

RISK PERCEPTION AND THE ROLE OF EXPERIENCE: CASE STUDIES OF ANNOTTO BAY AND PORT MARIA IN JAMAICA.

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Jamaica is a small developing country located in the Caribbean region. This island is affected by several natural disasters as it is located in the general path that hurricanes and other storms travel. Flash flooding, from seasonal rainfall is one of the main disasters affecting the island. Factors such as increases in population and intense rainfall associated with storms and hurricanes have played a role in the observed rise in flood damages. Another factor that worsens flood damages is poor planning or zoning of land especially when development is allowed to continue in areas not fit for construction or located on the floodplains. In spite, of the fact that floods continue to be the most regularly recurring natural hazard in Jamaica very little research if any has been done on flood risk and perception and the role that experience plays in decision making. The purpose of this research is to better understand risk perception and the role of intervening variables such as age, gender, monthly income and experience in the communities of Annotto Bay and Port Maria, St. Mary Parish Jamaica. Due to the nature of this study, at risk populations were surveyed and interviewed to get an idea of what their perceptions are. Results indicated that demographic factors do not influence perceptions of the residents, however,

residents from both Annotto Bay and Port Maria perceive their communities to be at high risk. Also, there is a variation between the threat that concerns each community more. Nevertheless, the river overflowing its banks was popular between the two. Older individuals within the study are more likely to take protective action in the event of a flood threat, and they also believed that the local authorities are taking some action to reduce flood risk. However, residents from both communities perceived that the authorities are not doing enough to mitigate flood risk. The residents were asked about their perception of what can be done to alleviate flood risk. Interestingly, all of the recommendations were structural, for example, cleaning of drains, dredging the river and implementing stone baskets. It is therefore important for emergency managers to understand what the residents of these vulnerable communities perceive, and the need for non-structural fixes such as better policies, improved flood plain maps and better building codes.

**RISK PERCEPTION AND THE ROLE OF EXPERIENCE: CASE STUDIES
OF ANNOTTO BAY AND PORT MARIA IN JAMAICA.**

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DEDICATION

This research is dedicated to my beloved sister Tavia, my mom Josette and Mr. Delford Morgan. Without the constant encouragement and support from you all I would not be where I am today. My sister Tavia, though you are no longer on this earth, while you were you always encouraged me to strive for excellence. Those words kept me going during the dark times. To my mom, I'm so grateful to have a mom like you. You have made tremendous sacrifices to ensure that I am successful. To Mr. Morgan you guided me to the path of Geography; look at me now I'm in love with the discipline. I cannot thank you enough for everything you have done for me. One day I hope to teach and inspire students like you inspired me. I'm deeply humbled and grateful. I thank you all.

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CHAPTER 1: INTRODUCTION AND RESEARCH PROBLEM

1.1 Introduction

At the beginning of the 21st century, flood magnitudes and frequencies have increased globally (Mandal & Maharaj 2013). Over the last decade (2000-2009) there has been an increase in flood related disasters (Nandi et al. 2016). This emerging trend prompted research in an effort to combat this increase with particular concern for vulnerable populations (Dostál and Langhammer, 2006). Factors such as increases in population and intense rainfall associated with storms and hurricanes have played a role in the observed rise in flood damages. Another factor that worsens flood damages is poor planning or zoning of land especially when development is allowed to continue in areas not fit for construction or located on the floodplains. According to the United Nations Office for Disaster Risk Reduction (UNISDR 2011), economic opportunity and poor land use planning are among the major factors attracting people to live in floodplains. This is the case for communities in Jamaica including Port Maria and Annotto Bay which are the study sites for this research.

Jamaica is a small island in the Caribbean centered at 18° 15' N, 77° 30' W with an area of 10,991 km² with approximately 1022 km of coastline. Several areas (especially further inland) of the island are mainly hilly and consist of a few mountain ranges. Most of the island's towns are located on the coast which served as shipping ports in previous times (Taylor et al. 2014). "Data from the Meteorological Service of Jamaica on extreme events such as tropical storms, hurricanes and depressions occurring between 1900 and 2012 shows that 44 % of flood events are attributed to hurricanes" (Nandi et al. 2016, p. 3). Despite the fact that floods continue to be the most frequently recurring natural hazard in Jamaica (Mandal & Maharaj 2013), very little research if any has been done on flood risk and perception and the role that experience plays in

decision making. This is frightening as towns located on the coastline are known to flood frequently and that is where most of the important institutions such as banks, grocery stores and government offices are located (Nandi et al. 2016).

Jamaica's climate is influenced by a bimodal rainfall pattern where May and September-October serve as the two peak periods. With this rainfall pattern, most of the floods experienced by the island's coastal towns are from events that are accompanied by intense precipitation but are often short lived. The towns of Port Maria and Annotto Bay are small coastal towns and are at risk of flooding; however, with different experiences, socio-economic backgrounds, economic and topographical profiles, each community is affected differently. Studies done by Mandal & Maharaj (2013) have focused on the towns' vulnerability to flooding, however, two factors often overlooked are perceived risk and the role of experience. It is therefore important to investigate these two factors with the aim of understanding their potential impact in policy making.

