

## ABSTRACT

### Vulnerability, Perceptions of Stress, and Coping with Natural Disasters: The Case of Hurricane Iris in Belize

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As climate change affects global weather patterns, coastal communities experience more high-intensity storms. Social and economic conditions have created more vulnerability to these disasters in some households, exacerbating the damage. The village of Placencia in Belize was particularly affected by one such event, Hurricane Iris, in 2001. This study uses data from households in Placencia to examine the relationship between vulnerability to coastal storms, feelings of stress, and coping strategies. My objectives are (1) to identify those households that are vulnerable, (2) to determine stress scores for each household, and (3) to examine the influence of stress on the coping strategies (used in response to Hurricane Iris) of vulnerable households. This study concluded that households with low levels of neighborhood cohesion did not use social interaction to cope with disaster. Additionally, highly-stressed households did not use monetary means of coping with the aftermath of the storm.

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VULNERABILITY, PERCEPTIONS OF STRESS, AND COPING WITH NATURAL  
DISASTERS: THE CASE OF HURRICANE IRIS IN BELIZE

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## CHAPTER ONE

### Introduction

The increasing prevalence of natural disasters has recently been of interest to the media, the general public, and scientists. Disasters such as hurricanes, tsunamis, and earthquakes have made headlines, not only for the loss of human life and damage to property they cause, but also for the long-term recovery process involved for victims, communities, and ecological systems. As of 1989, approximately 2 million residents in the United States alone were affected by natural disasters annually (Solomon, 1989, as cited in Benight, 1999). In 1989, two weather events exceeded \$1 billion each in damage. The number of ‘billion dollar weather disasters’ in the United States has steadily increased since then, with eight occurring in 1998, nine in 2008, and a record twelve events in 2011 (National Oceanic and Atmospheric Administration, 2011).

As global climate change affects weather patterns across the globe, coastal communities are experiencing more frequent high intensity storms. The number of lives endangered and people affected on a regular basis has increased over recent years. Compounding this dilemma, social conditions have contributed to increasing vulnerability to such disasters in some groups and individuals, exacerbating physical, financial, and emotional damage for many households.

Those who are more resilient to severe weather events are able to recover and move forward with their lives. More vulnerable households and communities, however, oftentimes do not have the means to effectively respond and are negatively affected for a comparatively extended period of time, often exhibiting psychological symptoms long

after the event itself (Norris et al., 1999). Today, social scientists are working to understand the complex factors that contribute to resilience or vulnerability so that efforts can be made to promote the resilience of the world's vulnerable populations, particularly to climate events.

This research is part of a broader study funded by a grant from the National Oceanic and Atmospheric Administration. The purpose of the broader study is to examine the vulnerability and resilience of households to climate change events. Within the broader study, this thesis focuses on the effects of perceived stress and neighborhood cohesion on the coping mechanisms of vulnerable and secure households.

The goal of this thesis is to examine relationships between vulnerability, perceptions of stress, and responses to natural disasters in a coastal community in Belize. My objectives are (1) to identify those households that are vulnerable, (2) to determine stress scores for each household, and (3) to examine the influence of stress on the coping strategies (used in response to Hurricane Iris) of vulnerable households.

The importance of this research, both the broader study and this thesis project, is in its potential to better understand the factors that contribute to vulnerability of households to natural disasters and how these households may respond differently to natural disasters than secure households. This thesis provides data on the relationships among perceived stress, neighborhood cohesion, vulnerability, and coping mechanisms. The resulting conclusions may be useful in creating plans to reduce vulnerability of households to disasters or improve stress levels and coping mechanisms of vulnerable households as they cope with specific disaster-related events.

The following chapter discusses the concepts of resilience and vulnerability to natural disasters, access to resources, factors of vulnerability, and stress and natural disasters. Chapter Three provides details about the study methodology. Chapter Four presents and analyzes the data, and in Chapter Five, a set of conclusions and recommendations are offered.

## CHAPTER TWO

### Literature Review

#### *Resilience to Natural Disasters*

The concept of resilience was first used in reference to ecosystem functions. In 1973, Holling defined resilience as “a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist” (p. 17). While other authors limited resilience to a single state of equilibrium, Holling proposed that multiple ‘domains of attraction’ exist, each with its own equilibrium. His observation was that a system would tend to stay centered around one point until one or more variables were pushed past the limits of that domain, at which time the system would shift to a new set of variables. The example given by Holling was the overharvesting of fish in the Great Lakes. Even when the fishing was discontinued, the abundance of fish populations remained low rather than returning to previous higher levels. This case clearly demonstrates the presence of domains of attraction; if only one point of equilibrium existed, the population of fish would have risen to previous levels once the overfishing ceased.

Holling lists two measures of resilience of ecosystems: (1) the amount that any variable can be changed before the system moves to a new ‘domain of attraction’, and (2) how far the system can be pushed before it no longer functions properly (1973). These measures express two facets of resilience: a system’s ability to resist being altered, and its ability to resist extinction.

More recently, resilience has been explored by social scientists to describe functions of social systems. Adger defines social resilience as “the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change” (2000, p. 347). A resilient community is one that has the ability to resist or recover quickly from disturbances, such as natural disasters, political upheavals, or any other event that is capable of causing instability in a society. The concepts of social and ecological resilience are similar. In both cases, resilience implies that the system can absorb shocks and recover quickly from them. The idea is not necessarily that the system will be the same after the shock, but it will continue to function rather than collapsing, in a similar or a different form.

Although the usage of the term in both systems is similar, as Adger points out, one cannot simply transfer the concept of ecological resilience to social systems without considering the differences in behavior and structure that exist between the two types of systems (2000). For example, institutions such as governments or social organizations that are present in social systems are not a factor in ecological systems. Additionally, society is itself directly dependent on ecosystems, as is apparent in the dependence of the economy on natural resources; therefore, ecosystems are part of the social system rather than a separate entity (Adger, 2000).

Because of society’s dependence on ecosystems for resources and the ability of social systems to affect the resilience of ecosystems, the two are often considered collectively as socio-ecological systems. A society’s ability to recover from a natural disaster or another type of disturbance is linked to the resilience of the ecological system on which it depends (Adger, 2000). In turn, human societies affect ecosystems. For

instance, a forest provides homes for many species of plants and animals. When humans deforest a significant portion of this habitat, many species lose food sources as well as their natural living environment. As these species either migrate to new territory or die, other species that were dependent on them are in turn affected, resulting in a cascade effect. The ecosystem can no longer function as it was without the trees, which are a keystone resource, essential to the survival of the ecological system. However, the effects of deforestation do not end there. The natural resources provided to society by the ecosystem are no longer available to the community. These resources include not only the trees, but other products and resources that existed within the forest. Additionally, without the tree roots to secure the soil, the next hard rain could possibly cause a mudslide, severely damaging the community. In effect, the community's actions have not only harmed the ecological system, but they have also threatened their own social system because the two are integrated and co-dependent.

Socio-ecological resilience refers to the resilience of the connected systems as a whole. If there is a loss of resilience in either the social system or the ecosystem, it will affect the resilience of the socio-ecological system (Adger, 1999). For instance, during a civil war, political instability causes society to cease to function normally. People may be unable to obtain food and other necessities in the way they typically would, causing them to unsustainably use their natural surroundings to gain the resources they need. This practice reduces the resilience of the ecosystem until it is unable to support such activities any longer, resulting in the community losing its source of food, which can cause the collapse of the community itself.

