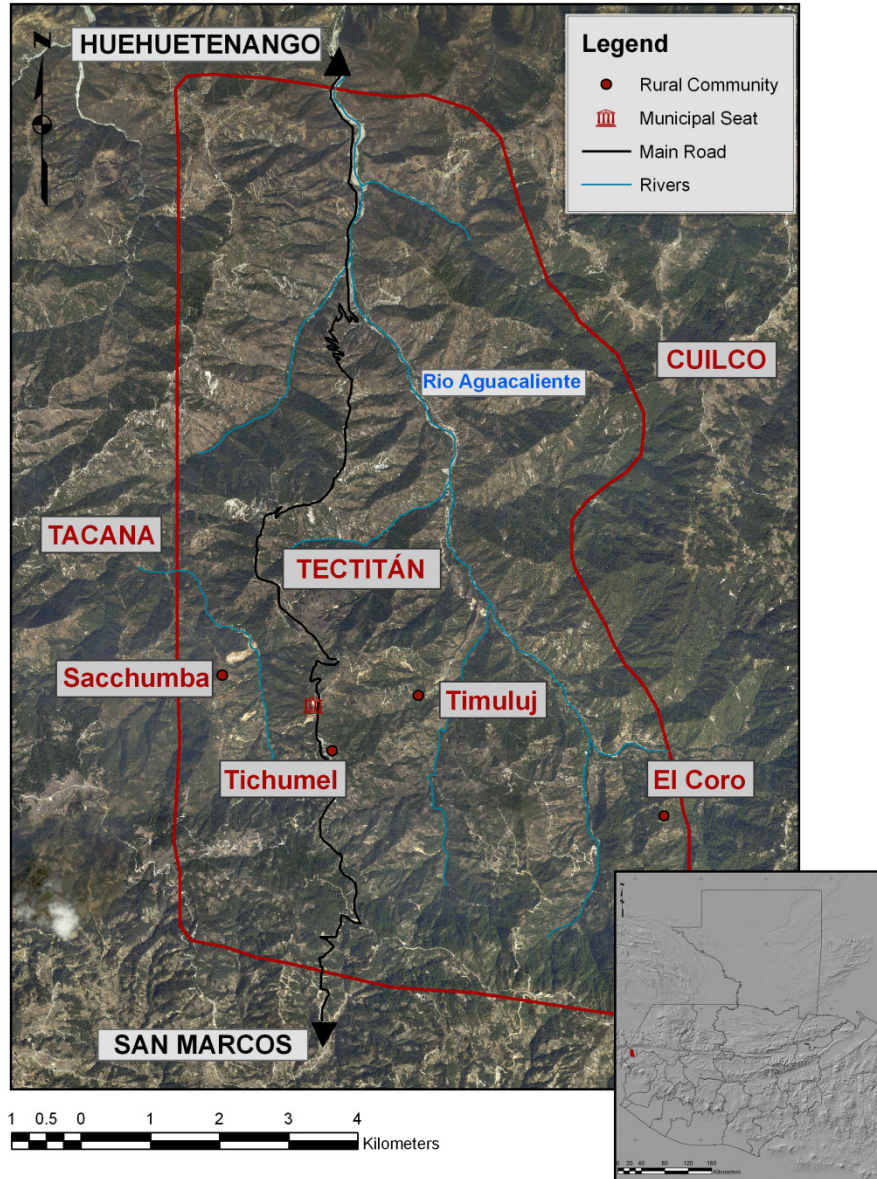


Figure 1 Map showing location of Tectitán in Guatemala, as well as neighboring municipalities, and several communities in Tectitán referenced in the paper.

Finally, the CONRED plan is critiqued against the Tektiteko response to reveal insensitivity to culturally ingrained proclivities and realities of disaster situations. This paper argues that the official national plan does not account for decentralized, consensus-based decision-making that occurs in the communities and municipalities in rural

Guatemala, and that it does not address limited capacity on the municipal-level for centralized disaster response.

This paper also presents an inventory of landslides that occurred in the municipal territory of Tectitán as a result of the heavy rains of Hurricane Stan. The landslide inventory is used to characterize landslide occurrence throughout Tectitán. Comparing the landslide inventory map with housing locations allows for an assessment of household exposure to landslides. The pattern of household exposure to landslides is used to argue that vulnerability in Tectitán is dispersed and therefore cannot be addressed effectively by centralizing response capacity.

Site Description

The town of Tectitán is a small seat of local government, in the department of Huehuetenango in northwestern Guatemala. Around 1,000 people live in the town itself and another 8,569 people live in 32 small rural communities within the boundaries of the municipality (INE 2002). The municipality is 73 km². The town of Tectitán is located at 2,200 meters on the northern slope of the San Marcos *altiplano*, 184 km WNW from Guatemala City. The highest elevations, close to 3,000 meters, are in the extreme south of the municipality and the topographic lows, near 1,000 meters, are found to the north where the rivers that drain Tectitán flow into the Cuilco valley. A characteristic feature of the geomorphology of the municipality of Tectitán is its dramatic steep and broken terrain; dominant drainages run roughly N-S and create valleys with 1,000 meters of relief. The slopes of 90% of the area of the municipality of Tectitán are greater than 12°, with an average of 30°. The average slope of house sites is 19° based on data from a 30 m DEM (see slope map, figure 2).

Located north of the Central American Volcanic Front but within the volcanic arc, the predominant lithologies underlying Tectitán are rhyolitic-andesitic volcanic rocks, along with granite to granodiorite intrusives, and some metamorphic rocks (Bonis et al. 1970; Kilburg 1979). The intrusive rocks are of Late Mesozoic to Early Cenozoic age and identified as the San Luis Granodiorite, and are overlain by Tertiary volcanic rocks that include rhyolitic tuffs and andesitic lava flows (Kilburg 1979). The volcanic rocks

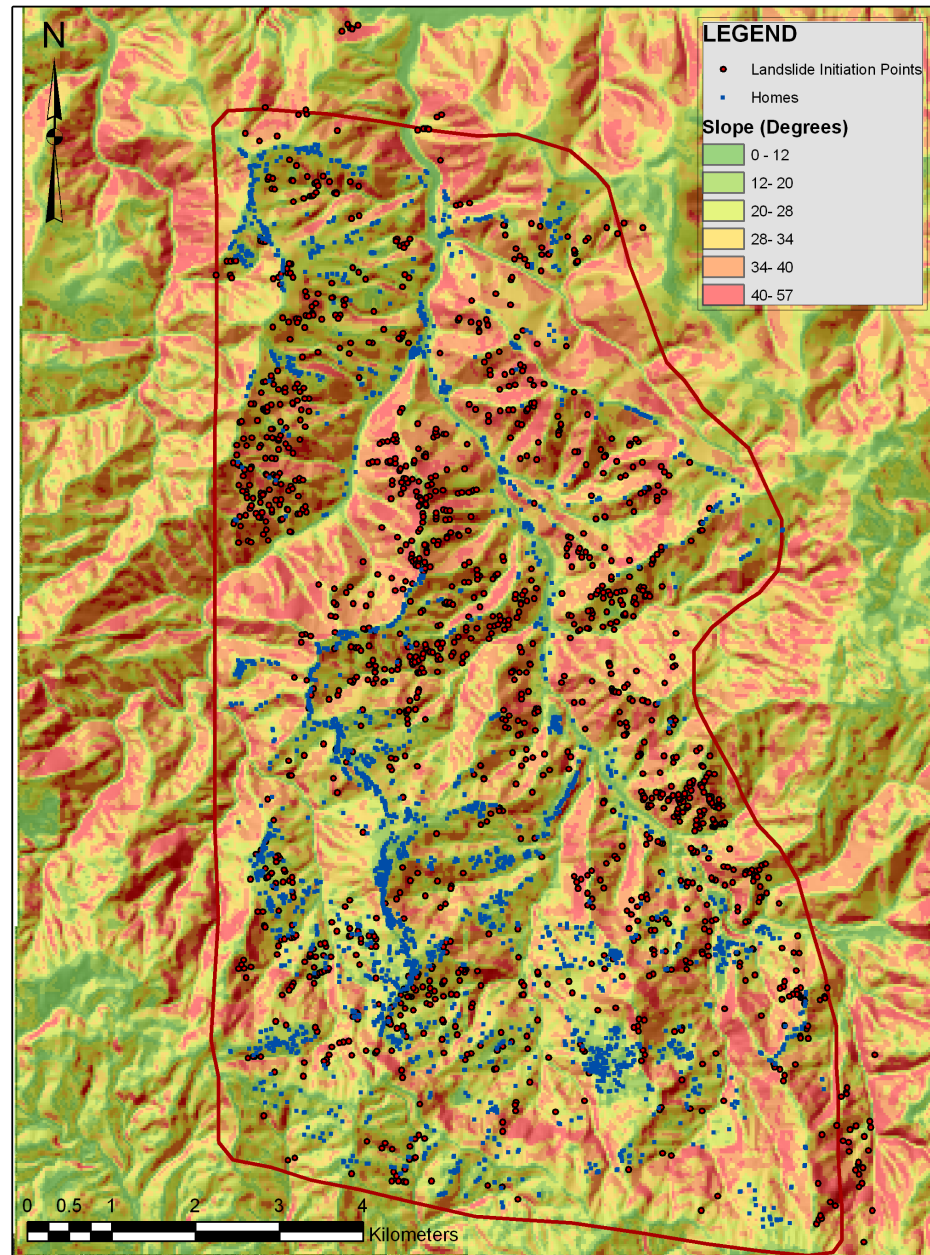


Figure 2 Map displaying the slope of the terrain of Tectitán calculated from a 30m DEM. The blue dots are digitized houses; the red dots are landslide initiation points. Notice how the houses follow ridgelines where the terrain is more moderately angled.

weather to produce soils with a high clay content. Known locally as *tierra de varro*, or *tierra amarillo*, it is utilized for making adobe bricks for houses as well as hand-built utilitarian pottery. The plutonic rocks weather to produce sandy soil, locally known as

tierra arenosa. Both soil types experienced mass-movements during Hurricane Stan, however deep-seated failures occurred preferentially in the clay-rich soils.

Most families in Tectitán rely on small-scale subsistence farming of maize, beans, and squash (*milpa*) to sustain their livelihoods. *Milpas* are individually owned, and are passed down as inheritance through the father to his sons. Women can also be the recipients of land as inheritance, but it is less common. In addition to inheriting land it is also possible to buy land, however land is becoming scarce. Most rural families in Tectitán own the land they farm on, which generally amounts to around 10-20 *cuerdas*, or between 3-7 hectares.

Despite its steepness, land is used for agriculture at all elevations in Tectitán. Most agriculture is rain-fed, and therefore only occupies the soils for the months corresponding to the rainy season. The normal rainy-season lasts from late May to late September and usually delivers between 1000 and 1500 mm of rain. Usually there is a bi-modal distribution of rain during the rainy-season, with an early peak in June, and a second in August, separated by a *canicula*, or dry period. Tektitekos plant *milpa* in late May or early June, after the first heavy rains have softened the soil. The harvest takes place between January and February, after the maize and beans have had time to dry in the fields. In the dry season agricultural plots are left to be colonized by annual plants. The leaves of some of these are collected as regular food sources.

Many families in Tectitán plant their *milpas* in multiple locations: on land near their home in their community, and on land in *la vega*, which is the lower part of Tectitán on the ESE facing, slopes of the *Aguascalientes* River. *Milpa* planted in the warmer lower elevations is planted later and can come to maturity earlier than *milpa* planted at higher elevations. *La vega* is almost completely deforested because all of the land is used for agriculture. The denuded slopes of *la vega* were particularly susceptible to landslides during Hurricane Stan. Serious slope stability problems in an area relied on for agricultural production stressed food security in Tectitán.

In parts of *la vega* and the lower valleys of Tectitán coffee production is increasing in popularity. Because coffee growing encourages retaining trees for shading

and does not require yearly disturbing the slope, it is potentially a good compromise between slope protection and a livelihood that relies on the land for production.

Year-round agriculture occurs in small plots where there is water available for irrigation, usually near a stream or the household. Whereas *milpa* crops are rarely converted into cash through sale in markets, vegetables grown in irrigated plots are brought to local markets in the surrounding municipalities. These vegetables, along with fruit harvested from personal trees provide supplemental income and nutrition. With the exception possibly of coffee, no products from Tectitán reach the international market, and, most are sold at the markets in the nearest large towns.

Almost all Tektitekos cook with wood, creating a large demand for firewood. In the upper parts of Tectitán it is common to see slopes with north-facing aspects reserved as forest for wood collection, whereas all of the surrounding south-facing slopes are denuded for planting *milpa*. The woodlots are privately-owned, although there are forests protected by the municipality. These forests are principally in higher elevations of the municipality where the major springs providing water to the town are located. The municipality allows trees to be harvested from protected areas for a nominal fee, which is rarely collected. Clandestine timber harvesting occurs in several more remote locations in the municipality. Overall, there is greater forest cover in higher elevations of the municipality. In informal conversations many Tektitekos identify reduced forest cover resulting from pressures for arable land or firewood, as a principal cause of the municipality's slope stability problems.

In addition to subsistence agriculture most families migrate to Chiapas, Mexico to work on the large-scale coffee farms or *fincas*. During the principal harvest months, between October and February, when there is the most work, whole families migrate to the *fincas*. In these months it is common for rural communities to be nearly depopulated. Young men and adolescents may also look for work in the *fincas* throughout the year. Work at the coffee *fincas* represents the most important source of income for most Tektitekos throughout the year. Tectitán's proximity to the Mexican border also results in substantial migration to the United States, another principal source of cash income for families.

The frequent travel to Mexico and the US has undeniably had a positive impact on the standard of living in Tectitán. Remittances are responsible for changes in home construction styles. Greater income allows families to build multi-story cinderblock and cement homes as opposed to the traditional single story adobe houses. Remittances also bring modern appliances to homes. Small businesses founded with remittance monies, have also proliferated, which has increased animal protein sales in Tectitán (personal communication Edgar Beach 2010).

Migration has also had a cultural impact on inhabitants of Tectitán, especially the indigenous Maya that comprise 65% of the municipal population (INE 2002). Travel and exposure to Mexican and American culture within the last 40 years has led the abandonment of traditional dress amongst indigenous Tektiteko men in favor of Western clothing. However, where it has led to erosion of certain cultural traits, it has also provided an opportunity for rural families to educate their children. The result is that in Tectitán there is emerging a group of educated professional indigenous Tektitekos who exert influence in schools and the local government.

The municipality of Tectitán is home to a distinct population of Mayans who speak Tektiteko, a Maya dialect, which is not spoken elsewhere in Guatemala. Though Tektiteko is recognized as a unique language it is related to the much larger language-group Mam, spoken in all of the surrounding communities. The number of Tektiteko speakers is unknown, but estimated at 1,000 and 2,000 speakers by the Academy of Mayan Languages in Guatemala (ALMG). Because of the low number of speakers, Tektiteko is neither the main language of business or professional communication in the municipal offices nor in most of the communities. However, there are 7-10 rural communities where Tektiteko is still the first language in the home and in most personal relations. Especially in communities in the southern part of the municipality there are Mam speakers who are descendants of people who moved to Tectitán from the neighboring municipalities, often these people will speak Tektiteko as well. Nearly all Tektitekos, regardless of whether they speak a Mayan language or not, speak Spanish.

Ethnicity is a complicated issue in Tectitán, and throughout Guatemala. There are many people in Tectitán who are ethnically descendants of Mayans, however they neither

speaking a Mayan language nor dress in a manner that identifies them as Mayan (more important for women). It is difficult to know whether these people identify as indigenous or *Ladino*. Socially and culturally, there is greater difference along class lines than ethnic lines; with *campesinos* having more in common with each other, regardless of ethnicity than they do with wealthier *Ladinos* from the town.

It is not well known when the Tektiteko people first inhabited the land now known as Tectitán. It has been theorized that the ancestors of the Tektitekos migrated west from the Mam stronghold of Zaculeu, the present-day site of Huehuetenango (ALMG 2004). The earliest accounts of the town of Tectitán survive from the 17th and 18th centuries, recorded by the historian Francisco Antonio de Fuentes y Guzmán and Archbishop Pedro Cortés y Larraz. Both give accounts of a small, difficult to access indigenous town devoted to subsistence farming. Fuentes y Guzmán reports 120 inhabitants, and within a century Cortés y Larraz reports the population having grown to 338 (Fuentes y Guzmán 1933; Cortés y Larraz 1958). Tectitán was founded as a municipality in 1879 by president Justo Rufino Barrios, and presumably received its first non-Mayan (*Ladino*) residents at this time. By 1930 there were five *Ladino* families living in Tectitán, a number which grew to seven or eight in the 1940's (ALMG 2004).

Vulnerability to Landslide Hazards

To Wisner et al. (2004) vulnerability is divided into three categories: Root Causes, Dynamic Pressures, and Unsafe Conditions, which layer and combine to create a situation where exposure to a hazard results in disaster. Root Causes are explained as those that are most distant from the local population in space and time; they include large institutionalized forces such as political marginalization, or exploitative economic policy. Dynamic Pressures act to focus root causes into creating unsafe conditions, they are contemporary as opposed to legacies from the past, examples include: rapid population growth or urbanization, civil conflict, or food insecurity. Root causes and dynamic pressures, because they exist on the national and international level and in some cases represent historic hegemonic discourses, are generally persistent and difficult to surmount by individuals at the local level. In contemporary Tectitán root causes such as historic

institutionalized marginalization of the indigenous population interact with current demographic trends of increasing rural population and the associated increased pressure on the environment to create conditions where households are exposed to landslide hazards.

Root Causes of Vulnerability

The colonial legacy of Guatemala is manifested throughout the country by the systemic marginalization of indigenous populations, who have suffered from limited access to education and infrastructure, as well as cultural repression. The indigenous populations of Guatemala were subjected to land seizures and slavery under the exploitative colonial economic system of the Spanish. As a result indigenous groups were re-located from the fertile low-land areas of the Pacific Coast into the highlands (Martínez Peláez 1998). Marginalization of the indigenous has propagated into the modern history of independent Guatemala by the persistence of colonial land ownership patterns which created an elite class of Spanish descendants who consolidated political power (Martínez Peláez 1998). Indigenous populations suffered under conditions of forced labor, during the Ubico presidency (1931-1944), where they were forcibly conscripted to build the country's infrastructure (ALMG 2004). During the country's 30 year armed internal conflict (1960's-1996) indigenous communities were targeted by the Guatemalan army and suffered, massacres, raids and martial law, which had extreme deleterious effects on indigenous civil society and identity.

In Tectitán this legacy of marginalization is displayed clearly, almost metaphorically, in the demographic distribution of the population. The town of Tectitán is a small urban center on relatively flat land on top of a hill. The urban center has developed around the local government offices, health center, school, and market. The town of Tectitán has been traditionally *Ladino*, whereas the surrounding communities situated on steep, unstable slopes are predominately indigenous. The indigenous communities rely on the town for health care, schooling, commercial and transportation opportunities, and development projects coordinated through the municipal offices.

The remnant colonial structure has favored *Ladinos* in town, who have been better situated to take advantage of commercial trade as travel has increased. Additionally, because of their proximity to the seat of government *Ladinos* have received greater benefits from development money from the National government. Therefore, even if current policies do not discriminate against the indigenous Tektitekos, they continue to be adversely affected by inequitable structures emplaced historically. This general history does not preclude the existence of poor *Ladino* communities. In the rural communities of Tectitán, both *Ladino* and indigenous communities experience limited economic opportunity, and hardship.

Physical Vulnerability

The municipality of Tectitán has several characteristics that result in high aggregate physical vulnerability. Tectitán is an isolated municipality, both from the centers of power of the national government, and the departmental government. During the rainy season, neither road leading out of town is dependably passable because of landslides. This means not only that help will be slow in coming, but also that because of its inaccessibility Tectitán receives less attention from government programs and infrastructure strengthening development groups. Also, vulnerability results directly from the steepness of the terrain in Tectitán, and the pressures that the human population places on the steep slopes.