Given the above, the purpose of this research is to better understand risk perception and the role of intervening variables such as age, gender, monthly income and experience in the communities of Annotto Bay and Port Maria, St. Mary Parish Jamaica. After identifying residents that reside in the floodplain, more research can be done to determine why those residents perceive risk the way they do, as well as to understand if actual and perceived risk differ and to explore the role experience with past floods has on decision making. A majority of perception studies are conducted by survey or interviews with the at-risk residents in the study area. The specific hazard in this research is flooding. This research takes into account both biophysical risk in terms of the geographic context (location) and the social fabric (demography, perception and attitudes)

1.2 RESEARCH QUESTIONS

1.2.1 Introduction

The aim of this research is to investigate flood risk perception in Annotto Bay and Port Maria Jamaica. Both communities are located on the north-east coast and share similar flood frequencies, sizes and magnitudes. Given that, it is imperative to understand if flood risk perception is different between the two communities, the reason for any differences and also to explore the role, if any, that the experiences with floods have on decision making.

1.2.2 Questions

The specific research questions that are addressed are:

1. To what extent do the demographic factors of age, gender, length of residency, and socio-economic status influence flood risk perception in the communities of Port Maria and Annotto Bay, St. Mary, Jamaica?
2. Does perceived risk differ in the two communities; if so how and if not why not?
3. To what extent does the experience of floods influence flood risk perception in these communities?
4. What are the perceptions of what can/should be done to mitigate flood risk

1.3 Organization and Description of Remaining Chapters

Chapter Two provides a comprehensive literature review that discusses hazard perceptions, risks, hazard experiences and vulnerability. These factors are further elucidated based on two theoretical models, more specifically, the Protective Action Decision Model and the Social Amplification of Risk Framework. Chapter Three explores the study areas chosen for

this research: Annotto Bay and Port Maria, Jamaica. Chiefly, it discusses the environment, socio-economic and cultural characteristics that define these communities, as well as the flood histories of both communities. Chapter Four details the data and methods used to test each research question, description of the survey instrument, sampling approach and survey design, and finally, the statistical analyses. Chapter Five details the analysis and discussion of results. Chapter Six provides an overview of the key findings, and includes their relationship to the theoretical frameworks, contributions to the research, shortcomings and concluding remarks.

CHAPTER 2: REVIEW OF PERCEIVED RISK, EXPERIENCE AND VULNERABILITY LITERATURE

There are several factors that influence risk perception such as geographic location, age, gender and socio-economic status. Being influenced by so many factors, risk perception is a complex phenomenon. This chapter addresses risk perception and some of the factors that influence it, specifically experience and vulnerability.

2.1. Perceived Risk

Risk perception is very complex due to the many factors that influence, change and account for varying individualistic understandings. Because of this, there is no one model, approach, or concept that effectively covers all of the influencing external factors. Within the existing literature, there are several models and approaches that have laid a foundation which in turn created a platform for future research. A question frequently asked is why do people perceive risk the way they do? For some time comparing risk was thought to be relevant for risk communication, however, Starr (1969) showed that accepting a risk was not only based on technical estimations and benefits of that particular risk but also on individual aspects such as voluntariness. Individuals do not make the same approximation when they rate risk to themselves, their households or to the public, which brings into consideration the concept of risk targets. "It is clear that not everybody can be right in saying that he or she is subjected to a smaller risk than people in general" (Sjoberg 2000, p. 2) which could lead to risk denial. Cutter (1993) maintains that if an individual cannot understand his/her vulnerability in regard to the threat of a hazard, then he/she may in turn deny risks altogether. This feeds into how sensitive people are towards risk. In other words, some people may be worried and upset about possibly all hazards while others are indifferent or calm. The concept of specific fear is interesting in that an individual may react differently based on the fear they associate with a particular hazard. Fear

does not necessarily mean perceived risk, however, as often this fear is influenced by the damage which a threat brings; for example, for flooding, the specific fear of drowning ranks the highest (Paton et al. 2008).

The Protective Action Decision Model (PADM) is a multistage model that is grounded on people's responses to environmental hazards and disasters (Lindell and Perry 2012). This model is a decision-making model and not necessarily a risk perception one. However, what is interesting is that at the core of the model is what Lindell and Perry (2012) refer to as threat perceptions and what I want to explore in the context of risk perception (Figure 2.1).