## *Vulnerability to Natural Disasters*

One of the major themes in the literature regarding resilience is the discussion of vulnerability. Although an individual or community can be vulnerable to various events, this thesis will focus on vulnerability of coastal communities to natural disasters.

Vulnerability as it relates to natural disasters has been defined by various authors. I use the definition given by Wisner et al.: “the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural disaster” (2004, p 11).

Vulnerability is often viewed as the opposite of resilience although they are not quite antonymous. It is important to note that vulnerability describes a relationship between an individual, group, or community and a specific event. For instance, a coastal community might be vulnerable to a hurricane while remaining relatively secure from a volcano eruption due to its distance from an active volcano. Disasters are a combination of an event and vulnerability to that event (Collier et al., 2009; Wisner et al., 2004). It is the disaster that reveals the vulnerability of the community to that event. A natural disaster cannot occur without the physical event itself, but by the same token, if no one is injured and no property is damaged, the event will not be seen as a disaster. Therefore, an event without a human effect does not qualify as a disaster.

History plays a role in vulnerability in both the lives of individuals and in the current state of a population (Wisner et al., 2004). The past experiences of an individual or household can affect current savings, occupation, and relationships. On a broader level, a history of war, economic depression, or governmental oppression can affect the current status and policies of a nation, which in turn affect the vulnerability of its citizens.

It must be mentioned that many times natural disasters are not single events in the lives of individuals or a community (Wisner et al., 2004). In some instances, a natural disaster is one event in a sequence of occurrences that have negative impacts on an individual or community. Vulnerability and natural disasters often form a positive feedback cycle, in which the two are mutually reinforcing. Individuals who are vulnerable initially and are catastrophically affected by a natural disaster may be incapable of recovering from the event, leaving them even more vulnerable to the next disaster or life event (Norris et al., 1999).

#### *Access to Resources*

The Access Model proposed by Wisner et al. describes the way in which access to resources directly affects a household's vulnerability to disasters (2004). While there are root causes for vulnerability that date back to centuries before a given event, the immediate cause of a household's inability to recover from a disaster is its lack of means to respond adequately at that time and place. The ability of a household or community to obtain the various resources that are necessary to survive is crucial to its ability to resist being devastated by a disaster. In this thesis, these resources will be categorized into five groups, although some may overlap: financial, material, mental, social, and political.

Access to financial resources is significant in determining vulnerability. Wealth in itself does not necessarily mean security for individuals, but lack of wealth tends to indicate vulnerability (Adger, 1999). Adger explains this is the case because those living in poverty tend to live in "marginal" and hazardous places (1999). They are more exposed to hazards and have a longer distance to travel in order to receive aid after a disaster. As Wisner et al. reveal, both rich and poor people might live in an area that is at

risk of landslide. The rich people are living on top of the cliff by choice, usually because the cliff provides a view, but the poor people forced to live at the foot of the cliff may not be able to afford to live in a safer environment (2004). Financial status also makes a difference after the occurrence of a natural disaster. While the wealthy tend to lose more in absolute terms, they are usually able to rebuild and replace what was lost and secure credit easily, whereas the poor have lost everything, sometimes even their livelihood, with little or no means to replace it (Wisner et al., 2004).

Access to material resources, such as food, water, shelter, and clothing, is essential for human life. These are the most basic physical needs. While financial resources play a part in determining access to material resources, access to one does not necessarily mean access to the other (Adger, 1999). An individual can be wealthy, but if the material resources the individual needs for survival are not available purchase, the person's money will be useless for that purpose. On the other hand, a poor person might have access to food or clothing through the generosity of an acquaintance or organization, in which case the individual's lack of money does not translate to lack of access to resources.

Access to mental resources refers to the mental or emotional strength and coping methods used in the wake of a natural disaster, as well as the skills and knowledge a person has that allow him/her to secure a job and complete necessary tasks (Wisner et al., 2004). Mental strength can help a person prepare for and cope with a disaster. Having positive thought patterns and the will to keep going after losing a loved one, possessions, or a livelihood are important in promoting recovery. Possessing skills and knowledge that are valuable in the workplace are also helpful in securing a new job if a natural

disaster causes an individual to lose his/her original position. Having skills and knowledge tends to increase a person's confidence in him or herself, which increases his/her chances of actively attempting to recover from an event rather than losing hope and surrendering.

Access to social resources is also a factor in determining vulnerability. The number and nature of relationships that a person has and his/her membership and level of involvement in groups or his/her community promotes feelings of well-being and self-confidence (Lee & Robbins, 1995, as cited in Lee et al., 2002). Also, the more people with whom an individual has a good relationship, the higher the likelihood of someone helping them post-disaster. Involvement in groups that have the capability of offering assistance is also helpful for individuals who are affected by a natural disaster. Not only do these kinds of relationships bring assistance after an event, they also help an individual feel secure before and after a disaster strikes. They do not have to worry about what they would do in such a situation because they feel like they have friends who would offer assistance, and they are not alone.

Access to political resources means having the ability to be heard by policymakers and to bring attention to a problem, incite change in the system, and/or obtain governmental assistance (Wisner et al., 2004). In a country run by a government that does not listen to its people, it is not possible for citizens to obtain what could be very important assistance, and the government may not be willing to take preventative measures against damage or make the necessary changes to assist the community in its recovery.

### *Factors of Vulnerability*

There are various aspects of a person and of the environment in which an individual or community is located that affect that person's access to the resources discussed. Herein, the term "factor" defines an aspect of a person's self, situation, or location that should be taken into consideration when determining vulnerability. The factors affecting access to resources include: location, financial status, occupation, psychological state, political structure, economy, societal worldview, immigration status, ethnicity, class, gender, age, disability and health status, time, and history (Wisner et al., 2004). Factors such as these determine access to the various types of resources and ultimately influence vulnerability.

Aspects of location, such as geography and altitude, are important in determining which natural disasters are likely to occur in a specific community. If a town is located at a high altitude where flooding from coastal storms is unlikely, the community is obviously not as vulnerable to a flood as it would be if it were located directly on the shore of the ocean at a low altitude. The physical location of a population also determines which natural resources are available to the community.

Occupation is a factor for several reasons. First of all, occupation affects the income of the individual and the household. Secondly, the permanence or seasonality of the job and the dependence of the job on certain resources affects the stability of the career. For instance, if a person's main occupation is unavailable for one or more seasons, that person will not be receiving income for part of the year unless they have a second occupation. In relation to coastal tourism, a person might only have a job during the high tourist season. Occupational reliance on natural resources is also an important

factor because if the natural disaster causes the necessary resource to become depleted or unavailable, the individual will lose the ability to earn income from that job either temporarily or permanently (Adger, 1999). For example, after the Deepwater Horizon oil spill in 2010, the fishing industry in the Gulf of Mexico was negatively impacted and many people in the industry lost their jobs (Congressional Research Service, 2011).

If the activities of coastal tourism degrade the environment on which they depend, the cumulative effects will eventually cause loss of income unless people ‘adapt’. At the household level, if all members of a family rely on similar occupations or the same general source of income, there is the possibility all of them might lose their jobs at the same time if their profession is negatively affected by a disaster. Low diversity of income sources is indicative of vulnerability, so the more income sources and the more diverse those sources are, the less vulnerable an individual or household will be in this regard (Adger, 1999).