Adaptations have been made to habituate to this terrain, but because of the fragile equilibrium of steep terrains human disturbance increases the propensity for slope failures. One method of reducing human disturbance to the land has been to locate settlements along ridges, or on the interstitial highs between gullies, where the slopes are slightly reduced. This pattern persists and many villages are sited on ridges (see figure 2 for visual demonstration of housing patterns in relation to slope). However, a growing population and the construction of more modern roads have put pressure on this tenuous environment.

The 1964 census reported a population in Tectitán of about 3,000. More recent censuses have shown steady growth; in 1981 4,197, and by 2003 the population doubled

to 8,569, corresponding to a 2% growth per year (ALMG 2004). Population growth leads to more land under cultivation to produce basic grains, as well as more land impacted by human settlements. This population grew from elevated birth rate and migration, but it has lowered significantly since 2003 because of land scarcity. The people in Tectitán are aware of this growth and resultant land scarcity and would talk about the old times when the communities were only occupied by a few families. Growth has populated whole new villages that previously were planting grounds. Whereas there was likely enough relatively safe land to build on when populations were low, the growing population is forced to look to more marginal lands to build on.

When villages outgrow the moderate land of the ridges they expand to the steeper valley sides; one of the adaptations people have made to building on such steep ground is to create flat house foot-prints by carving back into the slope through soil and weathered rock. These cuts can be over 3m and are usually left vertical and without reinforcement. While they may not pose a problem on moderate slopes, on steep land where the cuts need to be greater they increase the house's vulnerability to slope failure. The fill material from the house cuts is generally used to create the adobe bricks. Fill that is not used for bricks may be left unconsolidated around the house-site, to be easily mobilized into debris flows during heavy storms. There is no data to determine what percentage of house damages during Hurricane Stan were due to failures of house cuts, but from anecdotal and personal experience with Hurricane Agatha (2010), it appears that these types of failures are a major contributor to house damages.

As recently as the mid-1970's there was no access to Tectitán by motorized vehicle; the transportation network was limited to donkey and foot trails, which had minimal impact on slopes. Today there is road access for cars to all but 2 of the 32 villages in Tectitán. New roads continue to be built to expanding parts of villages which, are located on steeper sites requiring steeper roads with more extensive cuts. These road cuts are loci of mass-movements during storms. Roads also create drainage problems, initiating gullies that if left unchecked become chasms that go through or past communities.

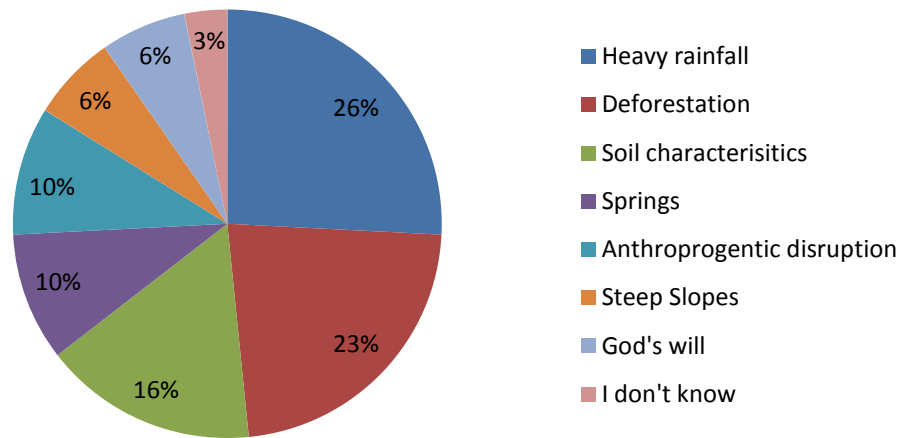
Despite anthropogenic influences on slope stability, mass-movements are clearly a part of the natural mass-balance process in Tectitán. There is evidence of pre-Stan failures on the landscape in the form of re-vegetated scars (Womack 2005). These scars tend to be from deep-seated translational or rotational slides at gully heads or on gully sides. In addition to observing the remnants of older landslides in the landscape, a good clue that landslides are not recent phenomena is that Tektitekos appear to be fairly familiar with the factors influencing landslides. In informal questionnaires with 19 mostly male Tektitekos between 20 and 75 years old, most were able to identify when and where landslides occur and other characteristics that have compounding effects on the likelihood of landsliding (see figures 11, 12). Some in this same group said that landslides occur frequently, perhaps even yearly, but that the landsliding associated with Hurricane Stan was unprecedented.

The Event: Hurricane Stan

Hurricane Stan occurred during the particularly active 2005 Atlantic Hurricane season, the most active year on record (Beven et al. 2008). Twenty-eight storms were recorded, 27 of which were tropical storms while one was a subtropical storm. Of the 28 storms, 15 reached hurricane status, and 7 of those were considered major hurricanes (Beven et al. 2008). Hurricane Stan, despite its short-lived status as a hurricane, produced nearly ten days of continuous heavy rainfall over Central America and Mexico from October 1st-9th resulting in destructive flooding and landslides.

Guatemala is exposed to significant hurricane events from both the Atlantic and Pacific sides. The Atlantic events originate either in the subtropical Atlantic or the Gulf of Mexico and usually are weakened by crossing Central America before reaching the Highlands of Guatemala, where they give rise mainly to very heavy rain. Prior to Hurricane Stan, Hurricane Mitch (1998) was a Caribbean storm that inflicted mass destruction throughout Guatemala and Central America. Pacific hurricanes may originate near Guatemala but generally head away toward the northwest. The volcanic front in Guatemala acts as an orographic barrier to the monsoonal rainy season precipitation, but hurricane events create heavy rains inland, beyond the volcanoes.

What are the causes of Landslides? n=19



Where is it most likely that landslides will occur? n=25

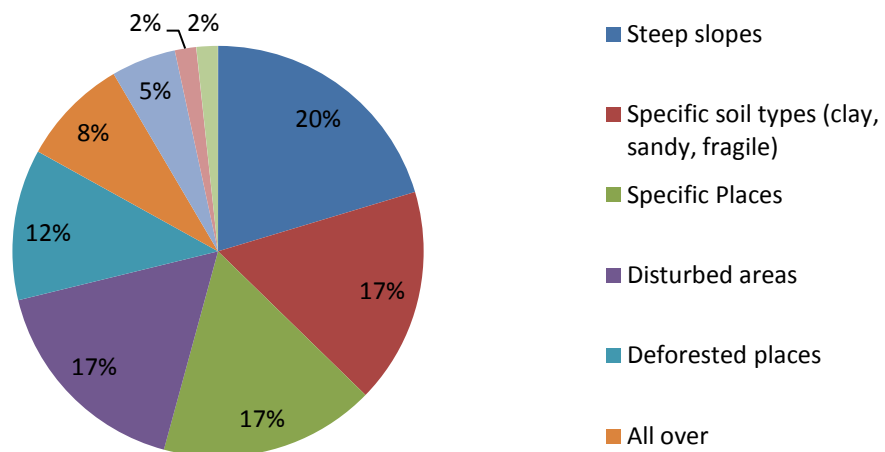


Figure 3 Results from semi-structured interviews on landslide knowledge and perceptions

Immediate Effects

In Guatemala the reported death toll as of October 28th 2005 from causes associated with the heavy rains of Hurricane Stan was 669, with 844 persons missing (CONRED 2005). An estimated 3,500,000 (31% of Guatemalan population) people were directly affected by the storm, including 474,928 people (4% of Guatemalan population) who were considered severely affected by the storm (CONRED 2005). An estimated 34,968 homes were destroyed or damaged by flooding or mass-movements. Based on investigations carried out by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC), the estimated total monetary impact (losses and damages) to Guatemala from Hurricane Stan was USD 983 million, which represents 3.4% of the 2004 GDP (ECLAC 2005).

The municipality where this study takes place, Tectitán, Huehuetenango, was identified as one of the municipalities where at least 10% of the population was affected by Hurricane Stan (ECLAC 2005). The only quantitative data available on the extent of impact Hurricane Stan had on Tectitán come from damage assessments that were carried out during and after the crisis by workers of CARE International and citizen participants. These documents are un-published and were given to the author by one of the CARE workers who participated in the disaster response and in subsequent assessments as well. There are two of these assessments, neither one reports data from all of the communities. Where there are inconsistencies between the two damage assessments both values are reported.

There were four fatalities in the municipality of Tectitán during the course of Hurricane Stan. Three of the victims were buried together by a landslide as they slept in their home; luckily their parents were rescued. The other fatality was a single mother who, while evacuating her house on a rural path with her children, was hit by a landslide. In Tectitán between 792 and 834 people evacuated their homes during the course of Hurricane Stan. The evacuees either stayed with neighbors and relatives, went to the municipal salon in town of Tectitán where an improvised shelter was established, or stayed in an improvised shelter in their communities (which were located in public

buildings). There is no data on the breakdown of where people sought refuge. Between 211 and 261 houses were affected, and between 46 and 62 houses were destroyed. Both major roads leading out of Tectitán to the two nearest large cities, Huehuetenango and San Marcos were blocked by landslides and were not fully cleared for weeks. Internal infrastructure was damaged as well; nine smaller roads and four bridges connecting the rural communities to the municipal seat were damaged, isolating those communities from the major shelter, and the center of the disaster relief effort. Water systems sustained heavy damage from landslides that broke or carried away the PVC pipes connecting the containment tanks on the mountains above town with the distribution systems in the communities. Only one community in the vicinity of municipal seat had a water system that remained functioning through the duration of the storm. Although water systems failed, because of the hurricane rains water was abundant. New springs formed within houses, and from these springs people were able to collect drinking and cooking water.

The data on crops lost during the storm is very incomplete; it comes from damage reports that were only conducted on what were considered the 10 most severely affected communities. Heads-of-households from these communities reported losing over 900 *cuerdas*, or 350 hectares, of land that was planted with corn at the time the storm hit (the data on other agricultural losses such as beans, or farm animals is too incomplete to present). This number is likely a conservative estimate of the overall agricultural losses of basic grains suffered by Tektiteko farmers because the majority of Tektitekos plant corn in land outside of their communities, including a region of the municipality that was highly affected by landslides. It is conceivable that there were families whose communities were unharmed but who still lost crops because they had been planted on slopes outside their communities where landslides occurred.

Development of the Storm

The disastrous rainfall event that has been remembered popularly as Hurricane Stan, or more familiarly Stan was only partly due to the effects of the passage of the storm officially named Hurricane Stan. The Hurricane Stan event occurred in October 2005 and resulted in widespread flooding and landsliding in Northern Central America

and southern Mexico. In Guatemala and Southern Mexico continuous rainfall persisted from October 1st-9th. This rainfall event was associated with the passage of the Hurricane Stan cyclonic system; however it was not exclusively a result of that system. Rather, the anomalous rains produced by the Stan event probably resulted from the interplay between Hurricane Stan to the north in the Caribbean and Gulf of Mexico and the Inter-Tropical Convergence Zone (ITCZ) which, located close to the Pacific coast of Guatemala created a strong low pressure system, itself generating rains (INSIVUMEH 2005).

Hurricane Stan had a complex history, having two periods of intensification and making two separate landfalls (see figure 4). The following is a synopsis of the history of this storm, including a history of the concomitant weather systems in the Pacific, which although not technically part of the Hurricane Stan system, the two systems interacted to produce rains that, have been remembered as part of the Hurricane Stan event:

- Prior to October 1st: The likely precursor to Hurricane Stan was a tropical wave that developed off the Atlantic coast of African on September 17. This wave moved across into the Caribbean where it organized and consolidated into a strong low-pressure system, moving into the western Caribbean from September 25th –30th (Pasch and Roberts, 2006). During this time the ITCZ was close to the Pacific Coast of Guatemala inducing rains and lightning events in the southern part of the country (INSIVUMEH 2005).
- October 1st: The National Hurricane Center warns that the low-pressure system in the Caribbean has intensified to a Tropical Depression; it is located roughly 500km from Puerto Barrios, Guatemala and moving to the WNW at 9 km/h. The ITCZ continues to provoke rain in southern Guatemala (INSIVUMEH 2005).
- October 2nd: The Tropical Depression intensifies and is upgraded to Tropical Storm Stan before it makes landfall near Tulum, Yucatan, 440 km north of Puerto Barrios. The maximum wind speeds were 75 km/h and the storm moved to the WNW at 10 km/h. The ITCZ continues to be very high and close to the Pacific

coast, causing strong convection and the formation of a low-pressure zone over much of NW Guatemala and SW Mexico (INSIVUMEH 2005).

- October 3rd: Tropical Storm Stan weakens as it crosses the Yucatan peninsula over the course of 18 hours, and is downgraded to a Tropical Depression. However, once over the Gulf of Mexico the storm strengthens and once again becomes a Tropical Storm with wind speeds at 65 km/h and moving to the W 17 km/h. During this time the low pressure system in the Pacific resulting from the ITCZ moves N towards the Gulf of Tehuantepec carrying moist air ((INSIVUMEH 2005; Pasch and Roberts 2006).
- October 4th: Tropical Storm Stan changes course to the WSW and intensifies to a Hurricane with wind speeds of 120 km/h and an intensity of 1 on the Safir-Simpson scale, before making a second landfall at about 9 am south of Vera Cruz, Mexico. The Hurricane rapidly weakens once over land and throughout the day is downgraded to a Tropical Storm and then Tropical Depression. Moisture from the low-pressure system in the Pacific is incorporated into the Depression resulting in heavy rains on the Pacific lowlands and the western highlands of Guatemala, where the largest single day rains were recorded during the entire life of the storm (INSIVUMEH, 2005).
- October 5th: The Tropical depression weakens as it moves SSW towards Oaxaca and eventually dissipates over Oaxaca. Rainfall continues over much of Guatemala especially in the Western Highlands and Pacific Plain resulting from a tropical wave in the Pacific and the high ITCZ (INSIVUMEH, 2005).
- October 6th-9th: Remnants of moisture from the Tropical Depression interact with low-pressure systems in the Pacific and Caribbean producing rain in the Western parts of Guatemala (INSIVUMEH, 2005).

The highest 10-day accumulated rainfall measurements in Guatemala registered by the national meteorological service (INSIVUMEH) weather stations were located in the Pacific lowlands, especially in the extreme west near the border with Mexico, presumably where there was the greatest confluence between the ICTZ-produced low pressure system and the Stan system. There are no INSIVUMEH weather stations in the vicinity of Tectitán. The nearest stations where rain data was recorded are San Marcos 40 km to the south, and Quetzaltenango 87 km southeast. Both of these locations, like Tectitán, are in the Western-Highlands and are at comparable elevations, Tectitán being around 200 m lower than either site. Accumulated rainfall recorded at the INSIVUMEH station in San Marcos was 362.5 mm and at Quetzaltenango 279.2 mm. These values may define the likely range of rainfall that occurred in Tectitán; comparable values are obtained from INSIVUMEH isohyetal maps of accumulated rainfall, where Tectitán is located between the 350 mm and 250 mm isohyetal (see figure 5).

The yearly rainfall average for Tectitán is between 1500 mm and 1000 mm according to an INSIVUMEH map that was compiled using rainfall data from 1928 to 2003. Using averages of the ranges of accumulated rainfall during Hurricane Stan, taken from the isohyetal map, and the average yearly rainfall, the rainfall experienced in Tectitán over the 10-day course of Hurricane Stan was roughly 25% of the yearly average. This prolonged precipitation event coming at the end of the rainy season, when the soils were already partially saturated, was the cause of pervasive slope failures throughout the Western-Highlands and in Tectitán. The next section will describe and characterize the landslides that occurred in Tectitán.



Figure 4 Map showing trajectory of Hurricane Stan, and how it changed from a Tropical Depression (D), to a Tropical Storm (T), to a Hurricane (H); Tectitán identified with red dot (courtesy of INSIVUMEH).

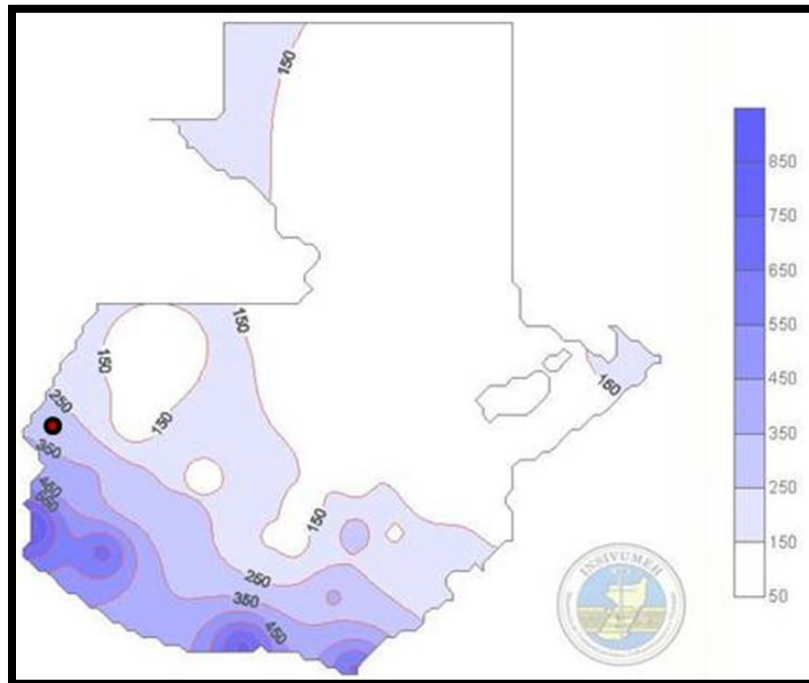


Figure 5 Map shows isohyets for rainfall accumulated (mm) over the 10 day duration of Hurricane Stan (courtesy of INSIVUMEH). Approximate position of Tectitán is marked with red dot.

The Landslides

The only study of the landslides that occurred in Tectitán as a result of Hurricane Stan is an unpublished study produced by a Professional Geological Engineer who traveled to Tectitán December 3-12, 2005 after the Hurricane to assess the damage to slopes and houses at the request of an American missionary who had been living in Tectitán since the 1970's (Womack 2005). The report resulting from that trip is referenced in this work. The study characterized the landslides that occurred in the vicinity of the town of Tectitán, and near surrounding communities, presented a hazard zone map for the area studied, evaluated and gave mitigation suggestions for specific homeowners in the communities within the extent of the hazard map. Through field investigations and study of aerial photographs Womack identified five categories of slope-failures that occurred as a result of rainfall during Hurricane Stan: shallow slumps or debris flows on steep slopes, failures of house-cuts, failures along joint-surfaces, large-deep seated failures, and moderate rotational failures (see figure 6).

The shallow slumps or debris flows were predominantly found by Womack (2005) south of Tectitán on steep slopes. These thin-skinned flows were up to 2m deep, and initiated at the soil/colluvium-bedrock interface where infiltrating water ponded above the less permeable bedrock causing the saturated soils to slump. These saturated slumps quickly became debris flows moving down slope incorporating more moisture and material as they flowed into drainages and gullies (Womack 2005). From further study of aerial photos this style of landslide was by far the most prevalent type of slope failure associated with Hurricane Stan. They often initiated near ridge tops or roads and flowed down slopes into drainages. This style of failure often had a large length to width ratio. Failures of house-cuts are very common in Tectitán during heavy rainstorms. Because of the steep nature of the topography and overall dearth of flat space to build on, many homebuilders have had to cut back into the hill-slope in order to create level ground for a foundation. The house-cuts, which can be in excess of 3 meters, are left nearly vertical without any reinforcement or grading making them vulnerable to heavy-rains, which load the cuts to the point of failure.