Political structures in a community can also be important in creating plans and reinforcing structures to prepare for a disaster, warning the community when a disaster is approaching and assisting citizens and businesses in recovery (Adger, 1999).

Effectiveness and efficiency in the implementation of policies and practices is affected by governmental structure.

The economy plays a role, not only in the prosperity of a community, but also in the sources of income and the nature of resource use on which the economy is based. For many years, people have believed that it is necessary for the economy to continuously grow, and growth has become the main objective. Wisner et al. argue that “[academic] support for the critique of blind belief in economic growth as the predominant goal of

development has been building up since the [United Nations Development Programme] began to publish its *Human Development Report* (HDR) in 1990” (2004, p. 25). This publication considered measures of health, equity, and education, rather than solely economic growth. This new scale forces countries to consider the welfare of all of their people. Often, methods of increasing economic growth in the present can do so without consideration of other factors. For instance, a company that cuts trees for use in manufacturing paper, furniture, and other consumer products is contributing to the economy. However, if the cutting is not done sustainably, enough trees will not grow to replace those that have been cut, and the company will one day have no remaining trees to cut and will either go out of business, resulting in layoffs and unemployment, or will have to change its means of making money. Another consideration is the effect deforestation has on the environment. As mentioned previously, the loss of trees has a major effect on the ecosystem itself and on the nearby community’s access to natural resources and vulnerability to mudslides, for example. The point is that decisions are often made for economic reasons, without considering other consequences, or sometimes without fully knowing what those consequences are.

Societal worldview has an impact on vulnerability in various ways. The common sentiment that natural resources exist to be used and should not be conserved has a great influence on the use of natural resources and the management of ecosystems. The current Western view is that standard of living means more material goods and that standard of living should continue to rise, which has led us generally to a society of wasteful consumption (Wisner et al., 2004). The combination of these and other common beliefs has led to a rapid decrease in resources and degradation of land, leaving the environment,

as well as human populations, more vulnerable to weather events. The tendency for many people, including government officials, to disregard the existence of global warming and greenhouse gases, despite the scientific evidence for both, has resulted in apathy and inaction on the matter (Wisner et al., 2004). This increases vulnerability in two ways. The first is that ignoring the issue means releasing the same or increasing amounts of greenhouse gases and further contributing to the increase in temperature and environmental pollution. The second is that the implication of denying the existence of global warming is a lack of preparation for events that might result from the change.

Immigration status, ethnicity, class, and gender can lead to marginalization in a society, which can increase vulnerability (Wisner et al., 2004). Immigrants may not be able to speak the language of the natives or might be looked down upon because they are ‘outsiders’, making it difficult for them to find a well-paying job or fit into a community. Likewise, ethnicity can be a factor if there is animosity toward certain minority groups. Class can be associated with occupation or income in many cases, but it can have other impacts as well. In some societies, people of higher classes do not associate with those in the lower tiers, and the lower classes do not receive as much government assistance or attention. Therefore, class can affect access to social and political resources as well as financial resources. Being the sole head of household is difficult because the individual is trying to support a family on one income, but being a single female who is the head of a household can be especially challenging. Females often earn less income than males and can be held in contempt for their independence in traditionally male-dominated societies, causing them to be marginalized. In general, minorities, or those who are

viewed as inferior, tend to be more vulnerable because they ultimately have less access to resources.

Youth or old age can affect vulnerability (Wisner et al., 2004). Children are dependent on an adult and often have no means of earning an income or supporting themselves. In the event of an emergency, they are reliant on an adult, not only for transportation and food, but for guidance and emotional support. Senior citizens, on the other hand, often have similar dilemmas. In many cases, they are no longer employed and are dependent on someone else to provide for them. Additionally, they are not as mobile as middle-aged adults.

Disability and health status can impact an individual's ability to earn an income (Wisner et al., 2004). It has an effect on the types of jobs an individual can hold. Additionally, a sizeable portion of the funds they do have often go to medical care and treatment indicative of their disability.

Time has an effect on vulnerability, as circumstances are constantly evolving throughout time (Wisner et al., 2004). An individual's or community's level of vulnerability does not remain constant; events can cause vulnerability to increase or decrease. Because of the variable nature of vulnerability, efforts can be made to strengthen a community or household in ways that will decrease vulnerability to multiple events.

### *Stress and Natural Disasters*

Stress is a normal part of everyday life although stress levels vary among individuals and across time. According to Lazarus, "Stress arises when individuals perceive that they cannot adequately cope with the demands being made on them or with

threats to their well-being” (1966). Thus, stress is associated with a feeling of being overwhelmed or threatened.

Before the 1960s, stress was measured solely using objective means, including life event scales, which quantify the number of stress-causing events (such as death of a family member), in a person’s life (Cohen et al., 1983). A more recent development has been the use of subjective measures of stress, based on an individual’s perception of his/her stress level (Cohen et al., 1983). While objective measures are easy to score and they avoid biases of personal sentiments, they do not take into account the interaction between an event and an individual or the feeling of being overwhelmed that is an essential component of stress (Cohen et al., 1983). In fact, Cohen et al. point out that subjective measures of stress are often better predictors of health outcomes than objective measures (1983), and Potter et al. observed that in older adult women, higher levels of memory complaints were positively correlated with perceived stress but had no correlation with life event measurements (2009).

There are many aspects of life that affect an individual’s level of stress, although some events that cause one person to feel stressed might not affect another individual as strongly. Stress is in the eye of the beholder, or rather in the head of the one experiencing an event. Therefore, stress is a combination of actual events and the mental response of the individual. The occurrence of the actual events can be measured objectively, but the response of the individual is a subjective measure.

For instance, a life event scale might ask whether an individual has lost a job, ended a relationship, or moved in the past year. Each affirmative answer would add a point to the individual’s stress score. While this is a good indicator of distinct traumatic

events, it does not take into consideration how the events might have affected the individual (Cohen et al., 1983). If the person who lost his/her job had another position immediately available, and he/she enjoys the new one more and earns more income, he/she might actually have reduced stress. Even when an event is a negative experience, the stress felt varies from one person to another. Each individual has different coping skills that they use to deal with stressful events (Kausar, 2010). Some of these skills work better than others and result in less perceived stress. Additionally, life event scores do not take into account the daily stressors that a person experiences. While daily events might not seem as important as life events, a large number of small events can accumulate to create great stress over time (Fernando et al., 2010). Once again, the size of the event is a matter of perspective, and something that seems small might have a significant impact on an individual.

There are a number of factors affecting each individual's stress level, including workload, health, status, financial situation, attitude, and social networks. Research indicates that increased social connectedness tends to reduce stress. This trend is evident in a study of college men and women, where respondents who had higher scores of social connectedness had lower perceived stress levels (Lee et al., 2002). As Lee and Robbins point out, individuals who do not feel connected with others lack a sense of belonging, feel lonely, and have low self-esteem (1995, as cited in Lee et al., 2002). It follows that having such a connection with other people causes an individual to feel like s/he fits in and to have more confidence.