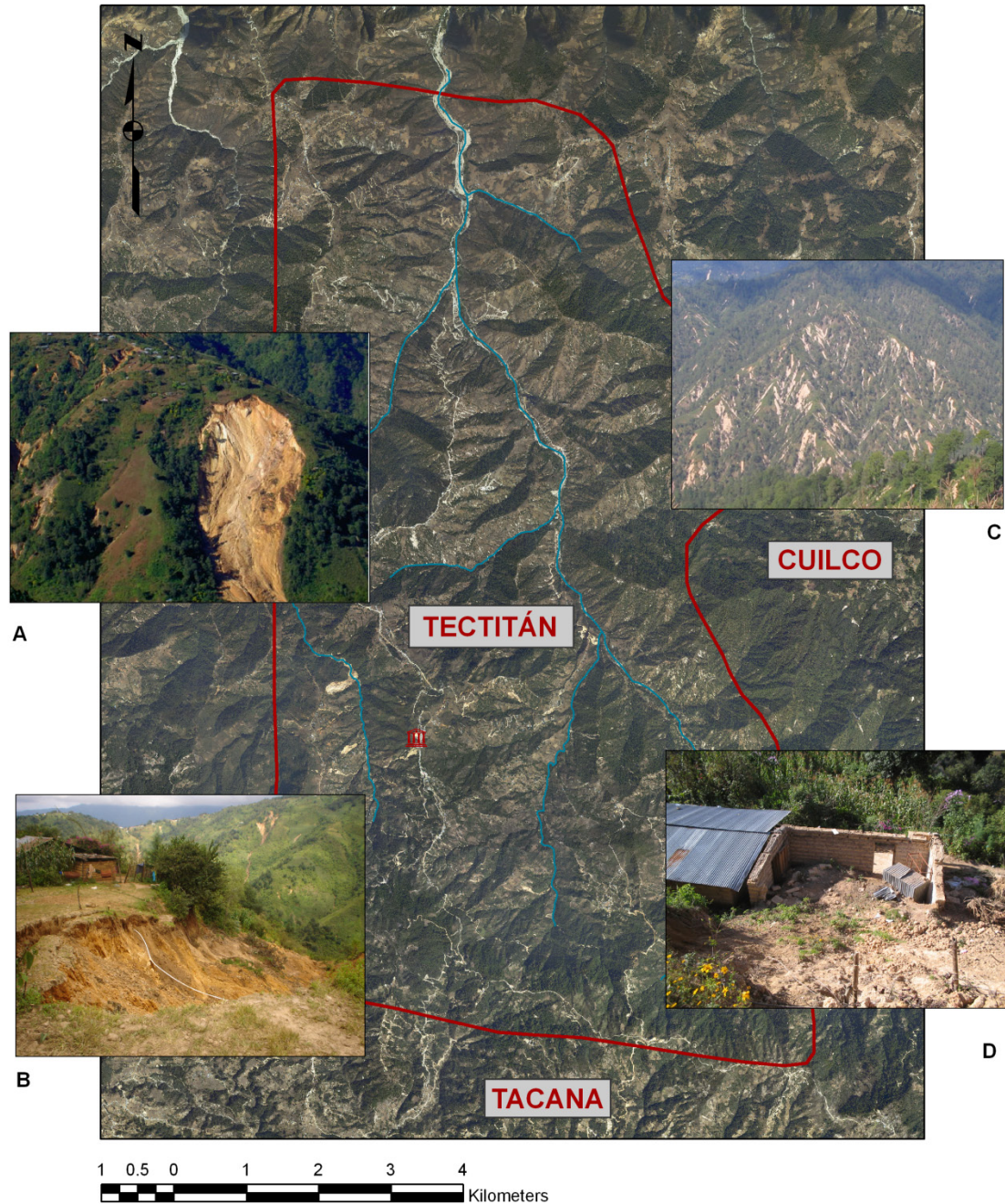


Figure 6 Examples of different styles of landslides and where they occurred in Tectitán as a result of Hurricane Stan. Photo A shows the largest deep-seated failure which involved weathered bedrock, B shows a moderate debris-flow, C shows thin-skinned “catscratches”, D shows a failure of a house-cut. Photo A courtesy of Ray Womack, B, C, D are courtesy of Jeremias Ramos.

Womack (2005) observed one slide initiating along bedrock joint surfaces, and several failed slides oriented along surfaces of the same orientation. The joint set dipped 55 WSW and had an azimuth of around 300°. These joints were only observed on the western side of the town of Tectitán.

Deep-seated or thick-skinned failures incorporating bedrock occurred mostly on the east-facing slope below the town of Sacchumba. The largest of these was over 20 m thick and 60 m wide. Based on field surveys Womack (2005) posits that these large failures resulted from the presence of argillite in weathered rhyolites and andesites that impeded infiltration and caused ponding resulting in failure. Where these large failures occurred there was often evidence of older landslide scarps, indicating that they are loci of historical instability.

Rotational failures, deep failures with curvilinear failure surfaces, were observed by Womack (2005) in a limited area near the village of Tierra Blanca. The depth of these rotational failures is not known as none was observed that had failed completely, rather they remained as coherent blocks. This type of failure often occurred in moderate to less steep terrain. From later study of aerial photos rotational failures were identified north of Tectitán forming around a gully where a debris flow had occurred.

Landslide Inventory and Characterization

Methods

This study presents a characterization of the landslides that occurred in the municipality of Tectitán during Hurricane Stan based on an inventory of landslides mapped from a geo-referenced set of high resolution digital aerial photos, or orthofotos. The orthofotos were taken in April of 2006 and provide an aerial view of the landscape before the Hurricane Stan landslides were affected by an intervening rainy season. Orthofotos were analyzed using ArcGIS software. Geo-referenced data were collected from these photos: landslide initiation points, landslide scarps and run-out paths, and house locations. A 30-meter digital elevation model (DEM) was used to derive slope and elevation over the study area. All digitizing was done by naked-eye analysis of the aerial

photos. Landslides without a dimension exceeding 10-15 m were left un-mapped. Landslide scarps and run-out paths were generally easy to detect. Because of the timing of the photos during the dry-season agricultural fields were unplanted allowing for good visibility of the scars. Also, the landslide scars had not had the opportunity of a rainy-season to re-vegetate, they therefore appeared as bright white scars. On north-facing forested slopes it was difficult to assess the presence of scars because there was minimal contrast between the shaded landslide scars and the dark-colors of the surrounding forest. This may have resulted in an underestimation of landslides occurring there. For the purpose of this study it was assumed that all un-vegetated landslide scars resulted from Hurricane Stan, there was no attempt to distinguish pre-Stan landslide scars. Lacking witness accounts, initiation points were assigned to the highest point of the landslide.

Homes were also easily identified in the photos. Family living arrangements are such that the sons of a family usually remain on the family property and build another structure to house their families. It is common for a family to have one building of their compound devoted to food preparation and service. For these reason houses often are grouped in compounds. It is difficult to distinguish between a building designated for cooking and one for habitation from the air. For this reason, and because each building represents a large percentage of a family's assets, no attempt was made to discriminate amongst structures; all buildings in a compound were mapped (except for latrines which because of their size and distance away from the house were easily excluded).

In total, an inventory of 1892 landslides flow paths, and 2620 houses were mapped over the whole area of Tectitán. Divided over the area mapped, $\sim 81 \text{ km}^2$, gives an average of 23 landslides per square km, affecting approximately 1% of the overall area. Distributions of landslides, homes, and total area with respect to slope generated from the DEM was plotted, as well as the distribution of landslides with respect to elevation were plotted (see figures 7, 8). Density rasters were calculated individually for the landslides and houses datasets using the kernel density function of ArcMapper with a radius of 1km. The landslide and house density rasters then were combined using the multiplication function in the raster

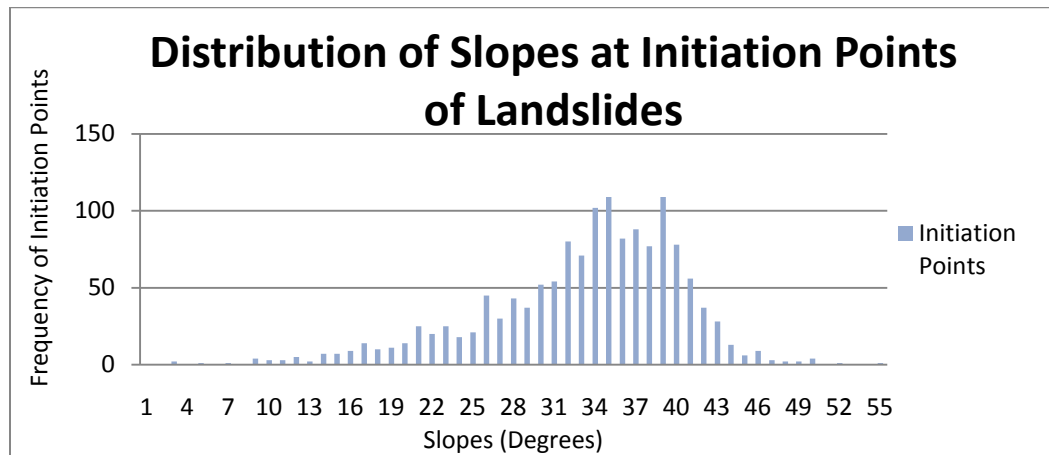
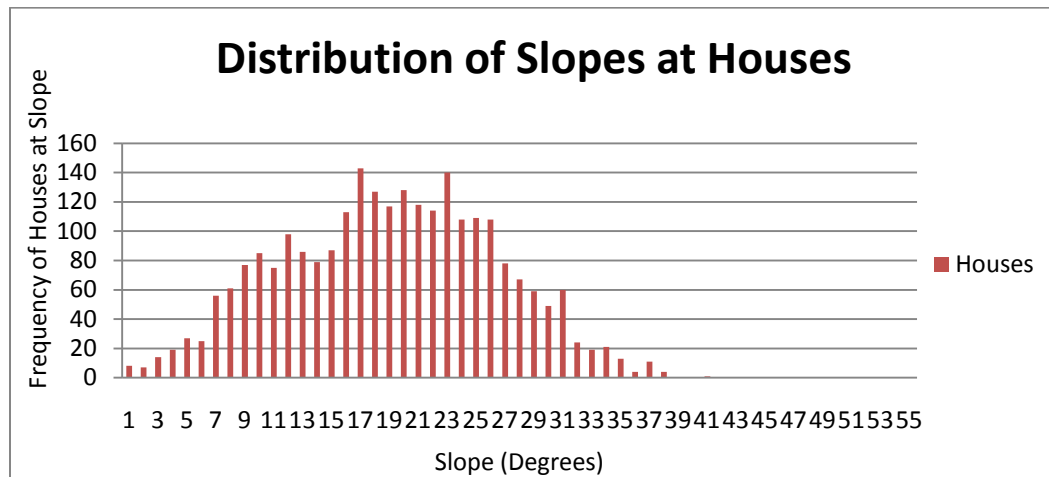
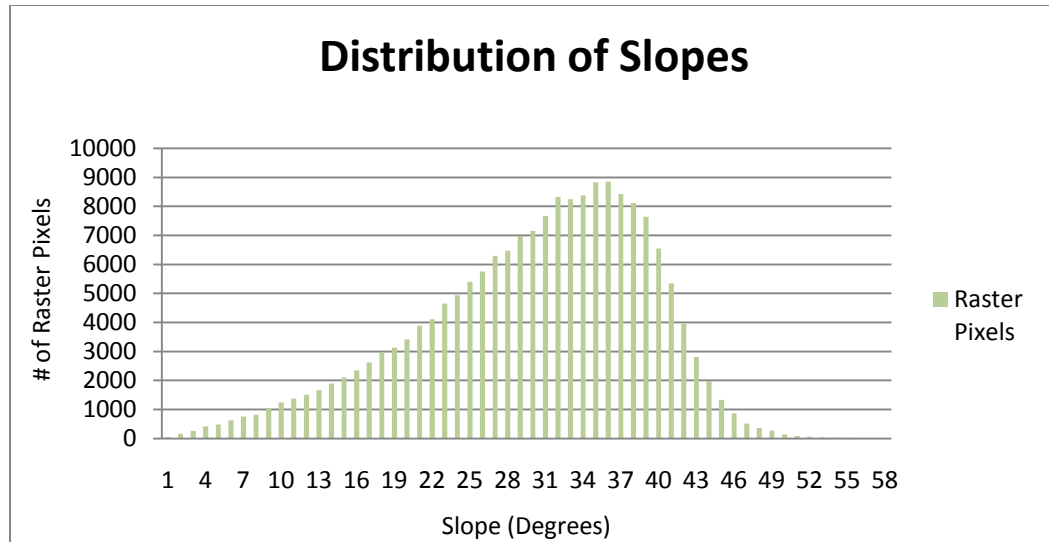


Figure 7 Histogram showing the distribution of slopes over the whole area of Tectitán, the distribution of slopes at house sites, and the distribution of slopes at landslide initiation points.

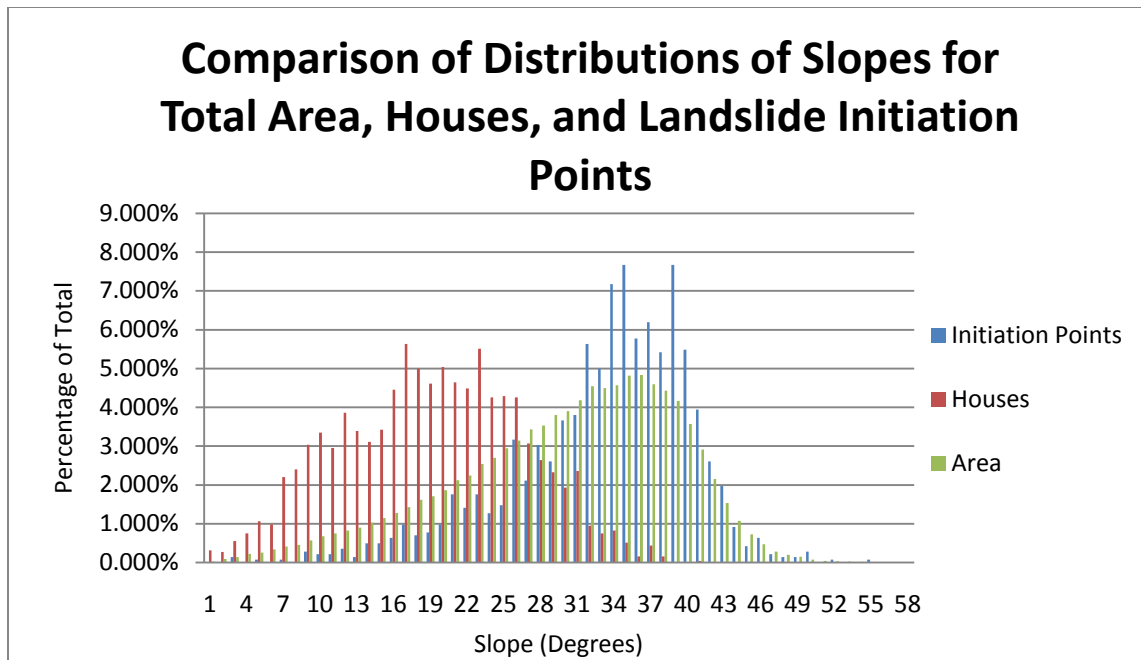


Figure 8 Histogram comparing the distributions of slopes for the total area, houses, and landslide initiation points. The frequencies are given as percentages of the populations. Notice how the population of houses is shifted to lower slopes, whereas the landslide initiation points have nearly the same mode as the overall distribution of slopes.

calculator toolkit to produce a map of home exposure to landslides in Tectitán (see figures 9, 10, 11).

Areas of high values on this exposure map indicate where high densities of the two layers intersect. Low values on the exposure map indicate areas of low density in either of the two layers, so an area with a high house density but low landslide density is indistinguishable from an area with high landslide, low house density. The exclusion of this latter case is problematic because it makes the analysis insensitive to isolated households living in areas of high landslide susceptibility; it privileges high population size. However, it provides a good visual description of areas where populations inhabit susceptible slopes.

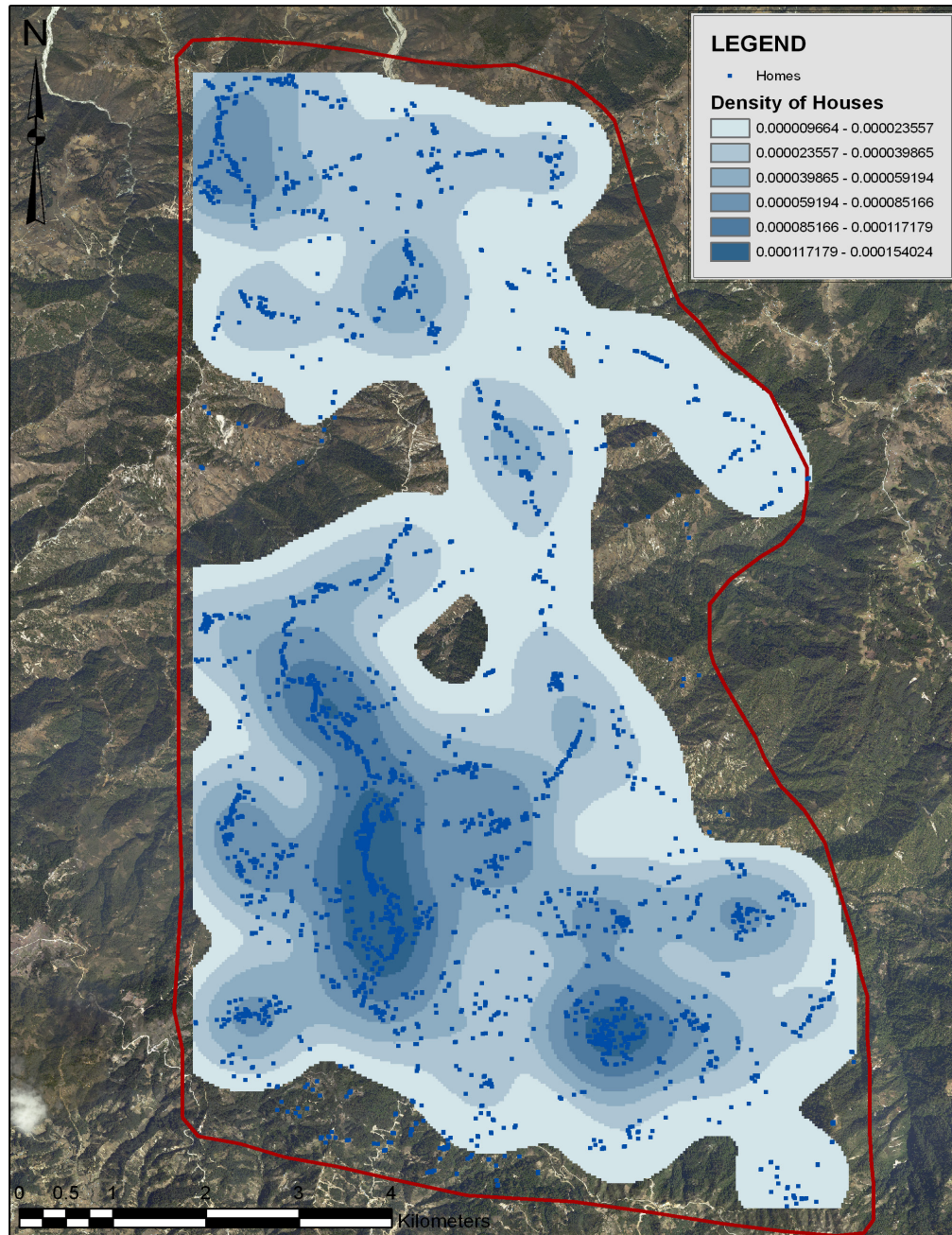


Figure 9 Map of Tectitán showing the contoured density of houses, and the digitized house points. Darker colors indicate regions of higher densities of houses; this is here used as a proxy for population density. The contours were done using the kernel density analysis tool in ArcMapper with a search radius set at 1000m.