Coping strategies are methods used by an individual to manage a stressor and address the emotions associated with it (Folkman & Lazarus, 1980, as cited in Kausar,

2010). Coping strategies are classified as task-oriented, emotion-oriented, or avoidance-oriented (Kausar, 2010). Task-oriented strategies are used to address the stressor itself and change the situation in order to reduce the amount of stress (Kausar, 2010). An example of this would be a person who is financially stressed getting a second job to increase his/her income. Emotion-oriented strategies are intended to address the emotional responses to a stressor and reduce the stress felt by the individual (Kausar, 2010). Exercising will not reduce a person's workload, but it might enable them to better deal with emotions associated with the pressure of work. Avoidance-oriented coping is characterized by denial, avoidance, or hopelessness (Lazarus & Folkman, 1984, as cited in Kausar, 2010). Unlike other coping strategies, avoidance-oriented coping is not proactive, and Billings and Moos have found that it is correlated with poorer adjustment (1981, as cited in Kausar, 2010). When people avoid their situation, they are not doing anything proactive to better their circumstances. It is logical that if a person refuses to acknowledge his/her situation, he/she is unable to adjust to it or relate to friends and family who acknowledge the reality of the situation.

In the context of natural disasters, people tend to think about stress as a result of experiencing or being affected by a natural disaster, and research confirms the psychological effects of such experiences. In a study that examined the contributions of pre-disaster, within-disaster, and post-disaster factors with psychological symptoms, Norris et al. found that all three factor types affected symptoms six months after the disaster but that two years later, symptoms were most affected by life events following the first six months after the disaster (1999). Two years after the incident, recovery was still not complete as psychological symptoms associated with the disaster persisted

(Norris et al., 1999). If another event were to happen at this time, individuals who had not recovered from the previous incident would be more vulnerable to the second disaster.

In a study conducted by La Greca et al., greater exposure to a disaster was positively correlated with an increase in major life events after the disaster (2010). Fernando et al. confirm that greater exposure to a disaster is positively correlated with daily stressors (2010). They also found that post-disaster daily stressors contribute to the relationship between exposure to a disaster and psychological outcomes. These results all indicate that not only can a disaster in itself cause psychological effects, but it can also cause further events to occur in an individual's life after the disaster, which can create even more stress.

Norris et al. contend that those who experienced loss or damage during the disaster will have a disrupted social life afterward due to grieving, rebuilding, or moving (1999). Additional stress can be placed on those whose homes are damaged or destroyed and must move in with friends or family; this can create new conflicts between people in the household, and it can be difficult to adjust to the new arrangement (Norris et al., 1999). Finally, Norris et al. believe that families who relocate away from the site of the disaster might recover more quickly because they are not reminded every day of the event and the destruction, while those who stay are dealing with their own recovery as well as that of the entire community (1999).

In conclusion, the concept of resilience has evolved from a purely ecological approach to encompass socio-ecological systems. Resilience reflects a community's ability to withstand damage from a disaster as well as its capacity to recover to its pre-

disaster state. Vulnerability refers to a community's relationship to a specific event. History affects a community's or household's vulnerability to a disaster, as does the level of access to a variety of resources. The occurrence of a natural disaster can heighten stress levels of those who are affected, which can in turn influence the coping mechanisms of the victims.

## CHAPTER THREE

### Study Methodology

#### *Introduction*

As mentioned previously, this thesis is part of a larger study entitled “From Vulnerability to Resilience: Helping People and Communities Cope with Crisis,” which was conducted in three coastal communities in Belize (San Pedro, Punta Gorda, and Placencia) during the years 2007 through 2009. The economies of these coastal communities are based mainly on fishing, shrimp farming, and tourism. The research focused on the development of a Resilience Index used to identify coping mechanisms that vulnerable households use to respond to climate-related events.

#### *Limitations*

As this study is limited to one community, the results might be specific to the context of Placencia. The larger study will include three communities; it will thus be possible to generalize the results to a broader area. Another factor that limits the ability to relate stress levels to the storm is the length of time between the storm and the administration of the survey. The questions regarding perceived stress inquire about feelings in the past month, whereas the storm had occurred several years prior to the study. Additionally, I used a proxy variable (percent of income spent on food) as an estimation of vulnerability rather than the thirty variables that are being used in the larger study. Finally, the preliminary analysis indicated weak, if any, correlations.

### *Research Site: Placencia*

Placencia is located in Stann Creek District in the southeastern region of Belize (see Figure 1). The community is situated at the end of a 27 km peninsula and is one of the oldest villages in Belize, existing before the arrival of the Europeans. For the last few centuries, Placencia has consisted of mainly Creole families who are descendents of Garifuna warriors, freed African slaves, and Scottish pirates. Recently, the number of North Americans, Garifunas, and Hispanics has increased. During the 20<sup>th</sup> century, Placencia was primarily a fishing village; however, the economy is currently transitioning toward tourism (Alexander, 2008). In 2001, Placencia received a direct hit from Hurricane Iris where over 90 percent of structures were destroyed, and much of the area was flooded.

The NOAA-funded study used participant observation, key informant interviews, and household surveys. Both qualitative and quantitative data were collected, the interpretation of which was highly dependent on the direct participation of informants. A random numbers table and maps drawn by researchers were used to randomly select households within each community.

### *Household Survey*

The data used in this thesis come largely from the Household Survey, which contained sections pertaining to household demographics, nutritional security, food security, environmental security, vulnerability to climate-related events, health security, perceptions of stress, education, economic security, and social networks. A pre-test was designed and administered based on ethnographic information and local context, and the survey was then revised to have a similar meaning in both the English and Spanish

languages. Households (n=50) were randomly chosen for participation, and the head of the household was interviewed. Respondents answered open- and closed-ended questions regarding climate-related events and community participation in responding to these crises. Additionally, they provided demographic information including marital status, age, gender, ethnicity, education level, occupation, and household composition. Respondents were also questioned about their membership in organizations and friendships within the community in order to gain an understanding about neighborhood cohesion and social connectedness.

Figure 1: Map of Belize with Study Site Highlighted



### *Specific Measurements*

This study focused on four main components of the larger study: perceived stress, neighborhood cohesion, vulnerability, and coping mechanisms. My objective was to determine whether stress levels or neighborhood cohesion levels affect the coping mechanisms utilized by households and whether stress levels and vulnerability are correlated.

#### *Stress Score*

A set of questions outlined by Cohen et al. was used to measure respondents' perceived stress levels (1983). These questions (see Table 1) asked respondents to judge how often in the past month they had experienced various feelings. The respondents replied to a Likert scale, which ranged from "never" to "very often." Each response was given a score from 1 to 5, with "1" indicating the least stress and "5" indicating the most. In the data analysis, these responses were summed to create a Stress Score. The higher the score, the more perceived stress a respondent had.

#### *Neighborhood Cohesion*

A second set of questions, derived from Buckner (1988), was used to measure neighborhood cohesion, or the sense of community felt by a respondent about his/her neighborhood. These questions (see Table 2) asked respondents to describe their relationships with neighbors as well as their feelings about their neighborhood. Responses were also given in the form of a Likert scale, which ranged from "strongly agree" to "strongly disagree". Each response was scored from 1 to 5, with "1" indicating low neighborhood cohesion and "5" indicating high neighborhood cohesion. The

individual scores were combined to create a neighborhood cohesion score. The greater the score, the more neighborhood cohesion that was felt by the respondent.

Table 1: Perceived Stress Measures

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In the last month, how often have you...

1. ...been upset because of something that happened unexpectedly?
2. ...felt nervous (and “stressed”)?
- \* 3. ...dealt successfully with day-to-day issues/problems?
- \* 4. ...felt confident about your ability to handle your personal problems?
- \* 5. ...felt that you were on top of things?
6. ...felt angry because of things that happened that were outside of your control?
7. ...found yourself thinking about things that you have to accomplish?
8. ...felt difficulties were piling up so high you could not overcome them?