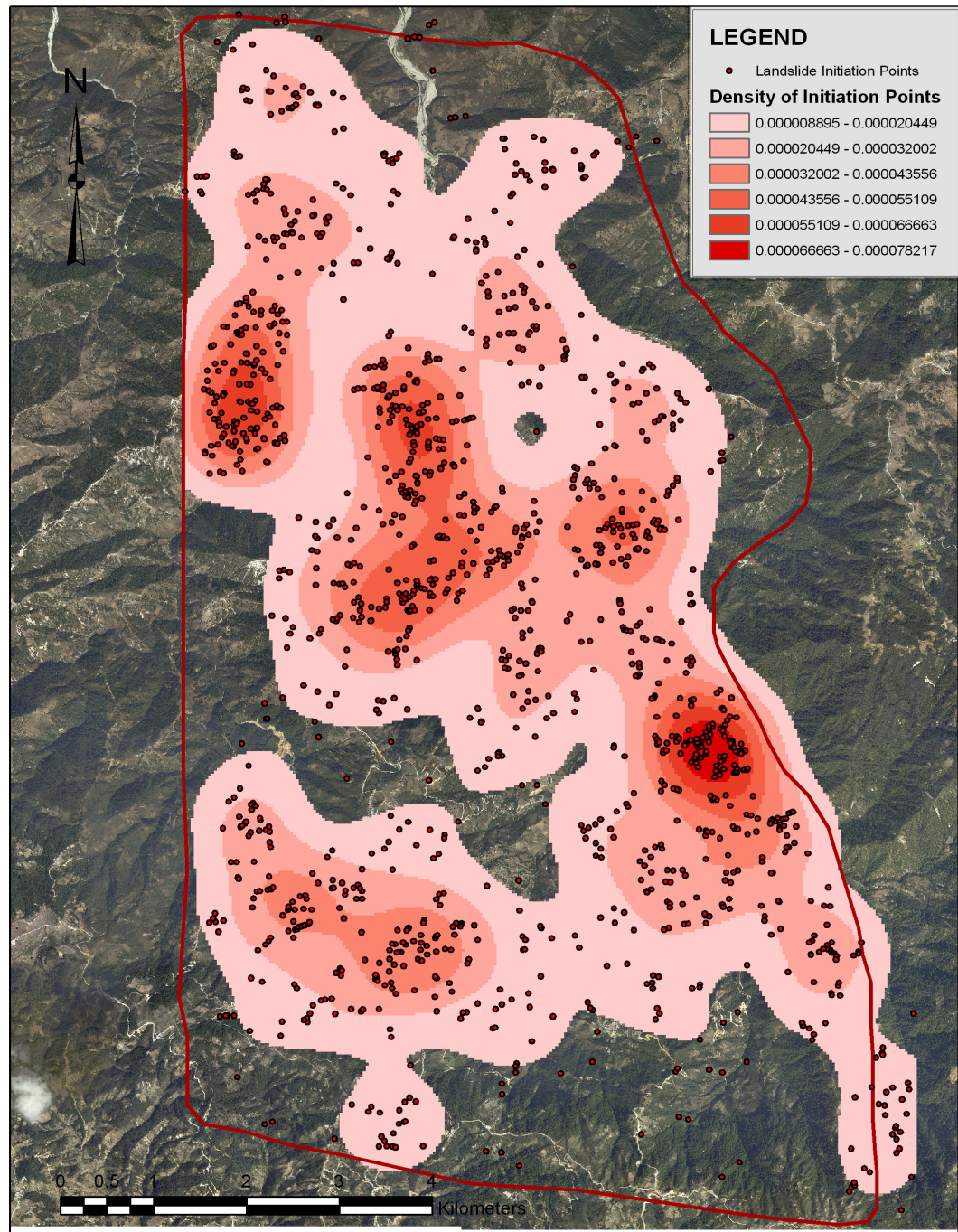


Figure 10 Map of Tectitán showing density contours of landslide initiation points and the digitized initiation points. Darker colors indicate regions of higher landslide density. This density is used here as a relative value for level of hazard. The contours were done using the kernel density analysis tool in ArcMapper with a search radius set at 1000m.

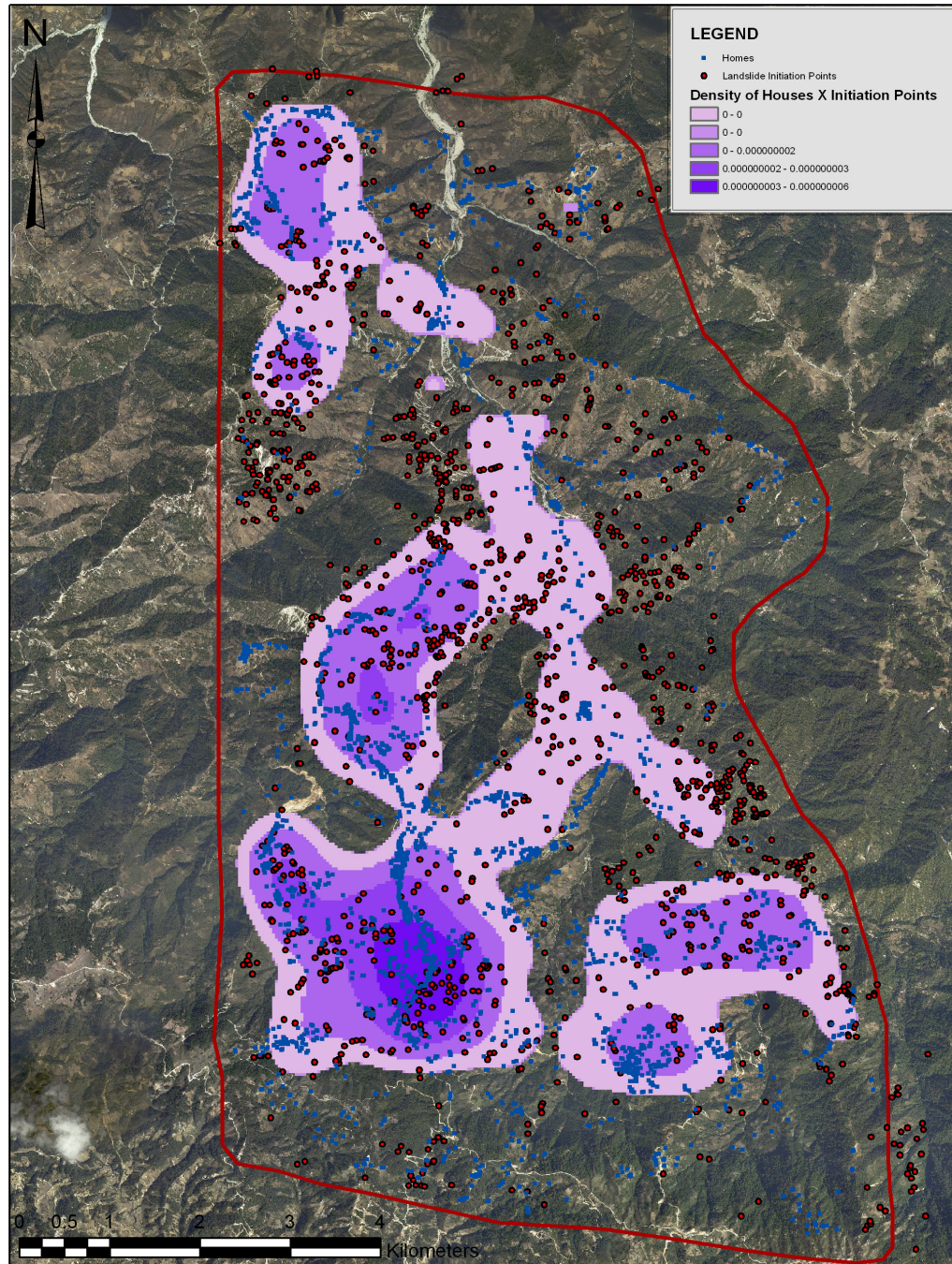


Figure 11 Map of Tectitán showing household exposure to landslides by overlaying the house density map (figure 5x) and the landslide initiation point density map (figure 6x). Darker colors indicate regions that have both high population density and high hazard level.

Landslide Characterization

Comparing the distributions of landslides, and houses with the slope distributions for the entire study area it is clear that their distributions are not random. Homes skew preferentially to the more moderate slopes, while the distribution of landslides is centralized around the mean of the overall slope distribution (see figures 7, 8). The average slope at a home site is 19° , whereas the average slope where a landslide initiated was 35° . More than 70% of landslides occurred on slopes between 20° and 40° , this slope range represents 75% of the total area of Tectitán; around 40% of houses in Tectitán are sited within this range of slopes.

Slope is a major predictor of occurrence of failure, but there are other variables as well that are implicated in creating greater susceptibility to slope failure. Most important amongst these other variables are land cover, and human disturbance including road and house construction. Only 17% of the landslides mapped occurred on forested land, but forested land accounts for 35% of the land in the mapped area. The remaining 83% of landslides occurred on slopes that were either completely deforested or only sparsely forested. As mentioned, it was not possible to collect data on house-cut failures because the scars were too small to appear in the orthofotos, but anecdotal evidence alludes to their prevalence. Despite the lack of quantitative analysis on the effect human disturbance had on Hurricane Stan slope failures in Tectitán it was obvious from studying the photos that landslides were initiating around roads.

Spatial groupings of landslides tend to be thin-skinned debris flows that occur on hillsides that are either diffusely forested, or completely deforested for agricultural use. These shallow, infinite-slope failures can occur in the sandy and clay-rich soils, though they appear with greater frequency in the sandy soils. Deep-seated and rotational failures preferentially occur on less steep slopes underlain with clay-rich soils.

Methodology

Data Collection

Three types of qualitative ethnographic information were collected for this study, data derived from: semi-structured interviews; unstructured, open-ended interviews, and ethnographic observation (Bernard 2006). The semi-structured interview guides were designed to gauge the respondents' degree of impact from Hurricane Stan, knowledge about the occurrence of landslides, and perception of landslide hazard planning through a fixed set of open-ended questions (see appendix for list of questions). In all cases I read the semi-structured interviews were read to the participant, and took paraphrased notes on the responses. The 33-question interview usually took between 15 and 30 minutes to complete. Twenty-three unique questionnaires were conducted: the sample demographics for which can be seen in table 1.

Respondents for the semi-structured interviews were selected primarily from a pool of people with whom I had a pre-standing relationship. The sample was constrained to people with whom the author had a standing relationship. It is understood that confining the sample in this way introduces biases into the data collected. However, I felt justified in making this choice because it allowed me to preserve my ability to function effectively in the community as a Peace Corps volunteer, by not causing undue suspicion. Unfortunately, questionnaires and censuses are not well culturally-understood and are viewed suspiciously. During the time this study was initiated people conducting a census to determine eligibility for a government welfare program were threatened to be chased out of a community in Tectitán, likely as a result of misinformation and suspicion. I sought to limit suspicion upon me as much as possible since my arrival in the community was interpreted by some to be linked to an unpopular mining project in the area.

As male interviewer it was especially uncomfortable to have private interviews with women. Women in many rural communities experience restricted access to

Table 1 Shows demographics of the participants in the semi-structured interviews on experience, knowledge and perceptions of landslides and emergency planning. N=23.

DEMOGRAPHICS OF SEMI-STRUCTURED INTERVIEWS					
Interview ID	Community	Gender	Age	Occupation	Community Role
1	Tectitan	M	46	Ag. Extentionist	COCODE
2	Barrio Nuevo	F	38	Domestic	Womens Group
3	Tectitan	F	49	Municipal Worker	Womens Group
4	Ixconoli	M	24	Teacher	Community Member
5	Ixconoli	M	34	Mayan Language Academy	Community Member
6	Timuluj	M	50	Farmer	Community Leader
7	Tectitan	M	22	Health Center	Community Member
8	Tojul	M	29	Farmer	COCODE
9	Tectitan	M	54	Farmer	COCODE
10	Tichumel	F	50	Domestic	Womens Group
11	Tojul	M	54	Farmer	Community Member
12	Manzanales	F	46	Municipal Worker	COCODE
13	Tectitan	M	76	Farmer	Ex-Mayor
14	Tojul	M	49	Farmer	COCODE
15	Ixconoli	M	60	Ag. Extensionist	Community Leader
16	Tojul	M	50	Ag. Extensionist	COCODE
17	Sacchumba	M	63	Pharmacist	COCODE
18	Sacchumba	M	45	Farmer	Municipal Corporation
19	Totanan	M	46	Farmer	Disaster Committee
20	Tichumel	M	49	Store Owner	Community Member
21	Totanan	M	54	Farmer	Disaster Committee
22	Tichumel	M	23	Teacher	COCODE
23	Tojul	M	31	Literacy Coordinator	COCODE

education, and limited freedom to leave the house; therefore they are often timid to respond to questions that they might not understand or feel that their husbands may be wary of. The results from the questionnaire are therefore not presented as being a statistical representation of the population of Tectitán. Rather, they are presented to provide qualitative corroboration for behaviors or opinions witnessed in the open-ended interviews, or from ethnographic observation.

Whereas the aim of the semi-structured interview was to collect information on Tektitekos' knowledge and perceptions of landslides, the unstructured interviews were intended to allow the respondent to recall and contextualize the narrative of how the community responded to the emergency instigated by Hurricane Stan. The interviews were one on one, and I conducted all of them. There were twenty-one interviews conducted, lasting between around 10 and 88 minutes; with an average interview time of

30 minutes. All were recorded with a handheld digital voice recorder. The interviews were all conducted in Spanish, which was either the first or second language of all the Respondent s, and which I tested as an advanced speaker.

The interviews were open-ended, there was no prescribed list of questions for all participants, rather questions were adjusted based on the Respondent and responses given. The subjects of the interviews were generally the effects Hurricane Stan had on the community of Tectitán, how the people responded to the crisis, and what particular role the Respondent had in the response actions. The participants were notified prior to their agreement to participate that the interviews were both anonymous and confidential. The Respondent s were also told that they were being recorded for the purposes of academic research and that they were neither obligated to participate, nor eligible to receive any monetary benefit *vis a vis* their participation. All Respondent s agreed to these conditions prior to initiating the interviews, in compliance with procedures approved by the Institutional Review Board (project approval # M0661).

The sample set for the interviews consisted of people determined to have played a key role in the response to Hurricane Stan. These “key informants” were identified through informal discussions on the events that took place during Hurricane Stan, and during the interviews when new people were introduced into the narrative (see table 2 for demographics).

The ethnographic observation took place over the course of 27 months of continuous living in Tectitán as a US Peace Corps volunteer. In addition to observations drawn from the daily cultural life, and ceremonial events, this paper specifically draws on observations made during community disaster reduction workshops, which I facilitated in four communities: El Coro, Timuluj, Toniquin, and Tichumel (see figure 1 for locations). These workshops were designed to train community disaster response groups how to plan for and operate during crises. They provided recurrent opportunities to engage with Tektitekos concerning the issues of disaster planning, and past experience with Hurricane Stan. They also provided insight into how Tektitekos perceive hazards and disaster planning that informed the data collection and analysis for this study.

Table 2 Shows demographics of the participants in the unstructured interviews on response actions taken during Hurricane Stan. N=21.

DEMOGRAPHICS OF UNSTRUCTURED INTERVIEWEES				
Interview ID	Duration (Min.)	Gender	Occupation	Role in Hurricane Stan
13	64	M	Farmer	Community Leader
15	45	M	Ag Extensionist	CARE worker
19	55	F	Elementary Teacher	COE Vice President
24	87	M	Farmer	President COCODE
27	41	M	Law Clerk	COE President
31	26	M	Farmer	Family buried in landslide
33	14	F	Municipal Worker	COCODE Member
34	13	M	Farmer	Community Leader
35	29	M	Farmer	COCODE Member
36	12	M	Farmer	COCODE Member
37	10	F	Head of House	Community Member
39	38	M	Ag Extensionist	COE Member
41	32	M	Municipal Corporation	Community Leader
42	10	M	Store Owner	Community Leader
43	41	M	Farmer	Community Leader
49	78	M	Farmer	President COCODE
50	24	M	Farmer	Community Member
51	25	F	Landlady	Community Member
62	8	M	Farmer	Community Leader
63	11	M	Farmer	President Disaster Committee
69	23	M	Municipal Worker	CARE worker

Data Analysis

Paraphrased written responses to each completed semi-structure interview were transcribed, and then compiled by question number. The compiled answers were sorted according to themes identified in each set of answers. Themes were ordered in terms of significance based upon the occurrence of responses they received.

Recorded unstructured interviews were transcribed verbatim using a foot-pedal and Olympus DSS transcription software. Initially the interviews were transcribed directly into Spanish. I was the only transcriber for all of the interviews. However, when there were parts of the interviews where the meaning was either ambiguous or elusive, a native Spanish speaker from Guatemala was consulted for assistance. Once transcribed, the interviews were read over and a method of coding was developed to consolidate and organize the transcriptions.

A grounded theory approach of iterative analysis, using open coding was employed to synthesize and elicit themes from the data (Glaser and Strauss 1967). Grounded theory is an approach that aims to describe and explain social phenomena through repeated and structured study of texts, to develop theories that are “grounded” in evidence from the texts (Glaser and Strauss 1967; Corbin and Strauss 1990). After a first reading of the transcripts broad categories were identified that occurred in nearly all of the interviews. The objective of categorizing this data was to reconstruct the narrative that led people to form organizations as a coping mechanism, and understand people’s perceptions that led to the recognition of the disaster. To achieve this objective a broad criteria was used for determining categories, important factors included: pervasive occurrence of action or theme, importance to the understanding of the response narrative, and revelatory of the perceptions of the respondents.

An example of a category that represented a major action that took place during the emergency period is “Evacuations”. An example of a category relating more to the psychological narrative was “Perceptions of Physical World/Danger”. During a second round of readings segments of interviews were identified as relating to one or more of the categories, and these quotes were copied onto a document compiling all of the responses pertaining to a certain category. At this point the quotes were organized by category into documents, and according to interview number within the documents. A similar process as the one used to identify the major categories from the full transcripts was now applied to the compilation of quotes within each category to determine sub-categories and themes. During this step, portions of each quote that epitomized the sub-category it belonged to were translated into English and given tags or codes to facilitate regrouping them into sub-categories. An example of a sub-category from the “Evacuations” category would be “reluctant evacuations”, which was further grouped by explanations given for reluctance to evacuate, “nowhere to go”, “didn’t want to leave the animals”, etc. These along with the other sub-categories within the category were synthesized into themes relevant to the category.

The results section of the paper presents a reconstructed narrative of the organizational emergence during Hurricane Stan on multiple levels in Tectitán. Rather

than present the categories and themes directly they are incorporated into the context of the narrative. Data from the perception questionnaire are used to bolster claims derived from the interviews. Ethnographic observation collected from participation in daily life over the course 27 months living in Tectitán, and from observation of and participation in the response to Hurricane Agatha (June 2010) informs the analysis throughout, explicitly in the sections where themes from the Hurricane Stan response are compared to the culture of daily life.

Results

Description of Tektiteko Response

Emergent Organizations

Two broad categories of organization emerged during the citizen response to Hurricane Stan in Tectitán that can be simplistically described as municipal-level and local-level organization. The municipal-level organization emerged in the town of Tectitán where the municipal seat of government exists and brought together people from the major civil and developmental organization in the town. The local-level organizations emerged in the villages and were composed entirely of village members. This distinction does not perfectly describe what occurred because in practice the local-level organizations which formed independently of the municipal-level organizations eventually coalesced around the municipal-level organization, supporting it and supplying it with the human resources necessary to function. Conversely, parts of the municipal-level organizations arrived in the communities and assisted the local-level organizations. Similar tendencies towards participation and consensus or culturally informed decision-making were displayed on both levels of organization.

However, whereas on the local-level groups that formed were very informal, composed of bands of neighbors responding to concerns for each other, at the municipal-level organization assumed greater formality because interfacing with outside organizations demanded legitimacy. Ultimately there was conflict between the local culture of organization and the culture expected by outsiders (aid-agencies); this conflict resulted in loss of aid opportunities for Tektitekos. Both types of organizations emerged spontaneously, there was no “authority” present that had experience with an “official” disaster response plan, therefore the strategies employed reflect culturally intuitive ways of dealing with adversity.

The novelty of this event to the population of Tectitán is significant. No one present in the organizations had prior experience with a disaster context except for one CARE International worker who received search and rescue training. No pre-emptive

actions were taken, because no one presaged danger or, possessed the experience with this type of rain to know that it could be dangerous. Consequently, it was not until after the first houses were damaged in landslides that people began to recognize the perilous situation and take action. The actions taken were usually reactive, although there were cases of preemptive evacuations initiated by individuals and local-level groups (usually in communities where landslides had already occurred). On the municipal-level, the formation of the organization was the result of citizens responding to a situation where people fleeing the rural communities came into the town looking for shelter whose basic needs required mobilization of resources.