---

Adapted from Cohen et al., 1983

Respondents were given the following options: never, almost never, sometimes, fairly often, very often. The responses were scored from 1 to 5.

\*Typically, “never” received a score of 1 and “very often” received a score of 5. Questions which were reverse scored, with “never” receiving a 5 and “very often” receiving a 1, are marked.

### *Vulnerability*

While the larger study uses approximately 30 variables to determine levels of vulnerability, I used a proxy variable to estimate vulnerability to natural disasters. As percentage of income spent on food can be an indicator of household vulnerability (Alexander, 2008; Drinkwater & McEwan, 1992), this variable was used to approximate each household’s level of vulnerability. The higher the percentage of income spent on food, the lower the amount available to the family for other expenses and for saving. Thus, the higher the percentage of income spent on food, the more vulnerable a household is, and in particular, in the event of a disaster.

Table 2: Neighborhood Cohesion Measures

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Indicate how you feel about each of the following statements:

1. I feel like I am part of this neighborhood/community.
2. I visit with my neighbors in their homes.
3. The friendships and associations I have with other people in this neighborhood mean a lot to me.
4. If the people in the neighborhood were planning something, I'd think of it as something "we" were doing, rather than that "they" were doing.
5. If I needed advice about something I could go to someone in my neighborhood.
6. I regularly stop and talk with people in my neighborhood.
7. I think I agree with most people in my neighborhood about what is important in life.
8. I feel like I have a voice in the neighborhood (community) decisions.
9. I believe my neighbors would help me in an emergency.
10. I would help my neighbors in an emergency.
11. I borrow things and exchange favors with my neighbors.
12. I would be willing to work together on something (project or program) to improve my neighborhood/community.
13. If I can, I plan to remain a resident of this neighborhood for a number of years.
- \* 14. I rarely have neighbors over to my house to visit.
- \* 15. Given the opportunity, I would like to move out of this neighborhood.

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Adapted from Buckner, 1988

Respondents were given the following options: strongly agree, agree, neutral, disagree, strongly disagree. The responses were scored from 1 to 5.

\*Typically, "strongly disagree" received a score of 1 and "strongly agree" received a score of 5. Questions which were reverse scored, with "strongly disagree" receiving a score of 5 and "strongly agree" receiving a score of 1, are marked.

### *Coping Mechanisms*

Respondents were asked if they had experienced any problems resulting from Hurricane Iris. If they responded that they had, they were asked what they did to deal with these problems. As this question was open-ended, there was a wide range of responses, and many people gave more than one response. For this study, I used the first response, as respondents typically express what they feel was their primary response first (Bernard, 2011). There were 19 different responses. I sorted these responses into the following groupings: helped others; received help; worked to make money; used savings to address their needs; rebuilt their residence or made repairs; bought new belongings; borrowed money; and other responses. Some of these categories might overlap, but I sorted the responses based on the main intent of the respondent. For instance, someone could have said that they used savings to rebuild their home, and I would have put it in the ‘rebuild’ category because that was the ultimate purpose.

### *Data Analysis*

The open-ended responses recorded for coping mechanism measures were coded and collapsed into major groupings. I used SAS to analyze each variable relative to the others in a cross-tabular frequency table, which compared the answers given for one variable to the response from the other variable. Additionally, basic descriptive statistics were produced for each variable, including stress and neighborhood cohesion scores, each stress and neighborhood cohesion measure, coping mechanisms, and household vulnerability. The results are presented in Chapter Four.

## CHAPTER FOUR

### Data Presentation and Analysis

While my thesis focuses on four composite variables, it is important to consider these data in the context of basic demographic information. As stated previously, Placencia is one of Belize's oldest villages and is located in Stann Creek District, which contains approximately 11% of Belize's population and 8.2% of the country's poor. Roughly 35% of the district's population is considered poor, and 5.6% are indigent (Government of Belize, 2004).

Immediately after Hurricane Iris struck, approximately one-third of households in Placencia reported economic vulnerability related to financial difficulties, diminished savings, and reduced income as a result of the hurricane. Businesses were destroyed; employees were laid-off; and the income from the 2002 high tourist season was significantly diminished. Approximately 25% of households could not afford basic expenses, and more than 50% needed additional credit to cover repairs and construction costs (Alexander, 2008). Most occupations held by residents of Placencia were associated with tourism and approximately three-fourths of businesses owned by residents were tourism-related businesses (Alexander, 2008). These statistics contribute to the image of the financial turmoil that occurred after the hurricane.

The majority of the fifty respondents in my subset were married (38%) or in a common law relationship (30%). Most of the respondents (62%) were Creole; other ethnic groups that were represented were mainly of Hispanic and European descent. The

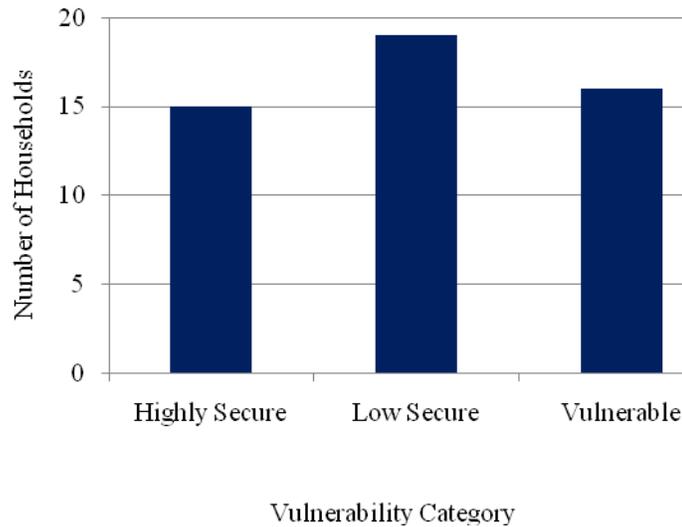
religious denominations that were represented most prominently were Anglican (34%), no religion (22%), and Catholic (20%).

Seventy-four percent of the primary heads of household were born in the community, and sixty-four percent were men. The mean age of the primary heads of household was 45.8 years, and the mean education level was 10.98 years. The mean household size was 3.1 people. Thirty-two percent of households were nuclear in structure, with two parents and their children. Ten percent of households contained multiple adults with no dependents, and another 10% of households consisted of a single male with no dependents. There were a variety of other arrangements.

#### *Vulnerability*

Three categories of vulnerability were created, based on the percentage of income spent on food: highly secure (0%-20%), low level secure (21%-49%), and vulnerable (50%-100%). This scoring is based on previous studies (Alexander & Gibson, in press) as well as groupings within the data set and qualitative information gathered on food access, food availability, and food prices relative to income during the course of the study. Figure 1 shows the number of households in each category. Thirty-two percent of households in the Placencia sample were 'vulnerable'.

Figure 1: Number of Households in Each Vulnerability Category



### *Stress Measures*

With eight questions in the ‘Perceptions of Stress’ section (refer to Table 1), each rated between one and five, a respondent could have a Stress Score ranging from eight to forty. The Stress Scores in this data set ranged from ten to thirty-three. The mean was 20.26, and the standard deviation was 5.71. The median was 20. Based on qualitative information provided by community members regarding how people “think about stress” in this region, the Stress Scores were separated into three groups representing low-level stress (10-18), mid-level stress (19-23), and high-level stress (24-33). Figure 2 shows the frequency of households in each stress group.