Municipal-level Organization

In the context of evolving crisis the municipal-level organization that formed was made up primarily of representatives of the institutions that had a presence in the town. The COE was predominantly *Ladino* because it was comprised of professionals from the town. The institutions represented were: the municipal government (though not by the mayor), the National Police (PNC), CARE International, the Judge of the Peace, and concerned citizens whose status and/or personality was bent towards leadership. This patchwork organization was called the Emergency Operations Center (COE in Spanish) and formed without prior co-ordination. The individuals were familiar with each other from town life and had probably worked together before in town leadership roles.

The COE developed not just in the context of an unprecedented local emergency but also within a power vacuum left by the mayor. The mayor's absence was ultimately interpreted as abandonment by the townspeople despite legitimate claims that he had left Tectitán prior to the storm and was unable to return until many days later when the roads were finally cleared. The absence of the mayor and most of his fellow officials in the municipal corporation, who were away dealing with the disaster in their own communities, deprived the town of the logical focal point of leadership and coordination during the disaster response. One member of the corporation who lived in town initially assumed a position of leadership as a representative of the municipal authority. He was sought out to bear witness to the destruction of houses and other damages, and began to

promote the idea of an organization as the situation was beyond his capacity to respond to. In certain cases he did perform actions in the role of the mayor. For instance he coordinated the disposition of municipal funds (or organized personal donations that would then be reimbursed by the municipal budget) for immediate spending to repair water systems, buy gas necessary for transporting water, and as a gift to aid a community grieving three deaths. He also made the first contacts with the departmental authorities to alert them of the situation in Tectitán and ask for advice and help. It was from this communication with the departmental authorities that news came to Tectitán that the rain was in fact the result of a hurricane and that was affecting other parts of the country and that the nation was in a state of alert. However, this man did not become a replacement mayor in the sense that he retained or was given decision-making power. Instead, the COE was formed, in part because it was recognized that this one man alone needed support, and he was subsumed as an equal into the COE structure of distributed decision-making.

The individual members of the COE who were interviewed (see table 2) expressed different explanations for the impetus to form organizations. Some members understood that forming a COE was a necessary requirement to receiving aid, or having their access roads cleared. Others who had been out into the communities and seen or heard of damaged houses remembered that seeing the needs of the affected people were the compelling factors. Both perspectives are probably valid. The coordinator of the CARE project in Tectitán was in contact with the CARE officials in Huehuetenago who were in turn communicating with CONRED (National Coordination for Disaster Reduction) officials who were pressuring for an official account of what was occurring in Tectitán. In the absence of the mayor and his office the COE assumed the position of recording the effects on the population, communicating them to the outside, and managing their resources into an organized response to the events.

The vice president of the COE remembered that no one had ever heard of a COE, nor knew what it consisted of or how it functioned. However, they were convinced that some organization was necessary both to manage the proliferating needs and to be eligible for outside aid. They received knowledge how to structure the COE from

communications with the CARE office and CONRED. There is not a clear account of when the COE was actually formed, or who convened the various parties that would become the COE, except that there was a meeting held in the municipal salon on the first day of extensive landsliding where the COE was decided upon.

The internal structure of the COE was a copy of the official hierarchical structure that pervades Guatemalan associations and is a requirement for political legitimacy. The directive group included a president, vice president, secretary, treasurer, and several *vocales* or *suplantes*. However, it does not appear that decision-making necessarily followed this hierarchical structure in the actions of the COE; power to decide was not consolidated at the top but was distributed within the organization and even beyond it creating a paradigm of consensus and participation. In the following quote a member of the COE describes how the organization grew in accord with the need and recruited members of the community to take charge of portions of the response, highlighting both the inclusiveness of the response and its reliance on people's participation:

Our organization was born out of necessity. We saw that it was necessary to organize, so first we made a simple committee, we got a space in the school, and they gave us a place to cook. We didn't think that it was going to be bad at that point, but the more rain that fell the situation got worse and worse, and we had to organize more. It was the type of organization where you just bring everyone in, we would say to someone, "you take charge of this and bring Don X and Don Y with you" and they would go off with some people to this commission. Then we would say, "hey why don't you take charge of this", really just bringing people into the organization. There were no elections to say this person does this, no it was only based on the need and the willingness to work... and as the people came to the shelter we had to expand our commissions, the need obliged us prepare this and that, we would say, "you take charge of this and go find people to help you do it". The people themselves found their own commissions to participate in, there was no election (Respondent 39)¹

Although the COE did technically have a hierarchy with a president members of the organization claim that responsibility was distributed. The COE structure was distributed into commissions- instead of being centralized, with each member of the directive serving as a representative to a certain commission. The following quotes from COE members describe how leadership was distributed in the organization:

There wasn't really a president, it was like an organization where everyone has a responsibility, the people that were part of the shelter commission had to give information on the shelters and so on (Respondent 16)²

We were organized like a committee each person, for example the president, vice president, vocal was in charge of a committee and we had to find people to help us fill the jobs of our function (Respondent 27)³

Several of the most urgent commissions were designated at the inception of the COE, but commissions were frequently added as the amplitude of the response widened. The members of the COE representing the various commissions met nightly to discuss what resources were needed to complete their tasks and to report on the situation they observed in the field. The reporting of damages that were observed in the field was consolidated in the COE; this information was collected both by COE volunteers and citizen leaders of the individual towns. These data were used initially in the aid-distribution process run by members of the COE.

The commissions that formed the COE were: search and rescue, water transport, food preparation, aid receiving, storage center control, and security patrol. The resources, such as gasoline to run transport cars, and PCV piping to restore water systems were paid for with money that the municipality had on hand, and loans given to the municipality by private citizens. Food was obtained from a small stockpile administered by CARE originally allocated for aid to mothers with malnourished children. When that

supply ran out the COE organized a donation campaign. The labor supply for these commissions was provided by a combination of the citizenry of the town, unaffected peoples from the rural communities, and people who had sought refuge in the shelter. Prior gender roles were maintained during the response and did help to define who attended to what specific tasks; women volunteers were employed mostly around the shelters, especially in the planning, preparation, and distribution of meals, whereas men were primarily involved in search and rescue, evacuations, and water transportation.

The COE was the organization of highest authority during the response period, before the crisis had stabilized and before outsiders could reach Tectitán. During this time they habilitated and ran the shelter, organized search and rescue and contact trips to cut-off communities, encouraged evacuations, organized water transportation, collected and maintained food donations, and organized vigilance groups. Continuing into the recovery period, when refugees had ceased coming to the shelter and there was a quiescence of damages they were important in running the shelter in the municipal salon, managing the aide depots, and the distribution of aid according to their records of damages. The COE, however, was continually undermined during the recovery phase as more outside institutions made their way to Tectitán.

The major cause that undermined the COE during this time was the presence of the town's mayor, whose return was met by a popular uprising culminating in his nearly being lynched. Despite the public manifestation against the mayor, and the existence of a functioning organization that had coordinated the majority of the response to the crisis, the mayor was sought out by the newly arrived aid organizations. Despite this total lack of support, as the official authority, the aid organizations deferred to him and granted him power to determine aid distribution. It was widely felt amongst the members of the COE that the mayor marginalized them and kept them from having contact with the incoming aid organizations. The result of which was that the mayor became the channel through which outside aid had to pass between donor and recipient. In addition to distancing the COE from the aid organizations, COE members claim that the mayor appointed his own people to compile new lists of people who sustained damages by which aid distribution would be based, effectively removing the COE and the information they had compiled

during the crisis from deciding who would receive aid. COE members claim that the mayor did this specifically to promote his political favorites and allies.

The preceding anecdote, apart from providing context of the political situation illustrates the inability of outside aid organizations' to recognize emergent non-official organizations as legitimate, despite the important role they play in disaster responses. Being overlooked because they lacked official credentials was a recurrent problem for the COE, which as noted previously was denied aid requests because such request were only supposed to come through the mayor, and not allowed to pick-up an aid shipment because they lacked proper ID cards. The decision to neglect a locally organized, pre-existing, and functioning aid distribution system, in favor of the accepted authority demonstrates that the aid organizations adhered to a school of emergency response theory that advocates centralization of information and decision-making in bureaucratic and hierarchical structures (Schneider 1992). This school of thought has come under criticism for being unappreciative of the constructive role that emergent de-centralized organizations play in a disaster response. In this example dogmatically following the power hierarchy produced a result incompatible with the goals of the outside organizations (see discussion for a more complete treatment of emergency management models)

Local-level Organizations

Organizations on the local-level, like that of the municipal-level organization, emerged along with the evolving recognition of the seriousness of the event. Many people reported that they initially understood the rain to be "normal rain" and therefore not threatening, some even reported ignoring, or improperly interpreting cracks forming in the ground near their houses. It was not until there was destruction of houses in the communities that people began to take action. In most communities where houses were damaged community members united to form some sort of organization. The actions that these organizations engaged in were both reactive and proactive. In many cases they were compelled to action reacting to a collapsed or partially collapsed house. In the most serious case a whole village, including women and children worked together to liberate a

man and his wife from a mudslide that buried their house while they slept, killing three of their children. Less severe cases were more common, instances where house-cuts collapsed onto the walls of the house creating a potential for wall failure. In these cases it was usually groups of men came together to clear the mud from the walls.

An interesting example of local-level organizations working pro-actively was the formation of patrol groups that in at least three independent communities went from house to house to assess whether the residents were safe or in need of evacuation. In situations where the residents were reluctant to evacuate but the patrol considered it necessary for their safety to leave, the patrol would offer their labor to remove the valuables (important papers and food stores especially) to safety. In at least one confirmed case the labor provided by the patrol group made the difference between a family deciding to move to safer ground instead of staying in their imperiled home. The following are quotes from people that were involved in the local-level evacuations:

The third day the neighbors came and said “what are you still doing here? Let’s go up to the town.” That’s what they said and 15 people came telling me to leave soon because all the water was going to cause a landslide and I was going to die. Then they grabbed my clothing dresser and all of our things and took them to another house where we could seek shelter, they took everything. “If you are going to help me then let’s do it”, I said (Respondent 43).⁴

The people said this house is about to go, so they would yell to the others that the house is at risk, and we would come running. We would split up three or four people on each side, and then we would all meet up to help evacuate a house...we were working under the rain, with our ponchos and ropes to evacuate people’s property, their maize, their clothing, everything in the houses. It was hard work but we managed to save people, although it was a lot of sacrifice. We did what we could (Respondent 42).⁵

These patrol groups often initiated the self-evacuations before word came from the COE in town encouraging this action. In a community too far away from the town for the established shelter there to be a viable option, local-level organizations not only evacuated houses, but also created their own shelters in the public buildings. This was all accomplished without the benefit of prior experience of crisis situations, or emergency management training, and without the oversight of an official disaster management group.

The local-level organizations were most active during the response phase of the crisis, when they participated in evacuations within their communities and actions with the COE. Once the demand for large collective action no longer existed the local-level organizations dissolved back to the network of local networks and groups. Some were active again for periods of rebuilding of roads and water systems.

Perceptions and Behavior Changes

In this section data from the interviews are presented to demonstrate how people's perceptions of the environment influenced the manner in which they responded to Hurricane Stan, and how the experience of Hurricane Stan has consequently affected the way people perceive and interact with the environment.

“Normal” weather and historical experience of storms

For most Tektitekos the rain and subsequent landsliding triggered by Hurricane Stan deviated from their previous life experience and received knowledge of what were possible environmental conditions in their place. In a survey of 27 people (see figure 12) who were asked if they could remember another storm equivalent to Stan either in their lifetimes or from stories they had heard, 19 responded that Stan was totally unique to their experiences, 9 people remembered other storms but said they did not compare to

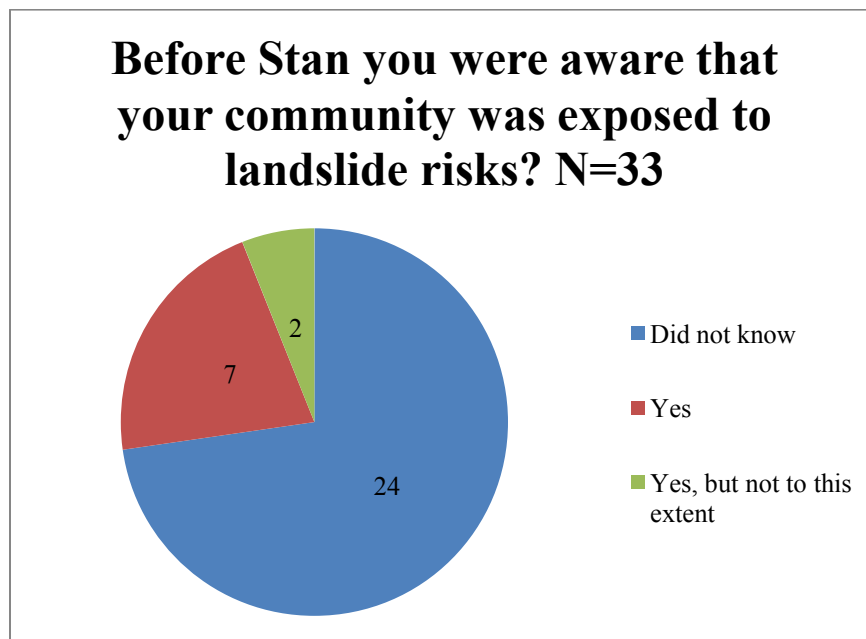
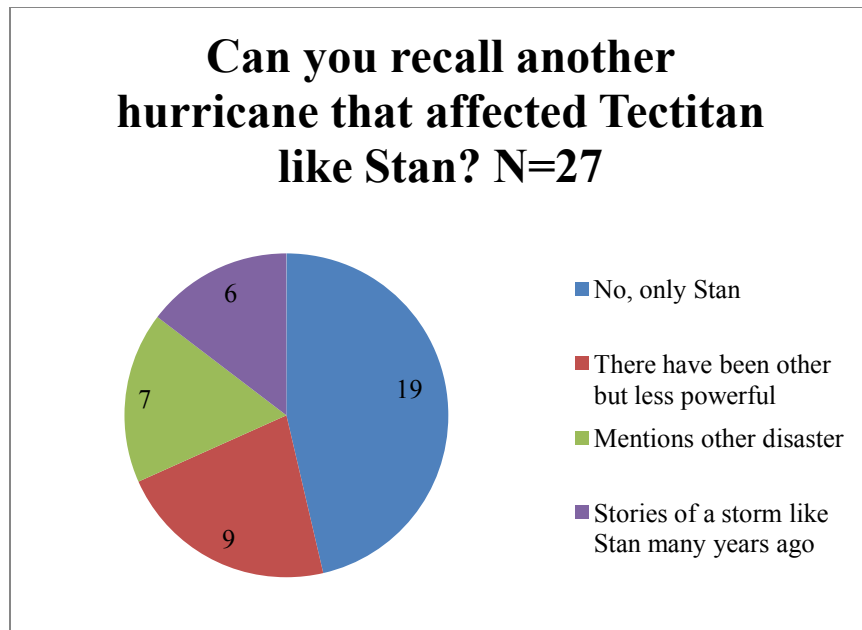


Figure 12 Charts show responses from the semi-structured interviews

Stan in terms of magnitude, and 6 people mentioned that they had heard of previous storms like hurricane Stan occurring around 50 years in the past. Also, 24 out of 33

respondents indicated that prior to Stan they were not aware their community was exposed to possible damages from landslides (see figure13).

It was commonly said that they had never seen anything like Stan before. One of the reasons Stan was such a surprise was that the storm fell outside of the “normal” rainy season, which is conceptualized by Tektitekos to last from late May to September, as illustrated by the following interview excerpt:

*The rainy season here ends in October and then summer comes, but it was the 5th of October and still it was raining. The time for rain is May through September, come October it should be over. But this storm we were just amazed that it came in October (Respondent 34)*⁶

In addition to occurring outside of the expected calendar range, it seems as though it was very difficult initially to recognize Hurricane Stan as different from a “normal”, non-threatening rain. This could have been because the rain was not intense but rather persistent, which over the course of several days made it dangerous. The following are two accounts from middle-aged men in separate communities of Tectitán remembering the onset of the storm:

*When I realized, the accidents had already occurred, because when it began we thought that it was just a normal rain because no one thought that it was going to last so that it would affect us, we thought that it was a normal rain and would only last a moment, but it lasted so we realized that it wasn't normal rain, but that it was a storm, that it lasted 4 days was how we realized and we said this isn't a normal rain this is a storm (Respondent 49)*⁷

One morning the day broke raining and I thought this is going to pass because I was thinking that it was normal rain, rainy season, so I said to my wife to my family 'this is going to pass', so the next day and night it

continued raining and when we looked in the next morning we saw it was cracking in front of our house...really we said nothing is going to happen, we were there the next day when the crack became even wider, I put some cement in the crack so that water wouldn't go into it, and in the morning we heard that Onorio's how had been covered [by a landslide]
(Respondent 43)⁸

From these two statements it is clear that some Tektitekos acted without an appropriate rubric to judge the danger of Hurricane Stan; this is largely because they could not distinguish the hurricane-produced rainfall from “normal” rain. The difficulty resided in the fact that the rains associated with the storm were not particularly intense, but rather persistent over the course of many days. Also, the storm had no associated high winds that would have provided indication that it was an extraordinary event. The “normal” rainy season rainfall occurs as convective storms in the afternoon after the ground has had time to warm and create strong convection currents. However, there are frequent disturbances from low pressure systems throughout any given rainy season that result in deviations from the afternoon storm pattern. These low pressure systems can produce multi-day rainfall events that are often not destructive on a large scale. Relying on observation alone it is very difficult to distinguish the rain associated with a low pressure system from that of a more severe event.

Subsistence farmers like the people in Tectitán, because of their reliance on the natural environment to provide suitable the conditions for their crops, are keen observers of weather systems. However, reliance on experience alone privileges the set of environmental conditions that reoccur frequently and reliably, which become the basis for what are perceived as the “normal” conditions. The “normal” conditions are depended upon so that instead of representing the likely conditions they are treated as the only conditions possible. During my service in Tectitán I often heard people give specific dates for when the first rains come every year, demonstrating the regularity that people expect from their environment. This is not inherently a bad way of understanding the world. In fact it usually does quite well to inform cultures on when to plant and harvest.

It becomes problematic however, when extreme natural events have long repose intervals, making it difficult for the information to be successfully transmitted through generations from the affected population to the one presently vulnerable. Also problematic is when the environment changes so that previous experience is no longer valid. It is possible that both of these circumstances contributed to for the inability of Tektitekos to comprehend the danger of Stan until landsliding occurred.

As mentioned previously there were 6 respondents who said they were aware of previous storms that affected Tectitán with a force equal to Stan. One man, who was 79 at the time of the interview, recalled a storm that he thought was in the year 1944 with a force equal to or surpassing Hurricane Stan. According to a compilation of historical hurricanes published by INSIVUMEH (1977) there were two devastating storms around this date, one in 1933 and the other in 1949, both storms affected large areas of the country between 37% and 22% percent respectively, that would have included Tectitán. A storm that was apparently less devastating nationally but whose effect could have been intense in Tectitán due to the proximity of its path also occurred in 1945 (INSIVUMEH 1977). It is possible that the man in the interview was referring to one of these large storms because there is no record of a large storm occurring in 1944.

It is interesting that all of these storms were late-season storms lasting into the beginning of October like Hurricane Stan. It would suggest that there was some historical experience of late-season devastating storms in Tectitán. If so, then this experience was not transmitted to the majority of Tektitekos interviewed in this study. There can be many possible reasons for this breakdown; perhaps the damages were not severe or novel enough to elicit the emotional response that would engender the telling and retelling of the story. Whatever the case, it demonstrates that it is not safe to assume that communities will have developed coping strategies to hazards just because it is probable that those same hazards affected the communities in question within historical memory. While a community's understanding of what constitutes a threat to its environment increases its capacity to respond effectively, in a time of modern storm forecasting and extensive communication systems (2005 was still prior to the proliferation of cell phones in Tectitán there were however several radio stations)

communities should not have to depend entirely on their own experiences and knowledge to be warned of imminent threats. In Tectitán the first notification from the government they received that the country was in crisis because of Hurricane Stan was when the member of the municipal corporation called the governor's office to report damages and ask if he could cancel school because of the heavy rains. In the communities people heard of the storm on the radio, tuning in to predominantly Mexican news stations for reports. It seems likely that the national government was caught as flat-footed by Hurricane Stan as municipal and local governments, and failed to give a warning or the warning failed to arrive.