As shown by the red and orange bars in Figure 3, most of the ‘Perceptions of Stress’ questions had a majority of responses indicating lower stress. The one question to which a majority of people indicated the higher level stress response was the one that inquired as to how often respondents ‘think about tasks they have to accomplish’. Seventy percent of respondents indicated the highest level stress response on this

question. In contrast, most people felt confident handling their personal and day-to-day problems, with 64% and 54%, respectively, indicating the lowest level stress response on these questions.

Figure 2: Households in Each Stress Category

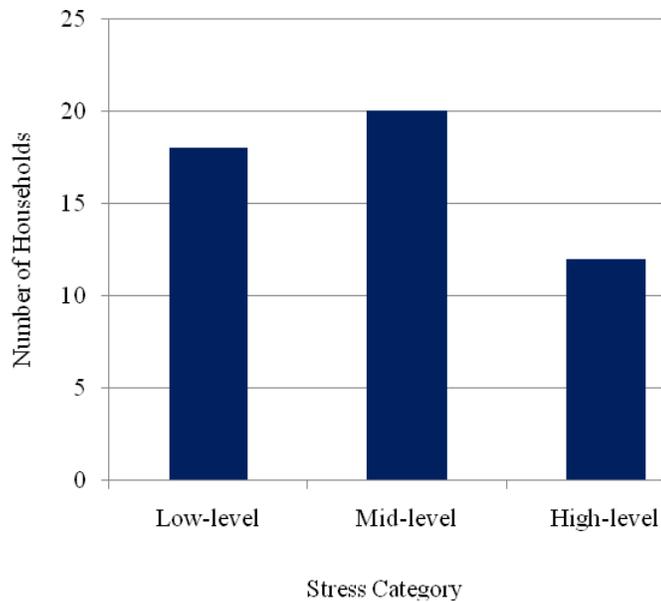
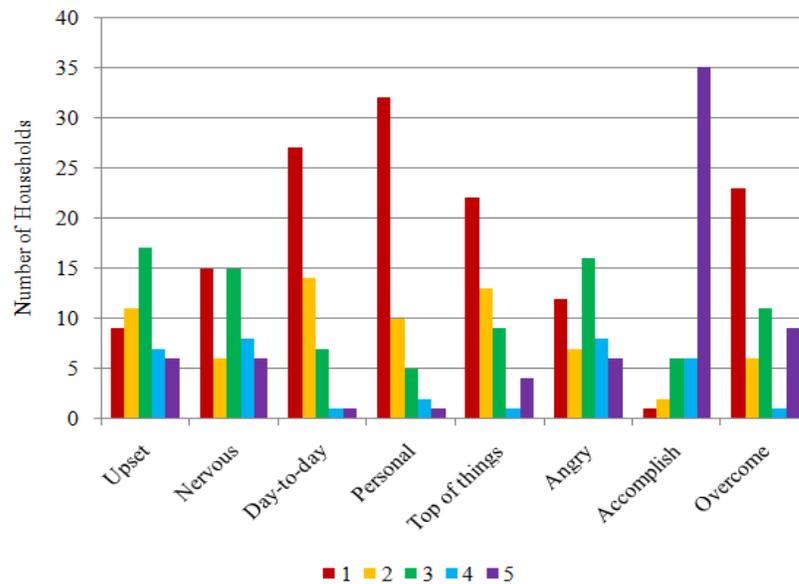


Figure 3: Frequency of Responses to Perceived Stress Measures



\*See Table 1 for complete questions.

### *Neighborhood Cohesion Measures*

There were fifteen questions in the ‘Neighborhood Cohesion’ section (refer to Table 2), each rated between one and five. The possible range for the Neighborhood Cohesion Score was between fifteen and seventy-five. The range for this data set was between thirty-one and seventy-four. The mean was 55.16, and the standard deviation was 10.06. The median was 55.5. Neighborhood Cohesion Scores were divided into three categories representing low-level cohesion (31-49), mid-level cohesion (50-64), and high-level cohesion (65-74). Figure 4 shows the number of households in each category, and Figure 5 displays the comparison of neighborhood cohesion and perceived stress. Respondents report getting along with their neighbors; there is an overwhelming response that they would help their neighbors and believe their neighbors would help them in an emergency. Respondents also feel that their neighborhood and friendships with neighbors are important to them, but the data indicate that the relationships are more casual than close. Most people indicated that they regularly talk with neighbors, but a smaller number of people claimed to visit with neighbors in their homes or invite neighbors into their own.

Figure 4: Number of Households in Each Neighborhood Cohesion Category

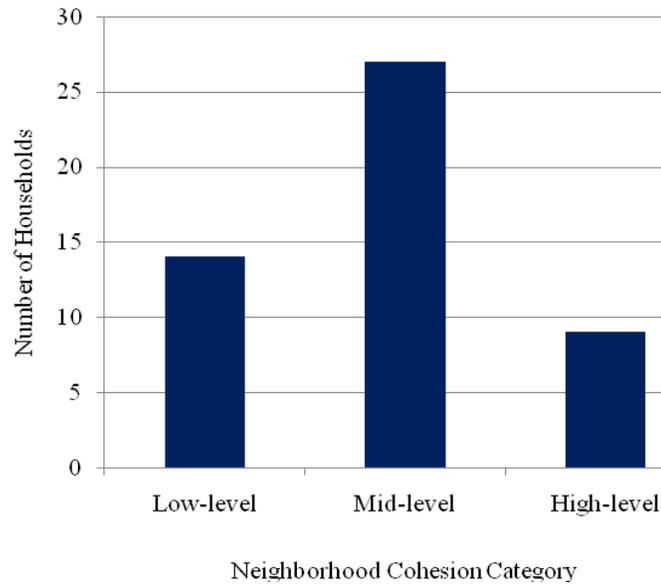
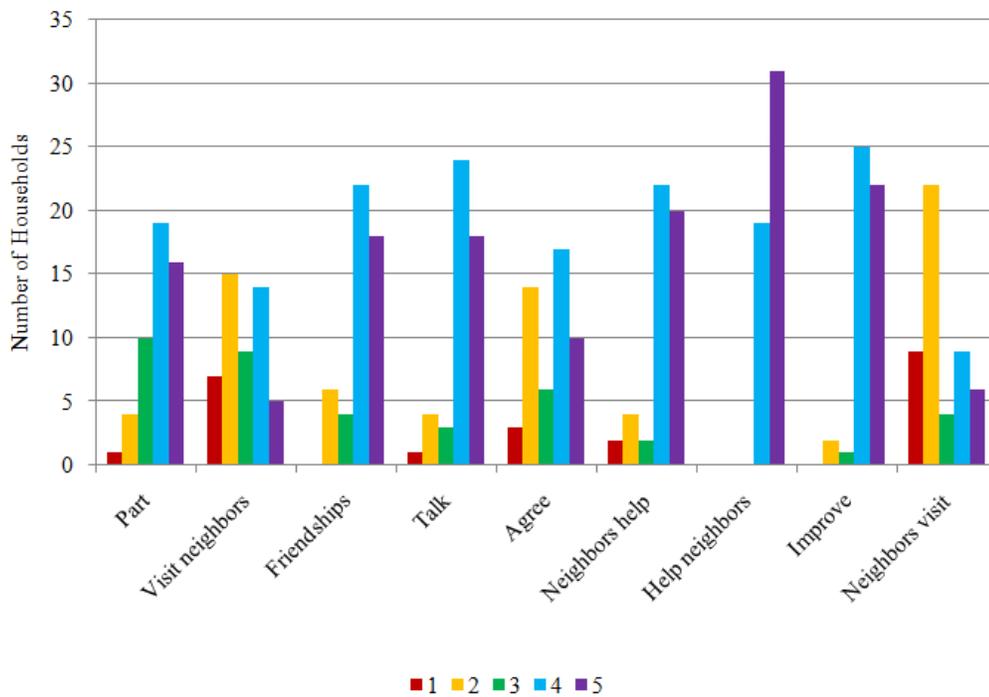


Figure 5: Frequency of Responses to Neighborhood Cohesion Measures



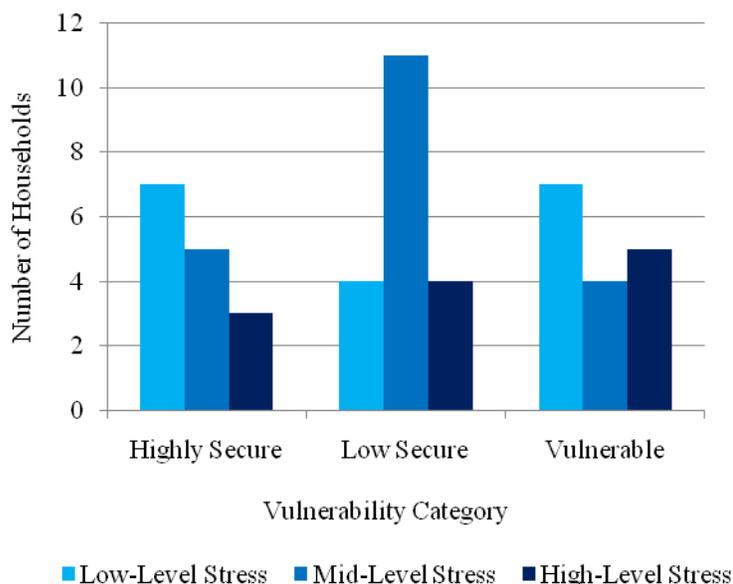
\*See Table 2 for complete questions.

## Discussion

### *Perceived Stress and Vulnerability*

When the vulnerability of the households is compared with their stress levels, one can see that the incidence of high-level stress increases with level of vulnerability, as shown by the dark blue bars in Figure 6. The proportion of households in the high-level stress category also increases with increasing vulnerability. Twenty percent of the highly secure households are in the high-level stress category, whereas this number increases to 21% of low secure households and 31% of the vulnerable households. This trend indicates there is a positive relationship between stress and vulnerability. It is unclear, however, whether one causes the other or they are mutually reinforcing.

Figure 6: Stress Levels Compared with Vulnerability

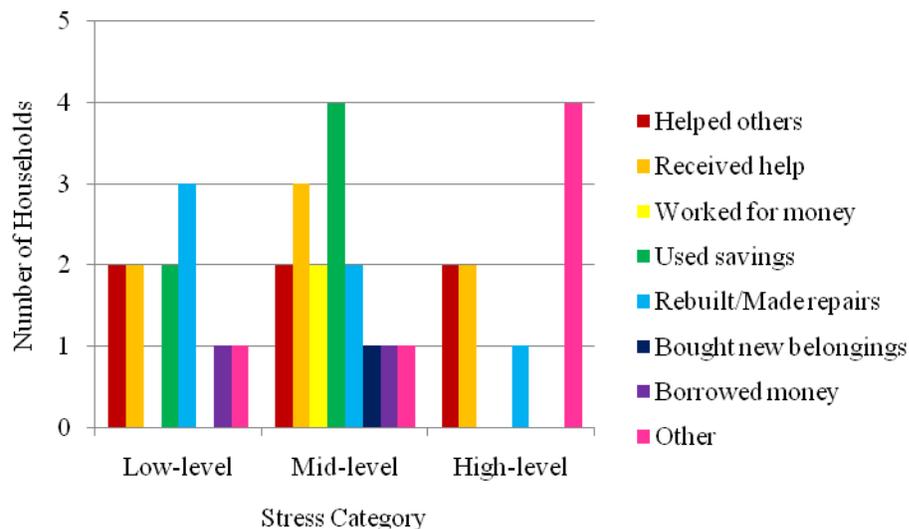


### *Perceived Stress and Coping Mechanisms*

Figure 7 shows the comparison of post-hurricane coping mechanisms and perceived stress. The high-level stress respondents' primary coping mechanisms were to help others, receive help, rebuild or make repairs. Their responses did not include using money or other financial-based activities. The reason for their lack of monetary coping mechanisms could be because those who are more stressed do not have money with which to respond, which may be a cause of their stress. They also might not have employment or a means of borrowing money, which can create stress because they feel they have no resources to begin the recovery process.

The mid-level stress group included responses from the entire range of coping categories, whereas in the low-level stress group, none of the respondents focused on working for money or purchasing new belongings. Instead, their responses indicated that they were capable of coping by using their own means or securing resources from friends or through credit.

Figure 7: Coping Mechanisms by Stress Category

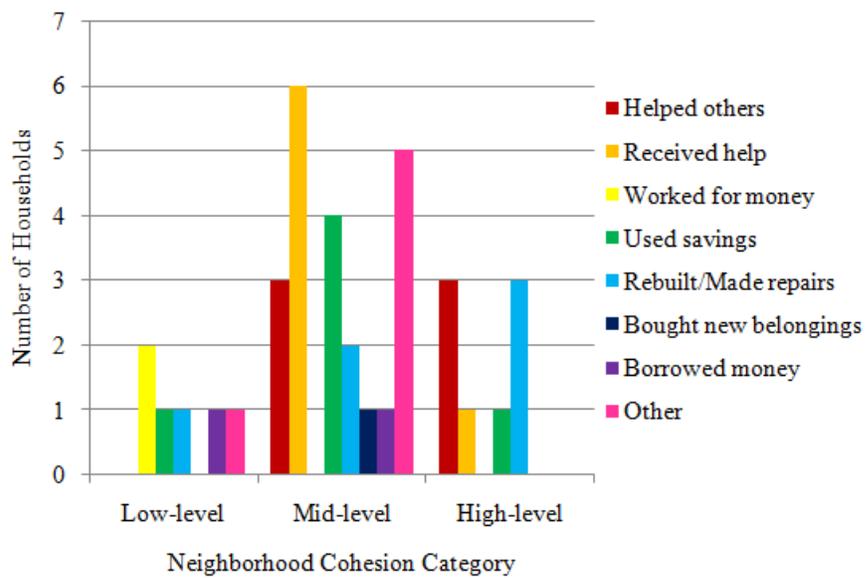


### *Neighborhood Cohesion and Coping Mechanisms*

Figure 8 shows the comparison of neighborhood cohesion and coping mechanisms. Whereas the low-level cohesion respondents did not tend to interact with others as a means to cope, through helping others or receiving help, households in the other two cohesion categories engaged in these activities. There are several possible reasons that low-level cohesion respondents did not offer or receive as much assistance. Perhaps they did not help their neighbors because they did not have a feeling of unity with members of their neighborhood. Conversely, because this survey was administered several years after the disaster, the low levels of cohesion could be due to the household not offering assistance after the storm. The reason for low-level cohesion households not receiving assistance also might be because of their lack of relationship with neighbors. Their situation could also be explained as a self-fulfilling prophecy, in which they expected that they would not receive help and behaved in a manner that deterred others who might have offered assistance. Alternatively, their feelings of low cohesion could be a result of not receiving aid from their neighbors post-disaster.