Perceptions: Hurricanes, Natural Disasters

A theme expressed by several interview respondents was that there was something new about Hurricanes. It was a widely held belief (see previous section) that Hurricane Stan represented a novel phenomenon due to the quantity of rainfall associated with it. Even more interesting, some respondents perceived that hurricanes in general, not just Stan, represented a relatively new phenomenon. The following are examples from interviews where this perception is expressed:

No because hurricanes are just now coming out...when I was a boy a storm (maliempo) was like this just two days of rain and no one was scared now when this storm started it was tremendous (Respondent 50)⁹

I think that there were [hurricanes] only in that time they didn't call them hurricanes, just now the hurricanes are coming, the people would just call them rain, rainy-season, but now you hear of Stan (Respondent 36)¹⁰

In many places you note that before there weren't so many notices of hurricanes like before 10 years ago you didn't hear of them but now in the last 10 ten years you hear if not in this community than in others or other

countries there are strong storms, not just rain but wind and earthquakes too (Respondent 35)¹¹

Now it is becoming stricter, because there are more earthquakes, the weather is becoming stricter, and now I think that there are going to be more because before you did not see these things and now it seems different they come more frequently (Respondent 31)¹²

These quotes can have a variety of interpretations. It has been reported in the literature that incidence of extreme precipitation events in Central America has been rising since the 1960's (Aguilar et al. 2005). Also, studies have shown that hurricane activity in the Atlantic and Caribbean is cyclic at the decadal scale; where there were periods of high activity between 1920 and 1960, followed by a period of quiescence from the 1970's through the 1990's (Gray 1990). Recently, it appears as though another cycle has begun. Researchers have observed that in a period between the mid 90's and early 2000's hurricane occurred in the Caribbean with a six-fold increase in frequency as compared to the quiescence of the 70's- mid 90's (Goldenberg et al. 2001). It seems likely that Tektitekos have been able to record through their attention to the environment changes in hurricane frequency.

Also, it is plausible that the perception that hurricanes and other related phenomena have increased in frequency as compared to the past is an artifact of greater coverage of natural disasters in the media, and greater exposure to media sources. A fundamental difference between the current procedure for reporting hurricanes and that of the past is the giving of names to individual storm events. Previously hurricanes were known as "the storm of '33" (*la tormenta de '33*). Despite the fact that it is possible that many of the yearly storms that hit Guatemala were of sufficient magnitude to be designated hurricanes and receive names, it was not until very recently that they did, this change perhaps influenced people to believe that the new term alone was indicative of a new or more powerful phenomena. The official naming of storms will possibly have an effect on the duration of historical memory of storms, as giving a storm a name

personalizes it and makes it easier to reference in conversation. For example, in Tectitán Hurricane Stan, or just Stan has been generalized beyond the specific catastrophic rainfall event in October 2005, and has been adopted by the population as a general word for hurricane or even disaster. It was not uncommon to hear people say, “what would happen if another Stan came along?” or some similar usage.

Changing Knowledge and Behavior

There is evidence from interviews of behavior change based on the new knowledge and experience garnered from the events of Hurricane Stan. Some respondents appear to have assimilated the experience of Stan to develop ideas of rainfall thresholds for landslides; the number of days of continuous rain they would let pass before becoming alarmed or taking some protective measure. As was seen in the delayed response to the rain provoked by Hurricane Stan the idea of a critical amount or duration of rainfall that would produce widespread landsliding was not a concept in the minds of Tektitekos. However, in several quotes people demonstrate that they now have an idea, based on the example of Hurricane Stan’s rainfall pattern, of how long rain can fall continuously before they are at risk from landslides. Several people identified between two and four days of rainfall as constituting a threat.

There are also examples from interviews where people not only identify a threshold but also identify an action that they would take if it the rain began to approach the limit. The following is a quote from a man who participated in the Stan response:

If the rain started at midday and rained all day and night then began the next raining too, it is best to evacuate in the morning, that is my suggestion, if it continues to rain better to leave (Respondent 13)¹³

A man from another community, who after resisting, evacuated his house during Stan, re-iterates the strategy of leaving the house to take refuge after a two day period of continuous rainfall and notes that this idea is a legacy of Stan:

I think that Stan has left us with the idea that from here on out we need to take greater precaution, finding where there is less risk, a refugee, because if it rains two day you have to find a safe place and be alert (Respondent 43)¹⁴

There are examples too of people taking preventative measures based on experience of Stan in the following years:

*When it rains 2-3 days, I take precautions I evacuate my family, if it rains one day and one night I start communicating with Herman (his brother who lives in the house nearest to his) (questionnaire 11)*¹⁵

In another example a man who participated in local-level a organization during Stan urged his whole community to evacuate based on a forecasted storm he heard on the radio. The storm did not materialize and he was publicly chastised for having the hubris to believing that he knew what the future held in store.

*I announced, when the day began raining and continued all day I got the bullhorn and said, 'please leave your houses, because really on the radio they are saying the rain will continue, so please leave and come to the community hall' ...but by the grace of god the sky cleared and Pablo Roblero said to me, 'you are a liar, what you think you are god and you know when it will continue to rain' (Respondent 13)*¹⁶

These examples suggest that Hurricane Stan produced new knowledge of the environment that has altered how Tektitekos relate with their environment. New appreciation of the hazards of their environment increased their likelihood of some community adopting preventative protective behavior. However, as noted it is still difficult to discern “normal” rain from threatening rain. The central government has a large role to play in giving credible predictions for extreme weather events.

Discussion

Cultural Derivations of Response Behavior

A trend in disaster research has been to move away from viewing disasters as isolated events of natural or technological origin that are clearly distinguished from normal life. Instead, it has been more instructive in deciphering what causes disasters, how they affect populations, and what can be done to reduce their impacts to conceptualize disasters as occurring within the context of a society. Disasters do not occur outside of societies nor do they obviate the cultural norms or understandings of a society. When disasters are studied in their contexts as opposed to in isolation it has been seen that there is a continuum of conserved features that are present prior to the disaster-event that exert influence on the outcomes. The conditions that lead to vulnerability are recognized as an example of this phenomena (Hewitt 1983; Wisner et al. 2004).

Another feature that is conserved throughout a disaster and deeply impacts how a society experiences crisis is culture (Oliver-Smith 2002). Culture profoundly affects how and when an event is perceived as a disaster, but it also affects or even constructs how people respond to disasters. This point was made early in disaster studies by (Clifford 1956) in his comparative study of Mexican and American responses to flooding along the Mexican-US border. More current work has emphasized the continuity of pre-disaster social networks during the disaster response (Dynes 2006). In this present study pre-existing culture and practices are seen to play a role in defining how Tektitekos organized themselves to meet the demands of the crisis. Several aspects of the response have direct linkages to normal life in Tektiteko culture, including: collective action, checking in on vulnerable households, donating foods to those suffering from loss, and consensus-decision making. In these instances the preservation of cultural practices increased the people's resilience even under duress of a never before experienced environmental crisis.

Collective action is a common occurrence in Tektiteko life, a hallmark of *campesino* life both for *Ladinos* and indigenous Tektitekos. While there are significant differences in *Ladinos* and indigenous culture collective action is a commonality. In the

course of two years living in Tectitán I observed men working collectively to plant and harvest their fields, prepare for and build houses, repair roads and water systems, and respond to minor calamities (fire, accidents, landslides). Some of these activities, especially planting, harvesting, and house-building, are usually organized along family lines, where the patriarchs of a family call on an extended family network to assist when the work required overwhelms one family's capacity to complete the job in a timely manner. This interaction is usually repaid with a meal and an implicit promise of reciprocity. Repairing of roads and water systems is usually organized by communities through their local leadership structures and is either required of all available village men or designated groups like a water committee.

Collective women's work focused predominantly around cooking for events; important events are all accompanied with food. For example during certain holidays when it is customary to eat tamales it is common for the women of a household and the women of the male relatives of the house to come together to share the laborious task of preparing tamales. Weddings and funerals are also opportunities for women to work collectively preparing food. In addition, in all of the public elementary schools, local women are required to take turns preparing snack for the school in groups.

These examples show that collective working is of high cultural value. Therefore, it is not surprising that during the crisis of Hurricane Stan neighbors intuitively formed groups and worked together. This was exemplified by local-level groups and even entire communities working together to liberate community members from fallen houses, save houses from collapse, or collectively evacuate a family's valuables from a house at risk of failure. Also, the collective work ethos was seen by women coordinating cooking meals in the shelter kitchen, and procuring food to ensure that there was enough food for all. In most cases collective action was not a deliberate decision that people made, rather it was undecided or habitual action.

Visiting households where a family member is sick or dying is a cultural practice that is reinforced by the town's two major churches the Catholic and Evangelical. Organized woman's groups affiliated with churches regularly visit invalid and convalescing villagers within their own villages and sometimes in villages quite distant.

Families also frequently visit the sick in this same very personal manner. When there is a death in a household this practice of visiting is intensified and further formalized by ritual. It is the practiced custom that families and community members visit the house where a family member has passed away on the day of the death. To this gathering the visitors bring a gift, usually a staple food (corn, beans, sugar), but sometimes firewood as well. The visitors are thanked with modest food and drink and stay with the family throughout the night until the day of the burial.

These rituals based on reciprocity, inspire empathy, unity, and shared responsibility for emotional and physical well-being. They are the basis for social capital in the communities, which in difficult times can be tapped to benefits everyone. Dynes (2006) indicates that it is social capital that compensates for loss of physical and human capital during a disaster. For this reason social scientists emphasize that pre-disaster social patterns are often indicative of how a community will respond during disaster (Dynes 1994).

During the disaster response and after the immediate crisis, these same empathetic and responsibility-sharing behaviors from normal life were conserved. Visits were made to families in the shelter and to families in other communities that had suffered losses. The actions of the local-level organizations making the rounds of the houses in their communities to determine the state of the house and if the home owner wanted help evacuating, can be seen as a conservation of the responsibility of checking in on neighbors when they are ill or compromised. Tektitekos from all communities, but especially those that were relatively unaffected by the hurricane, donated food to the COE to distribute at the main shelter in town in the days prior to the arrival of outside aid. During an interview, one member of the COE made the analogy that for the families staying in the shelter losing their house was like losing a family member. Perceived in this context, the community and individual impulse to give food donations, even though it was in response to a novel situation, seems like a continuation of normal cultural practice.

Cultural Considerations of Leadership

The leadership and decision making style displayed during the emergency crisis can also be related to everyday patterns observed in the communities. As detailed above, there is a high value placed on collective action in Tectitán. This penchant for collectivism is manifested as consensus-based rule when it comes to community decision-making.

In communities there are several positions of official leadership: auxiliary mayor, president of the COCODE and its members, and the coordinators of various groups (church, women's, water). Additionally, there are leadership positions attached to organizations, like the church. Although understood as official to the outside the official positions do not always accurately reflect the breakdown of leadership or decision-making power inside the community. In part this is due to the novelty of some of these political structures. The COCODE system for instance, was a result of the attempt to decentralize the Guatemalan government after the peace accords were signed in 1996, according to the most current law passed in 2002 (Decreto 11-2002 2002). Therefore, the COCODE does not necessarily represent an indigenous form of leadership within the community.

Commonly, each community develops its own distinct power balance, especially between the people in leadership roles, usually younger to middle aged people, and the respected older population. People holding official leadership roles would be expected to interface with outside power structures, however they would not be expected to make unilateral decisions within the community. Especially in the context of a crisis, decision-making would probably have proceeded collectively, with as much input from respected elders as the younger men occupying official leadership positions.

The case of the local patrols intervening to evacuate families in their communities illustrates clearly how the evacuation, and the disaster response in general, was facilitated by its being carried out within a paradigm of consensus. The local patrol groups understood intuitively that evacuating a home is not trivial. Homes are rarely ever left alone and then only so with extreme anxiety (many people mentioned that one of the

saddest experiences during Stan was either leaving their house or seeing others leave their houses). A home represents most rural families' largest asset, many of whom possess neither insurance, nor large savings to rebuild with. The prospect of abandoning the house to a threatening environment or possible thieves is uncomfortable and there were many families set on remaining in their homes despite danger to avoid the discomfort of having to leave it unattended. Understanding these anxieties, yet still believing that the families' safety required that they evacuate the patrol compromised (although they probably did not think of it in that sense) and undertook the laborious task of removing to safe-keeping families' most precious possessions, food stores being an especially significant one. Apart from the effort to remove possessions to safety, in several communities the local-level organizations worked in conjunction with a commission of the COE to organize groups to patrol the houses of the evacuated peoples to ensure that no robbers were sacking the houses of their possessions. It is unlikely that this implicit understanding of people's reservations and willingness to be flexible and engage with the affected population to arrive at a workable solution would have been displayed if the evacuation had been executed by a foreign group (Tobin and Whiteford 2002).

It is not the intention to represent this community as one without contestation or selfishness, indeed that would constitute a false representation. Also, in many respects cooperation is an endangered value, especially in areas where there has been significant migration to the US. The increase in cash on hand provided by remittances, and exposure to foreign cultural lifestyles could have several erosive effects on cooperation. A change in house-building habits is one area that illustrates this point well. Modern houses constructed of cinder blocks, cement, and metal rebar are popular amongst the young men who have worked either in the US or Mexico. Until recently were all built with adobe bricks. The adobe process requires large inputs of low-skilled labor to prepare the mud and fashion the bricks. The traditional house plans were also exclusively single story, which requires less specialized building knowledge than two stories. Low skill, high labor work is especially conducive to collective work because everyone can do it, and there is too much of it to do alone. However, because the newer houses require

specialized construction skills, and there is capital available to pay workers, home builders now tend to hire a small group of men with modern construction experience. This is no doubt good for the local economy but the more homes that are built with paid work-forces the less likely it is that anyone will be willing to work collectively for free, and there will be fewer and fewer people who feel compelled to help out building a house thinking that they themselves might require help one day. The culture in many places in Guatemala is very much still in a transition period, adjusting to the effects of the last 10-20 years of migration. It is uncertain how the culture will respond. It is possible that in places like Tectitán cultural traits that made them resilient to past disasters may not be relied upon in the future because of social and cultural change.

Community – Outside Organization Interaction

Throughout the recovery there were points of acrimony; accusations of theft and miss-allocation of aid directed at members of the COE by villagers, counter-accusations from the COE directed at villagers of falsifying damages incurred to receive “undeserved” aide, and villagers accusing those seeking shelter as either lazy or embellishing their situation to take advantage of free resources. Interestingly, when there occurred instances of divisive feelings, outside resources were almost always in contention. These expressions of suspicion and conflict during the recovery process are more striking because of their absence during the response period of the crisis. The response period was dominated by people acting in response to needs they saw others facing, however it would appear that during the recovery period people began to act out of self interest, or at least they perceived that others were acting out of self interest.

This inconsistency is strongly related to the way people envision themselves with respect to each other and to the outside world. Disparity of resources is culturally uncomfortable in the communities. In most communities there was a pervasive feeling that all of the community members were on an equal level of resources and needs. Even in the face of clear material differences community members tended to generalize a level of poverty or low resources to everyone, especially when making appeals to the resource-rich outside world. I observed this tendency to generalize equality of standing to cause

communities to reject external-aid projects where only certain “prioritized” community members receive benefits. Even in cases where the “prioritization” seems legitimate to an outsider, the excluded community members felt that they were victims of an injustice, because in their minds their situation is equal to those who were chosen as recipients.

The culture of mutual reliance and collective action in communities is substantially different from the impersonal bureaucratic culture of outside development organizations. For interactions between communities and the outside organization to be successful, compromise is commonly required. Because the power balance is shifted to the outside organizations, it is the communities that are forced to compromise. One of the compromises required of the communities is that they be structured in ways that are consistent with the expectations of the outside organization; the expectation is that they mimic the outside organization’s own bureaucratic structure. This creates a situation where the communities have to negotiate between the demands of outside power structures, which control access to goods the communities desire, and the expectations of community members for culturally sensitive power distribution.

This negotiation is present in nearly all interactions between communities and outside organizations, and often it seems that the communities come out as losers. Several examples have been presented here that demonstrate the difficulty of negotiating these interactions, including: outside organizations repeatedly not recognizing the legitimacy of the COE, and individuals taking advantage of powers afforded to them for personal benefit (the mayor, recipients disproportionate aid). Post-disaster settings provide abundant opportunity for this balance to fail because of the influx of goods and the pressure to disperse them rapidly. Outside groups ignore that their interactions with groups are a negotiation, demanding structures or organizations that may have no precedent in the communities, and individualistic elites take advantage of the privilege they are afforded by the outside organizations. Both cases result in aggravating and perpetuating unequal power relationship in communities (Doughty 1999).

Disaster Response Analysis

In this section the Tektiteko response to Hurricane Stan is analyzed using conventions from the field of sociology of disaster responses. Here a background of pertinent literature from this field of study is presented, focusing on tools that can be used to understand the degree of emergent behavior that took place during the disaster response. Ultimately this section evaluates the emergency management plans promoted by CONRED based on the described response of Tektitekos, cultural considerations, and critiques from the disaster sociology literature.

Overview of Disaster Responses

The literature on disaster response is ponderous and specialized by discipline and focus in the cycle of disasters. The review here is not meant to be exhaustive but cites research that this paper draws on, specifically that done by sociologists on how communities respond to disasters. Themes of this research are classification of organizations involved in disaster response, emergent groups, and theories of disaster response. After introduction these concepts will be applied to the Tektiteko response to Hurricane Stan, and to an evaluation of the disaster management plans proposed by CONRED for communities like Tectitán.

A major center for the study of disaster response in the US since the 60's has been the Disaster Research Center (DRC). One of the main research strategies of DRC has been to employ a field group of sociologists who can be rapidly mobilized to sites of disaster programs to gather and document information pertaining to the response. Applying this practice DRC scientists have compiled over 600 field studies of disasters. The DRC has not followed this vein alone and especially more recently disaster response has been taken up by several research centers in the US, including the Natural Hazards Center at University of Colorado.

It is widely considered from DRC disaster response literature, that there are several generalizable aspects of the way people respond to disaster. Many of the traits of this consensus on response behavior are counter to the popularly accepted vision of post-

disaster response, which assumes panic, hysteria, anti-social behavior, and a breakdown of social norms and functions. In fact the extensive literature shows that are very few cases where disasters elicit a panic response (Quarantelli and Dynes 1977). This is because the conditions that produce panic, namely feelings of social and moral isolation, do not occur during disasters. Instead, there is a high degree of continuity between pre-disaster society and disaster-response the result of which is that people still feel that they are part of a greater community during disasters (Tiernery 1993; Aguirre et al. 1995). If anything it has been shown that pro-social behavior increases during disaster response and that people can behave very altruistically owing to the rapid development of a “disaster consensus” which prioritizes immediate needs (Dynes 1974).

Numerous reports show very high levels of volunteer participation in responses, an example from Mexico City after the 1985 earthquake estimated that close to 10% or 2 million people volunteered in some fashion (Dynes et al. 1990). It is widely noted in the literature that even badly damaged communities retain a high capacity to respond to disasters this is in part owing to that the first responders in many cases will be the people themselves and not “professional” first-responders. There are examples in the literature where untrained search and rescue crews account for between 80-90% of overall rescues after earthquakes. In an example from the 1976 Tangshan earthquake (Noji 1997) reported that 80% of the rescues were carried out by people who themselves were trapped beneath rubble. (Aguirre et al. 1995).observed that the efforts of untrained search-and-rescue groups are coordinated along pre-existing social relationships, and rely on intimate, knowledge of people’s daily patterns to be effective This participation in search and rescue by “un-trained”, spontaneous groups or individuals is present in the US too; one need only remember the efforts of fishermen with boats rescuing people off of roofs in Hurricane Katrina.

“A key feature of disasters is that they create a very high demand for a range of activities (e.g., life-saving, medical care, debris removal)—demands that exceed the normal response capacity of the community or society” (Tiernery 1993). To fulfill the new and immediate needs presented during disasters, communities create new organizations and networks within them; this has been called emergent behavior

(Stallings and Quarantelli 1985). According to a review of social science contributions to the National Earthquake Hazards Reduction Program (NEHRP) one of the most distinctive features of disasters responses is the proliferation of new groups and inter-organizational relationships (GA. Kreps et al. 2006). Integrating emergent behavior into the official disaster responses is now widely understood as critical to the effectiveness of disaster management (Wegner 1991). This recognition has lead to the study and classification of emergent groups and behaviors during disasters.