Most households that said they received help after the storm fell in the mid-level cohesion group. This is interesting because I would have expected the group with the highest level of cohesion to receive the most help. This trend could be due to the sample size, or it is possible that those households with the highest levels of cohesion were not in as much need of help as the mid-level cohesion households.

Figure 8: Coping Mechanisms by Neighborhood Cohesion Category



## CHAPTER FIVE

### Conclusions and Recommendations

#### *Conclusions*

The data suggest that both stress levels and levels of neighborhood cohesion affect coping mechanisms in response to a disaster. Households with high stress levels have fewer monetary responses, and those with low neighborhood cohesion levels have fewer socially-oriented coping mechanisms. These households are limited in their available methods of coping, which could make them more vulnerable should another disaster occur. The highly stressed households have low access to financial resources, and the households with low cohesion levels have low access to social resources. These trends mean that they do not have a full range of resources from which to draw in the event of a disaster.

The literature would suggest that stress does influence the nature of coping mechanisms (Kausar, 2010). My question is whether coping differs by level of vulnerability. If this is the case, decreasing the vulnerability of households may bring about the use of more effective coping mechanisms or vice versa.

#### *Recommendations*

In light of the findings of this study, I would suggest that development practitioners focus on increasing the cohesion of neighborhoods in coastal communities and attempting to integrate households that do not have strong relationships with neighbors. Creating connections with community members will help those who currently

have low neighborhood cohesion to increase their social resources, which will increase their chances of being helped in the event of a future disaster.

Wisner et al. (2004) make several suggestions with regard to reducing the vulnerability of populations to natural disasters. Their first recommendation is to identify the vulnerable households within communities and determine their access to resources. Their level of access can then be monitored over time to determine if they are gaining or losing access to resources. As efforts to reduce vulnerability are made, researchers can gauge the results based on whether access to resources increases in the previously vulnerable populations (Wisner et al., 2004).

Wisner et al. also recommend that efforts be made to “reduce risks by addressing root causes, dynamic pressures and unsafe conditions” (2004, p. 342). If vulnerability is rooted in history, society, economic systems, and government institutions, it is logical that some of these underlying causes will need to be addressed. If they are not adjusted, we will only be addressing the symptoms instead of the ‘disease’, and vulnerability will only continue to persist. It is my opinion that addressing these root causes will be the most effective but also one of the most difficult methods of decreasing community vulnerability. For instance, if increasing the resilience of women or minority groups means confronting and altering traditional political or social structures, these efforts will most likely initially be met with resistance. Such changes in deeply-rooted societal beliefs will probably be hard-fought, but once these groups are removed from marginalization, they will experience a long term increase in resilience to disasters.

The current Western economic system emphasizes energy-intensive methods of production, high levels of consumption, and urbanization. This type of development

promotes continuous economic growth, which is generally seen as a benefit to society. What is not considered, however, is the negative effect on resilience associated with these processes. Development experts and the general public need to be made aware that what is needed is sustainable development, in which the environment and human society are not made more vulnerable to weather events. Government officials should promote more potable water, sanitation, and energy initiatives to reduce the vulnerability of those currently lacking these resources. Encouraging sustainable development that benefits all members of communities is important in reducing the vulnerability of the least resilient sub-populations (Wisner et al., 2004). Communities should avoid using methods of development that deplete and degrade natural resources, which are a source of livelihoods and which provide the foundation for environmental and social stability. Instead, developers should work toward implementing projects that ensure the long-term viability of a community's natural environment. An emphasis on continuous economic growth will ultimately result in exhaustion of the resources on which the economy is based, at which point the economy will collapse. At the same time, the environment will be degraded, leaving the community vulnerable to natural disasters. A focus on sustainable development, on the other hand, will ensure that natural resources are available for use by future generations and that the environment is a stable foundation for socioecological resilience.

Wisner et al. (2004) also suggest improving the livelihoods of vulnerable individuals. Livelihoods that increase vulnerability have low income, are not resilient to shocks, and put employees in dangerous situations at the workplace. In order to become less vulnerable to natural disasters, people need to have access to jobs with enough

income to provide for their families. They need an occupation that will recover quickly from a shock and will provide them with a safe working environment. At the household level, individuals in the household should have jobs with different sources of income so that if one sector is affected by a disaster, other members of the family are still able to provide income and support (Wisner et al., 2004). In a community such as Placencia, whose economy is based on fishing and tourism, a natural disaster can greatly affect both primary economic sectors. For instance, an oil spill might deter tourists as well as devastating the fisheries, leaving the village with no means of income. It would be wise for communities in this situation to diversify their economies so that alternative sources of income are available to citizens.

As a community is recovering from a disaster, it would be beneficial to that community to incorporate risk reduction into the recovery process. Because various aspects of community life have already been upended and will have to be rebuilt and restructured, it makes sense to do so with the next disaster in mind. Social, political, and structural improvements can be made that will reduce the vulnerability of the population to the next event (Wisner et al., 2004). For instance, if an earthquake or hurricane devastates an area, structures should be rebuilt to withstand the next disaster. While it might cost more to include extra protection, the payoff will be evident when community members avoid the emotional and monetary expense of rebuilding again after the next event.

Finally, Wisner et al. (2004) recommend utilizing micro-credit schemes to increase the economic resilience of vulnerable communities. These small-scale lending schemes require no collateral, instead using social pressure to encourage repayment. No

new loans are made until the old ones are repaid; the funds are cycled so that a relatively small amount of money is used to assist a large number of people (Wisner et al., 2004). This type of program could be useful in increasing highly stressed households' level of access to financial resources. Also, these schemes provide the necessary assistance to those who need to increase their resilience without creating dependence upon external help. With relatively little financial input, micro-credit schemes create opportunities for households to increase the structural resistance of their homes to natural disasters; invest in a means of diversifying their income sources, such as through planting a garden or making a product to sell; and otherwise decrease their vulnerability to disasters. In order for these schemes to be effective for the poorest households, however, household members will require enough income to repay the loan while still providing for their family, which will necessitate improvement of livelihoods.

These recommended steps are not simple and will not be easily implemented. In many cases, they will require changing the very fabric of society and the political system, which will take time. However, these are measures that must be taken if the destruction caused by the increasing number of disasters is to be mitigated. Attempting to save money by choosing not to implement the suggested changes will only result in greater financial and emotional losses in the long-term as people's lives and homes have to be continuously rebuilt.

### *Next Steps*

The next steps in taking this study further would include examining relationships between stress levels and neighborhood cohesion levels as well as comparing individual stress and neighborhood cohesion questions. I would also examine the coping strategies

relative to vulnerability and household stress levels. Then I would compare stress levels, cohesion scores, and coping strategies among all 3 study communities to determine if the trends are consistent across communities. I believe it would be helpful to identify factors that influenced the households' decision making regarding coping strategies. For instance, did they respond in the manner they did by choice or because they had no other options? Finally, I would conduct a full analysis using the complete Vulnerability Index to gain a better representation of vulnerability levels.

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