Characterizing Disaster Organizations

Based on a review of documented disaster responses, (Dynes 1970; 1974) introduced a typology to classify organizational responses to disasters based on two dimensions: task and structures. This typology, which became known as the DRC typology yields four types of organizational response to disasters: established, expanding, extending, and emergent. Established (type I) organizations perform the same tasks and have the same structure during the disaster response as prior to it, these organizations tend to be highly specialized and rigidly structured. Expanding (type II) organizations retain the same tasks during a disaster as pre-disaster but, experience changes in their structure (i.e., the influx of numerous volunteers to distribute food at a soup kitchen). Extending organizations (type III) will experience no change in their structure but will be asked to fulfill new tasks during the disaster (i.e., a small business that accepts the task of receiving and organizing a stockpile of aid for distribution). Lastly, emergent (type IV) organizations are those that develop new structures and assume new tasks during an emergency response. Often this last category describes citizen groups; untrained volunteers that work collectively at tasks that they perceive as necessary and for whatever reason not receiving attention from official response groups. In a review of over 400 case studies of organizations responding to disasters from the DRC archive, Kreps and Bosworth (2007) determined that 13% the responses were emergent, and 22% were either extending or expanding, while 65% of the responses were established (G.A. Kreps and Bosworth 2007). These four types may all be present in the same response, and it remains one of the challenges of disaster management to coordinate between the various

groups to take advantage of the emergent groups and networks (Drabek and McEntire 2003).

Kreps and Bosworth (1993) expand on the DRC typology by providing a framework to look at the structure of organizations. Their work has helped to elucidate what organized behavior consists of, and how it differs from collective behavior. Kreps and Bosworth (1993) proceed from what they determine to be an acceptable definition of organized behavior using a structural code. For behavior to be considered organized they determine it must have four components that occur in a given order. Those components, in order are: Domain (D), Tasks (T), Resources (R), and Activities (A), where: Domain refers to an understanding of the designation of an entity, Tasks is understood as distributed assignment of responsibilities, Resources refers to human or material resources that can be mobilized, and Activities refers to specific actions take. As mentioned, the order these elements occur in is important to how the response is classified. An organized response, DTRA, is one in which the resources used and the actions taken are pre-determined by the domain of the organization and by the assignment of tasks (G. Kreps and Bosworth 1993). This order of elements is the end member on the organization side on the spectrum, whereas its inverse, ARTD, represents the end-member case for collective behavior. Collective behavior occurs when the activities and resources of a group determining its tasks and eventually determine the domain of the group. There are 24 possible combinations of order of occurrence for the four elements along the continuum from organized behavior to collective behavior. Kreps and Bosworth (2007) analyzed over 400 DRC field studies and reconstructed both the type of response using the DRC typology and where the response fell on the DTRA-ARTD spectrum. Interestingly, they found examples for nearly all of the 24 combinations of organizational forms. More importantly, they showed that in emergent, responses a variety of organizational forms will be represented; in 52 examples of emergent response 14 of the 24 possible organizational forms are present. This, they conclude demonstrates that neither organized nor collective behavior dominates in emergent responses.

Analysis of Tektiteko Response Organizations

The response in Tectitán demonstrated many of the characteristics that are highlighted in the literature on disaster responses from other case studies. The citizens' response was dominated by pro-active and pro-social behavior. This was evident in the formation of evacuation and rescue groups that performed tasks at their own peril for their neighbors. The social fabric was preserved during the crisis, and informed and facilitated the response collaborations (Neal and Phillips 1995). Perhaps most notably amongst the similarities displayed by the response in Tectitán was the dominant role of un-trained citizens and the emergence of new groups in providing emergency services throughout the disaster. The abundant participation of citizens in committees of the COE was recognized several times by members of the COE directive as being absolutely essential to the success of the organization, as described in the following quote from a COE member.

The organization worked for us because it was fast. The people would always say yeah let's do this. That was the best, we would say let's do this and the people were always there to collaborate. That was the reason for our success. I think that the people never denied helping us (Respondent 16)¹⁷

Using the DRC typology (Dynes 1974) described above the majority of the groups that formed were either *extending* or *emerging* groups. For instance, the COE was an emergent organization because having never previously existed in the community; it took on new tasks and invented a new structure to deal with the circumstances of the emergency. However, it incorporated entities that were both expanding, and extending and facilitated their coordination with the emergent groups and a willing volunteer force. Examples of this arrangement where an expanding group became subsumed by the COE were members of the health center who in coordination with the COE attended to people in the shelter, or members of the PNC who teamed with emergent groups from the communities to perform security rounds in the communities that had been evacuated.

The local-level response would either be considered an expanding or an emergent response; the tasks that they performed: digging out houses and evacuating families were new tasks on that scale. However, it is difficult to determine if the structure of the group would be considered novel. In many cases, because there were no predetermined search-and-rescue or evacuation crews, the structure of the group was a large percentage of the whole town. This may appear to represent a new structure but, as demonstrated in the discussion on derivation of the response, is not necessarily an unfamiliar structure in Tectitán; rather it is a sort of latent structure in the community that can be tapped into during times that require great effort. More commonly the effort of the community is used for constructing houses or cleaning roads, but it can be directed to attend to life-saving activities during a crisis. This behavior again demonstrates that pre-disaster community relationships and social networks are preserved during disasters and impact response behaviors.

Despite the emergent character of the COE its organizational form was on the organized behavior side of the spectrum. It was formed to interact with outside groups as a single entity (D); either through elections, or consensus nominations a division of labor was established (T), corresponding to the representatives of the committees; in many cases coordinated actions (A) were carried out before resources (R) were fully accounted for, for example shelters were opened before there was food, or bedding for the refugees. This would make the COE a DTAR organization, which falls near the organized behavior side of the spectrum. That it was an organized group does not mean that it was necessarily a rigid group. Perhaps the quality that led to the COE's successful management of the emergency response (and part of the recovery) was its organizational flexibility, and its ease of expansion. Organizational flexibility was displayed by the facility in which the COE designated new committees (T), which formed constantly to keep up with new perceived needs. To operationalize (A, R) the new committees it was required to expand, which it achieved by appropriately taking advantage of the local-level groups and their personnel.

The groups on the local-level displayed an organizational form closer to the collective behavior end of the spectrum. In most cases emergency activities (A)

developed first, such as coordinated actions to responding to the collapse of a neighbor's house, these actions required accessing either greater human resource or tools (R). In some communities this was the extent of organization. In a few communities, a division of responsibilities (T) was established, for example where groups split-up to check on people living on one side of town or the other, or designated some members as watchmen. It is unclear whether the local-level groups ever considered themselves as community disaster groups (D) and projected themselves as such to outside groups. This would make the local-level organizations AR or ART.

Emergency Management Critique

The following section presents the dominant approach to emergency management, and a critique of its operating assumptions from the point of view of the disaster literature. Then the Tektiteko response to Hurricane Stan documented is placed in the context of disaster management theories. The official disaster management plan of the Guatemalan government is evaluated in the context of disaster management theories, and compared to the Tektiteko response. The result is a discussion of how future disaster planning could incorporate aspects of the Tektiteko response and the disaster literature critique to become more germane to disasters that occur in the rural, mountainous regions that typify much of the Guatemalan highlands.

The Dominant Model

(Dynes 1994) identifies one theory of disaster or emergency management as the dominant or normative model of emergency planning that is often incorporated into plans as “conventional” wisdom.. This model is termed Command and Control (C&C) and is generally associated with plans that strictly define a centralized decision making authority, rely on Para-military type groups to respond the crisis, and discount the capacity of the affected population to impact the response (Dynes 1994; Neal and Phillips 1995). C&C is recognized to have become the dominant emergency management model because early civil defense planning in the US was seen with a militaristic discourse and populated by people from military backgrounds who extended military operating

procedures to disaster situations without critically assessing whether the two situations were compatible (Dynes 1994).

The plans that C&C models advocate assume the following about disasters and how individuals and societies respond to them: disasters represent a break in continuity from “normal” social functioning, because “normal” social units are overwhelmed people will devolve into anti-social and problematic panic behavior, pre-disaster or “normal” society organizations and spontaneous action of the population cannot organize an effective response. Based on these assumptions the most important task of the emergency manager is to regain control of the population and substitute a failed or overwhelmed civil society for a stronger one with clear authority. C&C plans therefore rely on the mobilization of specialized groups into the affected area to replace the incapacitated civil society. The specialized groups are usually military or Para-military (National Guard, or police and fire departments), which respond to hierarchical and centralized command, and leave no opportunity for partnership with emergent groups of civilians. The assumption of anti-social behavior culminating in chaos leads to over emphasis on restoring control and justifies the centralization of power and employing measures like “martial laws”. Authority in “normal” society is often multilateral, so the structure of power during disasters is altered to allow for greater centralization. Therefore, C&C emergency management plans often focus on designating authority and chains of command during disasters; usually having to create new disaster specific organizations to account for the dissolution of pre-disaster organizations, and formalized ways to communicate between them. Because all of these new relationships need to be pre-stipulated in the disaster plan, the document is usually rigid, and in practice officials want to “keep to the plan” as much as possible, effectively closing the official response off from a spontaneous or emergent response. The assumption that people are untrustworthy during disasters, either because panic distorts their assessment, or because they operate with individualistic aims, results in C&C models privileging official information and discounting information not officially derived or sanctioned.

Critique of the Dominant Model

The C&C model has been widely critiqued in the literature from social scientists on disasters (Dynes 1994). Many of the critiques are directed at the central assumptions of disaster behavior that underpin the C&C models. They argue that the literature of case studies on disaster behavior does not support the ideas that pre-existing social organizations collapse and that individuals respond with anti-social behavior during disaster (Dynes 1994; Tierney 1993; Neal and Phillips, 1995). Rather, they claim the literature demonstrates the opposite: even damaged societies are resilient and possess capacities to effectively respond to disaster, pre-emergency social organizations and relationships are conserved during disasters and inform how people interact and cooperate, because of this people do not panic, or act individualistically but collectively.

In practice, the major critiques of the C&C models are that they over-emphasize centralization of decision making, do not plan to take advantage of the spontaneous and emergent actions of affected individuals, and impose an artificial organizational structure while ignoring the potential that exists in “normal” social organizations. The centralization of information and decision-making is an inefficient way of approaching diffuse problems; disasters often occur over large areas that because of obstacles to communication and travel make the consolidation of information and authority onerous and slow (Dynes, 1994). One of the most distinctive aspects of disasters is the proliferation of new organizations and the alteration of existing organizations to meet the new needs presented by the unique disaster situation (Drabek and McEntire 2003). C&C models routinely ignore and marginalize the potential resource of spontaneous organizations, considering them as potential hazards to the proper functioning of specially trained disaster organizations. Privileging special disaster organizations over emergent groups assumes that the outside groups will be able to access the disaster area within a relevant timeframe. The imposition of special disaster organizations with new authority structures ignores the existing capacity within social systems to organize and can result in conflicts when societies that are normally governed multi-laterally are replaced with more authoritarian forms of governance.

In reaction to the C&C approach, models have been advanced from the social sciences that better appreciate the patterns of behavior observed during disaster responses. These models have been termed “Problem Solving” or “Emergent Human Resources”. Both models emphasize decentralization and coordination as a means of optimizing the capacities of emergent and existing but altered groups.

Critique of CONRED model

Dynes (1994; p.149) claims that, “with no planning social units would likely evolve a more adequate effort in emergency response than they would burdened by the assumptions inherent in the command and control model” He directs planners to envision disasters in terms of problem solving, where the community is the problem-solving unit, and to study the way that social units within the community solve problems. This study documents the unplanned and spontaneous response to an unforeseen disaster in a small municipality in rural Guatemala in 2005. Since then, there have been efforts made by the German GO GTZ in partnership with CONRED to create codified municipal and community disaster management organizations and plans. In this section the proposed hazard management plans are critiqued based on the unplanned response to Hurricane Stan and the insights from disaster literature.

The CONRED disaster management strategy is heavily influenced by disaster management ideas developed in the US. CONRED partnered with the Federal Emergency Management Agency (FEMA), and has received oversight from them on the formation and initiation of Emergency Operations Centers and other emergency organizations (COEs in Spanish) (FEMA/USAID 2002). This influence has caused CONRED to adhere to the discourse of consolidated command popular in US emergency response agencies without taking a critical account of the capacities of Guatemalan authorities on the Municipal and Departmental-level to respond to crises. This paper argues that two aspects of CONRED’s emergency management strategy implemented in Tectitán are misdirected: the assumption that Municipal-level governments possess the resources to respond, and the emphasis placed on creating disaster-specific organizations, rather than building the capacity of existing community organizations. Additionally, carrying out disaster response activities in a militaristic style is ineffective in a country

where there are persistent negative associations with the military, which endure from abuses carried out during the internal armed conflict.

Centralization, and Expectations of Government

There appears to have been a false analogy drawn between the multilayered civil defense structures in the United States and those in Guatemala. In the US the local, State and National government structures are loosely coupled, where the State and Local authorities exhibit high levels of autonomy from the National government, and capacity to respond to external shocks. In contrast, in Guatemala resources are extremely consolidated at the National level, and the inferior levels of authority are highly dependent on the Central government.

To illustrate the level of dependence on the Central government, the municipal government relies entirely on the National government for its operating budget; the municipality itself does not generate any appreciable income. The case of Tectitán can be generalized to many municipalities throughout rural Guatemala: municipalities do not have the resources to allow them to carry out basic development projects addressing daily needs, let alone acquire resources to allow them to engage in significant response activities. The municipal authorities in many cases will be unable to reach the most affected communities during geo-meteorologically induced crises because the infrastructure throughout much of the interior of Guatemala is highly vulnerable to landslides. This situation was observed in Tectitán and recognized by two employees of the municipal government to represent a formidable obstacle to the Municipal response:

If the road is blocked when are they going to arrive at the communities, now if they had a helicopter or plane they could get there, but if not they can't. The radios without power they don't work, maybe you would need some batteries because you are left incommunicado, without power, or water, without anything. This is our experience from Stan; we can't wait for the mayor or the aide institutions because when are they going to arrive? (Respondent 41)¹⁸

The topography of Tectitán is such that as soon as there is a storm the roads are debilitated and it isn't possible for COMRED to get to the communities, so we can say that the COLREDs are without support in the moment of a disaster (Respondent 69)¹⁹

The situation in most of Guatemala is that the capacity to resist the shock of disaster is consolidated at two extremes: at the level of the National government where that capacity is manifested in access to capital and ability to marshal physical resources, and at the level of the local civil society where that capacity is manifested, as demonstrated in this paper, in social networks, and local knowledge. It is the unfortunate reality that these centers of capacity are rarely unified. In between these two poles there is no authority with the capacity of physical resources to respond to disaster. This exemplifies the incompatibility of centralizing capacity to confront a diffuse problem. Centralizing resources at any level of the Guatemalan authority structure does not necessarily mean that they will be available to affected populations.

Additionally, the services Tektitekos expect from their government are substantially different from the services expected by Americans from their government. This influences Tektitekos' perceptions of what role the government should have in disaster situations, where Americans would have high expectations for government intervention. Many of the regular public services that are performed in developed countries by formalized government entities are performed in Tectitán through informal community groups and associations. Services such as road maintenance, water system maintenance, and fire fighting for example, are organized through community groups using un-paid community labor. The community internalizes these services because neither the National, nor the Municipal governments have sufficient revenue to assume the responsibility of those services. In Guatemala's present political situation, Tektitekos' only experience with the National government is through the implementation of development projects (major roads, schools, or electrification), and the dispersal of aid, or election-gifts. The result of these patterns of government involvement is that

Tektitekos do not think of their government as a constant service provider, but rather as power to appeal to for relief, or aid, as a worker would look to his *patron* for favor. This means that in a disaster response Tektitekos would be less likely to expect a strong response from government. However, they may have high expectations of government for aid dispersal during the recovery stage of the disaster.

These expectations were exemplified in Tectitán by actions of a community where three people died in a landslide. The community worked through the night with hoes to free the two living victims, and recover the three bodies from the debris. In the morning the community sent out a delegation of the president and other members of the COCODE to the municipal government. The delegates reported to the COE the events that took place the previous night and requested money to defray the costs of a proper burial for the three victims. The COE was able to pool money together (mostly personal contributions, that were latter reimbursed by the municipal government) to give to the community grieving community. Their request for only money and not services, like transportation to medical care for one of the survivors who was injured in the landslide, reflects their expectations of the authorities. As mentioned these expectations are conditioned by the limited possibilities of the situation. Perhaps the delegates knew that there was no service the COE could provide them on account of the ruined state of the infrastructure and the remoteness of their village. None-the-less, this is still demonstrative of limited expectations for services.

The important message is that, while CONRED prioritizes the importance of the National and Municipal-level emergency management structures, during the response phase of a disaster, people in affected communities will be more likely to look to, and receive emergency services from, their neighbors. Based on these expectations of the people, and the reality of limited municipal resources that underpin them, a more appropriate strategy of emergency planning would prioritize local response capacity building. Municipal structures then would be utilized as the means to coordinate recovery actions, which are actions that are more consistent with those that they already perform.

Complications of Disaster-Specific Organizations

A second major critique of the CONRED model of emergency response, on both the municipal and local-level, is its adoption of the idea from C&C theory that disaster-time activities must be carried out by specialized disaster organizations. This approach limits effective disaster response and burdens community members with another organization to support. Part of the CONRED plan for emergency management is that the CONRED organizational structure is mimicked on all levels of operation: national, regional, municipal, and local. This policy may make sense at the higher-levels of government where the players involved are career politicians, and people whose professional duties are closely linked to emergencies. Also, on the national-level there is a greater probability that in any given year there will be an event somewhere in the country that calls the group to action, creating a continuous sense of purpose. However, on the local-level, it is incorrect to assume that there will be yearly disaster events requiring community action in most communities. Lacking the reinforcement of constant responsibility it is unlikely that a community would be able to sustain an organization devoted to disasters. This is especially true for events like major earthquakes, or storms, which may have repose periods for individual communities of a generation or more.

Many communities in Guatemala are already saturated with no longer functioning community groups that were formed to be eligible for the development aid organization. The creation of another specialized organization that may never be called into action, to deal with disasters is likely to be cumbersome, to the point that it will be neglected. How can un-paid, un-supported community members justify that level of commitment to a non-urgent need, when there are countless other demands of greater urgency on their time and resources? One of the most difficult aspects of sustaining disaster preparation is the uncertainty associated with the repose period between events. It is difficult to convince people, not just in the developing world but everywhere, to commit resources to protect against a situation that is perceived as unlikely to occur based on previous experience with the environment.

It is impractical to rely on a specialized group of people, who have other immediate and continuous needs, to keep a potentially protracted vigil against an event

that may never occur. Instead, it is more viable to think of the multifarious small problems that communities continuously encounter and navigate as conditioning for a large problem like a disaster (Dynes 1994). As demonstrated in Tectitán there is latent capacity within communities to resist large shocks, even those that present unfamiliar circumstances. This capacity is accumulated in the form of social capital through the practice of routine and ritualized collective action. In Tectitán pre-existing social networks were re-purposed to provide disaster services, and did so successfully. The effectiveness of these networks most likely would not have been improved if they were forced to act within an imposed organizational structure, different from the one the networks formed within. Worst still they might simply be rejected: in disaster training I heard Tektitekos objecting to the formation of special disaster leadership structures that only involve a limited number of people on the basis that when a disaster occurs everyone will be out helping anyway. Once again, in emphasizing the isolation of disaster functions from the everyday functioning of a community, CONRED improperly adapts emergency plans to the realities of rural Guatemalan communities. Many communities, even municipalities, like Tectitán, have difficulty supporting the organizational structures of government (Tectitán could not support a Municipal Development Council). To add an additional organization guaranteed to see little action seems predestined to last only as long as CONRED or an NGO can create other incentives to keep interest high.

Decentralization and the role of NGOs

The CONRED model of layered response, where there are replicated disaster organizations at the national, regional, departmental, municipal and local levels, is a commendable attempt to decentralize disaster response capabilities. Although municipalities can be cut-off from the points of crisis as I have argued, they are likely to be much closer than the national or departmental governments. Political decentralization has been built into the Guatemalan government since the signing of the peace accords in 1996 as an attempt to give greater to autonomy to the diverse cultural communities of Guatemala. Political decentralization, and the roll-back of state services has also been

part of neo-liberal economic policy that governments have accepted as conditionalities to loans, or in efforts to appear more competitive to transnational businesses (Whitehead 2007).

It has been shown by researchers that decentralization, especially in developing countries, can lead to lower rates of deaths and losses during disasters (Iqbal and Ahmed 2009; Escaleras and Register 2010). However, Iqbal and Ahmed (2009) specifically point out that the reduction in disaster losses was only observed in countries where there is both fiscal and political decentralization. As discussed, in Guatemala subordinate governments are highly fiscally dependent on the national government. The case in Guatemala is unfunded decentralization, where although municipalities have some political autonomy, they rarely have sufficient resources to pursue development and capacity building. Instead of creating their own development agenda, municipal governments, like Tectitán, are beholden to development decisions made by higher levels of government and international donors. This lack of local empowerment does not create the environment that would sustain mitigation and disaster preparedness training. Instead, it leads to complacency, as hand-tied municipal governments and local groups wait for NGOs to bring disaster programs to them. If CONRED is going to seriously engage in a strategy of decentralized response, municipal governments will need to be fiscally stronger. As the situation stands now the unfunded decentralization places too much response burden on citizens. Also, because of a roll-back of services provided by the National government, services which should be centralized in a disaster situation, like early warnings, are not provided, complicating local response capabilities.

Conclusion

This paper documented two major themes in response to Hurricane Stan in Tectitán: 1) the capacity of civilians relying on culturally intuitive modes of organization to respond to crisis and, 2) the difficulties that civilian organizations encountered when interfacing with a group expecting official hierarchical structure. Examples of these difficulties were: having aid requests rejected because they were not made by the mayor, and aid organizations engaging unilaterally with the mayor while marginalizing the COE. In Tectitán the end result of centralizing decision-making power in the position of the mayor was acrimonious aid distribution that many still recall as unjust. Rather than emphasizing consolidation of resources and organizational power at the centers of governmental authority, disaster planning in Guatemala should focus on fortifying the ability of citizens to resist external shocks, and to coordinate their efforts when those shocks do occur.

As pointed out by Dynes (1994) functioning communities represent a unit of problem solving. Communities such as those in Tectitán have a history of working collectively to solve problems, as demonstrated in the section identifying the cultural derivations of disaster response activities. Therefore, these communities are rich in organizations and social problem-solving networks that are reinforced by everyday cultural practice. These organizations are not necessarily embodied by the officially recognized positions of leadership within the community, nor will they be embodied by another imported organizational structure specifically for disasters.

This is not an argument against specialized training designed to increase disaster preparedness on the local and municipal-level; communities unequivocally benefit from having people with first aid or rescue training amongst them. But, this paper points out that disaster responses, when effective, are whole community endeavors. Thus, emergency planners cannot just focus on creating specialized units, but must envision how the whole community will coordinate a response in the context of their culturally derived organizational patterns. Disaster plans that seek to impose an unfamiliar and unpracticed organization will be disregarded precisely because of their unfamiliarity, and plans that consolidate resources and decision-making will likely find that when disaster

occurs there is an unbridgeable gulf between the affected areas and the centers of response capacity.

This paper has documented that Tektitekos are acute observers of their environment, and have been able to observe and interpret cyclic patterns in hurricane frequency. Additionally, the experience of Hurricane Stan has produced new knowledge and awareness of the potential for danger in their environment. The new awareness has informed their behavior to take pro-active life-preserving measures in subsequent situations where they perceive a threat like that of Hurricane Stan.

The recognition that substantial capacity to respond to disaster exists embedded in civil society at the community level does not absolve the higher levels of government of their responsibility to engage in civil protection. However, it does signify that planned civil protection measures need to account for local capacities, and seek to coordinate their incorporation into the official response. This paper has argued that centralizing capacity to respond to disasters at the governmental levels alone is not an effective emergency management strategy in Guatemala. The reasons for this are the weak nature of municipal governments which results from unfunded decentralization, and a dispersed rural population connected by a vulnerable transportation infrastructure. This still does not mean that there is no role for the national government.

On a local scale, the government could improve its communication system. This paper has demonstrated that on the ground it is difficult to determine if a rain event is part of the “normal” rainy season weather pattern or if it is a system with potential for sustained rainfall. Guatemala has a meteorological service INSIVUMEH that is in communication with other regional forecasting services, the information they receive should be disseminated. INSIVUMEH has the capacity to issue warnings, which would help people make decisions without having to wait until the situation has escalated to the point where it is dangerous.

Looking at the greater picture of making communities more resilient to disaster, there is a large role for government to play in addressing root causes, and dynamic pressures that create situations of vulnerability within Guatemalan communities. Guatemala still suffers from the remnants of colonialism which, are manifested by an

entrenched social and political order that benefits elites at the cost of providing development for the majority of rural Guatemalans. Chronic underrepresentation, and subsequent underdevelopment for the majority indigenous rural poor, combined with increased environmental pressures on the land they rely on for their livelihoods results in greater vulnerability to environmental shock. The Guatemalan government is responsible for creating a political environment that can lead to social and economic equity. The capacity and resilience shown by the people of communities like Tectitán is manifested in spite of an ongoing history of political marginalization, economic exploitation, and government corruption.

Finally this paper has shown that when studying disasters it is important to recognize both capacities that exist on the local level, in the form of local environmental knowledge and social capital, and larger scale forces that construct the social-political environment in which disasters occur. Emphasizing both poles empowers local communities by validating their knowledge, and holds governments and aid organizations accountable for creating large-scale equitable structures. The existence of local capacity does not excuse the government from addressing the forces that determine an unsafe environment, and because communities have been marginalized does not excuse intervening organizations of valuing and working with their capacity.

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APPENDIX 1: The Questions for the Semi-Structured Interview

Date_____ **Place**_____

Personal Information:

Age_____ **Gender**_____ **Community**_____

Position in the community_____

Job_____ **Education**_____

Experience with hurricane Stan or other Hurricanes and/or landslides:

1. Were you in Tectitán when it was hit by Hurricane Stan?
2. Was your community affected?
3. Were people killed as a result of Hurricane Stan in your community?
4. Were houses destroyed or damaged as a result of Hurricane Stan?
5. Did you lose a harvest because of Stan? What? Did other people in your community?
6. Did you leave your house to seek refuge during the course of Stan? Did others in the community?
7. If you left your house, why did you choose to do so?
8. If you did not leave your house why did you chose not to?
9. Can you recall another hurricane that affected Tectitán like Stan? If so when? Have there ever been other landslides like during hurricane Stan?

Knowledge and beliefs about landslides:

10. What produces landslides and hurricanes, are they natural events?
11. When is it most likely that landslides happen in Tectitán?
12. Where is it most likely that landslides will occur in Tectitán?
13. Do you think that the people are somewhat to blame for the landslides that happened during Stan? If so why
14. Do you think that it is possible to prevent against damages caused by landslides? How?

15. Do you think that you will see another hurricane that affects Tectitán with a magnitude like Stan?

Perceptions of disasters:

16. Do you think that the damages caused by Stan could be termed a “disaster”?

17. Why do you think disasters happen?

18. What if anything can be done to prevent disasters?

19. The aspect of Stan that affected me the most was:

20. Do you worry about strong rains more now than you did prior to Stan?

21. In your life what causes you the most worry?

22. Do you think that the damages of Stan affected everyone in Tectitán equally?

23. Before Stan were you aware that your community was exposed to landslides?

24. Do you think it is possible that a landslide could destroy your house?

Perceptions of emergency planning:

25. Does your community have emergency management plans? Did you use them during Stan?

26. Do you think that emergency planning can reduce the damages that result from hurricanes?

27. Do you believe that it is important for your community to have emergency management plans?

28. Would you be willing to participate in an emergency management commission in your community?

29. Who do you believe is responsible for creating emergency management plans?

Experience with disaster trainings:

30. Have you participated in disaster management trainings?

31. Who gave the trainings? The municipality_____, CONRED_____, an NGO/GO_____, don't recall_____, other_____

Appendix 2: Transcriptions of the Included Quotes

1. Pues nuestro organización nació de acuerdo a la necesidad porque vimos que había la necesidad de organizarnos tuvimos hacerlo nos organizamos primero hicimos un comité sencillo fuimos a conseguir un local ahí en la escuela nos dieron para cocina pero no pensamos que iba ser grave pues no que pensamos que iba a ser suave pero entre más que caía la lluvia la cosa se fue poniendo más difícil fue donde tuvimos que organizar mas y no era de aquello de que mire sin no que solo íbamos jalando mire que miramos a alguien “mira encárgate vos de esto trabajo fulano, y este contigo” muy bien que se iba con 2, 3, 4 muchachos en una comisión pues mirábamos a otro, “mira porque no te encargas de esto” mire puros jalados no había de que mire lo vamos a hacer y por una elección que quede fulano de tal no aquí fue conforme la necesidad y la voluntad de trabajar... conforme a la gente iba viniendo nosotros también nos íbamos preparando pues que hay que hay que hacer este comisión y hay que hacer la otra bueno hay sí que la necesidad nos obligo ya solo decíamos que quede Fulano de Tal en la comisión este y encárgate ya no era de que si no que aquí lo que mandaba bueno encárgate vos con esto y Fulano que vayan contigo búscate a ver quienes quieren ir contigo la misma gente fue buscando su comisión no fue que se quedara un y un elección no la misma gente fu buscando su comisión (entrevista numero 39)
2. no era como una presidente pero como un organización donde todos teníamos un como una responsabilidad más que todos alguien que era de albergues tenía que dar informe de albergues (numero 16)
3. estábamos organizados como comité entonces cada uno de por ejemplo presidente, vice-presidente, vocal, fue el encargado de un su comité... cada uno de los otros que formamos parte tuvimos que buscar nuestras personas que nos iban a ayudar en este sentido en nuestros funciones (numero 27)
4. en el tercer día vinieron los vecinos y dijeron “que estás haciendo aquí? Vamos por arriba” dijeron y llegaron 15 personas los vecinos allá con migo dijeron que yo saliera pronto pues porque si el agua va a salir pues se va a derrumbar el terreno y te vas a morir... así será dijeron les agarraron roperos y todas las cosas y lo sacaron a la otra casa que esta arriba de AXXX y ahí nos estuvimos refugiando y sacaron todo pues si usted me ayuda con mucho gusto vamole dije yo (numero 43)
5. cuando la gente decía que esta casa y está en riesgo, ya se va a ir entonces gritaron uno a los otros que donde estaba jodido las casas entonces íbamos

corriendo puro con gritos entonces y se compartimos de tres o cuatro personas en cada lado entonces decían vénganse por acá auxilios entonces ahí nos amontonábamos para ir a sacar...debajo del agua y puestos nuestros nylon pero si estuvimos andando con nuestros nicaples para sacar sus cosas de la gente sacamos maíz sacamos sus ropa bueno todo lo que había en la casa para prevenirse pero fue un poco duro pero logramos salvar a la gente los salvamos aunque con mucho sacrificio pero lo hicimos lo posible

6. como el tiempo de agua aquí se va ya octubre y viene verano pero tanto repente cuando apareció el 5 de octubre medio de octubre ya llovizno porque los meros tiempos de aquí es en mayo empieza el agua en este tiempo mayo junio julio agosto septiembre ya octubre se va el agua pero este tiempo nos admiramos que tanto repente cuando empezó y vino el mal tiempo (numero 34).
7. o sea que ya cuando yo me di cuenta cuando ya estaba las accidentes pues porque cuando empezó pensábamos que era una lluvia normal porque nadie sabía que iba a tardar para que afectara pensamos que era una lluvia normal que tarda un momento pero que se ahí tardo pues entonces nos dimos cuenta que no era lluvia normales ya era un temporal es que tardía 4 días entonces fue que nos dimos cuenta dijimos esto no es lluvia normal sino que es un tormento (numero 49)
8. una mañana amaneció lluvioso y pensando verdad de que iba a pasarse la lluvia como que pensando de que era un lluvia normal pues, invierno pero yo decía a mi familia a mi esposa “esto si va a pasar” bueno el siguiente día en la noche sigue en la otro día y cuando vimos pues una mañana le dije mi esposa ya se está partiendo tiene una cinta y que va a pasar.... verdad decíamos que no pasa nada...estuvimos el otro día y en eso cuando ya vimos más abierta la grieta y puse agarré un poquito de cemento tire en la grieta para que no se fuera el agua verdad y en esto pues ya se por la mañana ya se oía que se fue la casa de Onorio se tapo (numero 43)
9. No no porque los huracanes hasta ahora que no hace mucho que empezaron a salir esto...cuando yo era niño así era un mal tiempo dos días y ya, ya no había miedo ahora cuando empezó esto de mal tiempo fue tremenda fue tremenda (numero)50
10. Creo que ya había pero en aquel entonces no se platicaba esto de huracanes no se platicaba hasta ahora está viendo huracanes no se sabía se fueron muchas derrumbes ahora pero no más la plebe decía la gente que era agua pues, invierno pues sigo derrumbe pero ahora no casi se oye de Stan esto es (numero 36)

11. en varios lugares también se noticia de que antes no había tanto de noticias de huracanes como hace unos 10 años de aquí para atrás no tanto se oía de 10 años ahora para arriba el momento cual donde estamos siempre se oído si no es en este municipio pero de otros lugares de diferentes países se han pasado fuertes temporales y no solo lluvias pero bien fuertes aires y temblores (numero 35)
12. pues horita está poniendo más estricto pues porque están pasando los terremotos ahorita pasen mas está más estricto el tiempo ahorita va a pasar más, digo yo así va a pasar más porque yo y me considera de mi porque antes no había de esto no había y ahora se ven unas cosas se ve diferente ya viene mas no sé que es viene más (numero 31)
13. si la lluvia empezó a las dos de medio día pero si lloviendo todo esta tarde y entra la noche y amanezca ya al amanecer mejor salirse de ahí pues así es mi sugerencia pues si sigue lloviendo mejor que salgamos (numero 13b)
14. Pues más que todo yo creo que nos ha dejado más que todo el Stan yo creo que de aquí y adelante vamos teniendo precaución, y seguro ya va viendo que buscando ya el donde hay menos riesgo un refugio donde hay menos riesgo quizás una lluvia de dos días hay que buscar un lugar seguro (numero 43)
15. Cuando llueve de 2- 3 días tengo precauciones, saco a mi familia, grito a la salgase, salgase. Un noche y un día Herman y yo comunicamos (encuesta 11)
16. yo le di anuncio pues a amaneció lloviendo y otro tarde agarré el bocino de aire yo les dije señores pues haga favor de salir de sus casa porque la mera verdad y ahorita la lluvia según lo que están comentando en la radio y por eso esta como nosotros somos el comisión de resgate salgan y busquen un lugar cómodo y vengan aquí al salón...pero ya con el bendición de dio más tarde aclaro y dijeron que yo me todavía me dijo este Pablo Roblero que vive aquí arriba, este Don Romeo parece que sos mentiroso casos sos dios caso sabe si va a seguir lloviendo (numero 13)
17. esto nosotros nos funciona porque fue rápido y la gente decía ba esta bueno esto era lo bonito porque nosotros decíamos hagamos esto o que hacemos y la gente estaba dispuesta a colaborar y esto fue el éxito también de dar respuesta me imagino que la gente no se negaba no decía que no pues... (numero 16)

18. si está tapada la carretera y que hora va a llegar a las comunidades ahora teniendo nuestro avión nuestro helicóptero llegamos rápido en todos los lugares, si no, no se puede llegar. Ahora con los radio de comunicación no esté seria porque sin energía no trabaja hay que tener por lo menos batería eso para poder comunicarnos, porque se queda uno incomunicadamente sin luz sin agua sin esta nos deja de una vez sin nada este es la experiencia que nos dejo de una vez el huracán Stan no vamos a esperar del alcalde municipal de la instituciones nada de esto porque a qué hora va a llegar allá (numero 41)
19. la topografía y el deseno geográfico de Tectitán es así, media vez que una tormenta llega al territorio las vías de acceso colapsan y no es posible la COMRED pueda llegar a las aéreas de las comunidades entonces podemos decir esto de que así las COLREDes están solas en el momento de un desastre (numero 69)

Appendix 3: Letter of permission from Ray Womack for use of photograph A of figure 6

The work was "published" in a conference proceedings, as shown below. You have my permission to use the photos and maps. Some of the photos, including one of the big red slide at Sacchumba, were conveyed to me by others in an informal way. I don't actually know who took them. I will ask my contacts in country. Frankly, it's probably fine if you just refer to the publication.

WOMACK, W.R., AND C. O'FARRELL: LANDSLIDES TRIGGERED BY HURRICANE STAN IN WESTERN GUATEMALA: INVESTIGATION AND MITIGATION IN A DEVELOPING ENVIRONMENT

40th Annual Symposium on Engineering Geology and Geotechnical Engineering

Utah State University

Salt Lake City, Utah, May 2006

From: Jesse Silverman [mailto:mrjessesilverman@hotmail.com]
Sent: Tuesday, April 26, 2011 8:54 AM
To: ray@waigeo.com
Subject: Tectitán

Hello Mr. Womack, I hope that everything is good by you. I have a couple questions. I am finishing up my masters thesis on characterizing the citizen response and creating a landslide inventory for Tectitán.

The work that you did has been extremely important for me. I have cited it as an unpublished report but I am wondering if you have published that work somewhere, in any case I would like to get the citation correct. Also, I have included a photograph from your report taken from a helicopter of the big slide in sacchumba that I assume is yours. I am required to provide proof that I have obtained authorization for all material that is neither public domain, nor my own personal work, so to include your photo I need your authorization (nothing fancy, just written authorization in an email). I thank you very much for your assistance through this process. Take care.

Jesse

Appendix 4: Letter of permission from Jeremias Ramos for use of photographs B, C, D of figure 6

A quien interese:

Por este medio hago constar que el Señor Jesse Silverman, es una persona de mi conocimiento desde hace tres años. Durante el tiempo que he tenido el gusto de conocerlo ha demostrado ser una persona responsable, honrada, proactiva, con excelente relaciones interpersonales, demostrando siempre sus buenos principios y valores. Por todo lo anterior considero que es una capaz de realizar cualquier actividad dentro de su área de experiencia. *Por lo cual no encuentro ningún inconveniente en autorizarle el uso de fotografías y cualquier información relacionada a lo ocurrido por la tormenta Stan en el municipio de Tectitán, Huehuetenango, Guatemala.*

Y para los usos que al interesado convenga, extendiendo la presente carta electrónica de autorización en el municipio de Tectitán, Huehuetenango, a los veintisiete días del mes de abril del dos mil once.

Jeremías Natanael Ramos de León
Responsable de la Emergencia y
Plan de Respuesta Inmediata durante el Stan
Al municipio de Tectitán, Huehuetenango.

Appendix 5: Letter of permission from INSIVUMEH for use of maps in figures 4 and 5

INSTITUTO NACIONAL DE SISMOLOGIA,
VULCANOLOGIA, METEOROLOGIA E HIDROLOGIA (INSIVUMEH)
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DIRECCION GENERAL
OF 268 -2011
DIR-2011

Guatemala,
03 de Mayo de 2011

A QUIEN INTERESE:

Atentamente me dirijo a ustedes, para autorizar al Señor Jesse Silverman de reproducir figuras de nuestro sitio Web de esta Institución para incluir en su tesis, ya que el estuvo como voluntario del Cuerpo de Paz en Tectitán Huehuetenago en nuestro País y realizó una tesis sobre los efectos del huracán Stan en la región de Tectitán.

Sin otro particular me suscribo de usted, como su atento y seguro servidor.




EDDY HARDIE SANCHEZ BENETT
DIRECTOR GENERAL



MINISTERIO DE COMUNICACIONES,
INFRAESTRUCTURA Y VIVIENDA