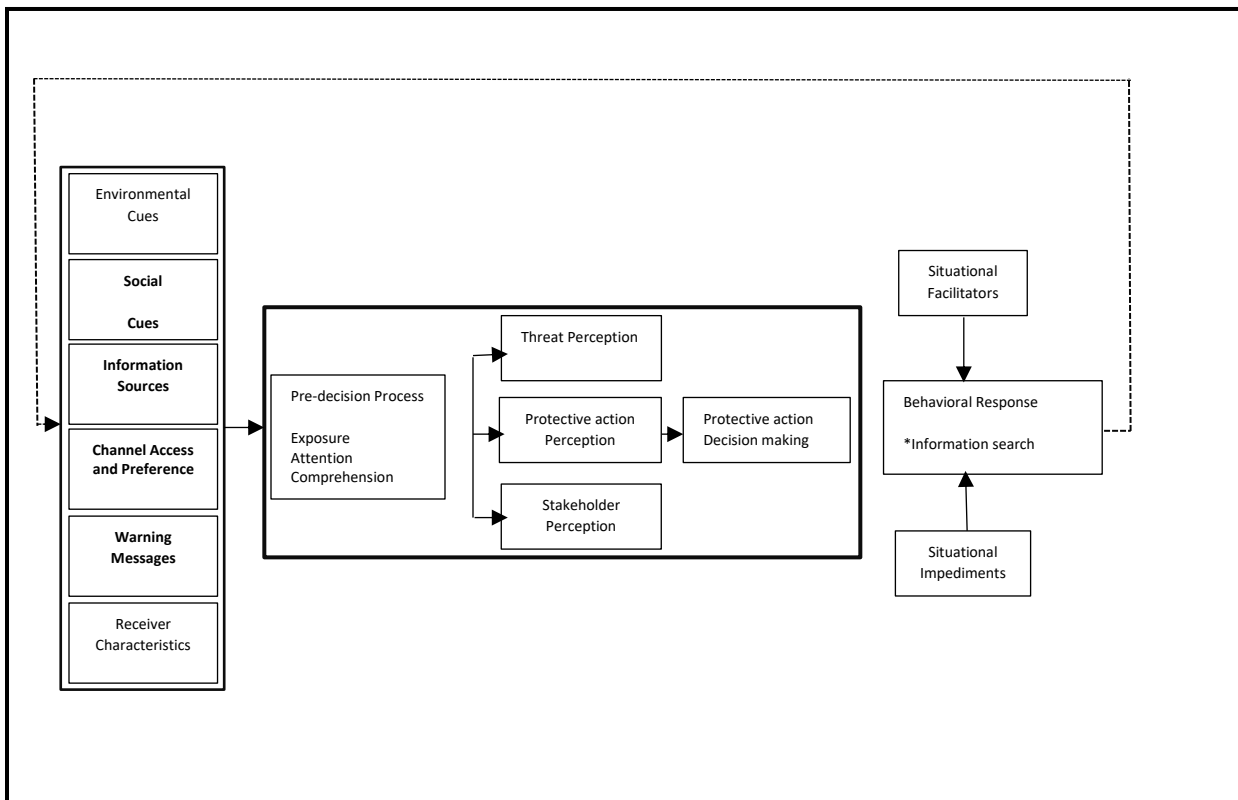


Figure 2.1 Information flow in the PADM

Source: Adapted from Lindell & Perry (2012)

There are several factors that start the information flow of the PADM, including warning messages, environmental and social signals and channel access and preferences that influence exposure, attention and comprehension. In other words, based on the environmental cues and the pre-decisional and threat perceptions, an individual will respond. The actual implementation of an appropriate response depends not only on people's intentions to take those actions but also on circumstances in their physical and social environments that can hamper actions that they planned to take or that can enable actions they did not intend to take (Triandis 1980). In several cases, the knowledge an individual possessed of a particular hazard may influence the type of protective behavior they seek (e.g., evacuating from a flood or seeking shelter in a basement from a tornado). People's concepts of environmental risk are sometimes influenced by others' views, as are the choices they make regarding how they might confront a risk (Paton and Bishop 1996; Lion et al. 2002). Therefore, people turn to others within their community to provide them with information that may reduce their uncertainty and guide their reaction to a particular risk. While environmental cues are more evident, social cues tend to prompt reasonable protective decision based on the observation of another person's behavior. The relationship between risk perception and behavior is contextual; the extent of any relationship depends on the nature of the risk, the risk perception and the specific behavior (O'Connor et al. 2005). At the same time, an individual's vulnerability or the perception they have of vulnerability is a key component in understanding why people perceive things the way they do.

2.1.1 The Social Amplification of risk

Kasperson et al. (1988) introduced a conceptual framework that seeks to connect the technological assessments of risk with cognitive and cultural perspectives of risk perception. Previously, the assessment made by the technological experts examined risk in terms of the

impacts of an event on human activity, for example, disease, death, injuries and damages to the environment. Over time it became apparent that consequences of risk events incorporate more than direct harm. The social amplification of risk framework (SARF) provides a theory capable of connecting the technological assessment of risk with the social and cultural responses that shape the public experience of risk (Figure 2.2). The argument of Kasperson et al. (1988) is based on the idea that hazards work together with social, cognitive and cultural processes in ways that may either increase or attenuate society's perception of the risk. While the authors explored social amplification of risk in the context of a corporation, my interest is located in the center of the framework where the portrayal of a risk event produces a signal based on the characteristics of that particular event, which then influences risk related behavior.

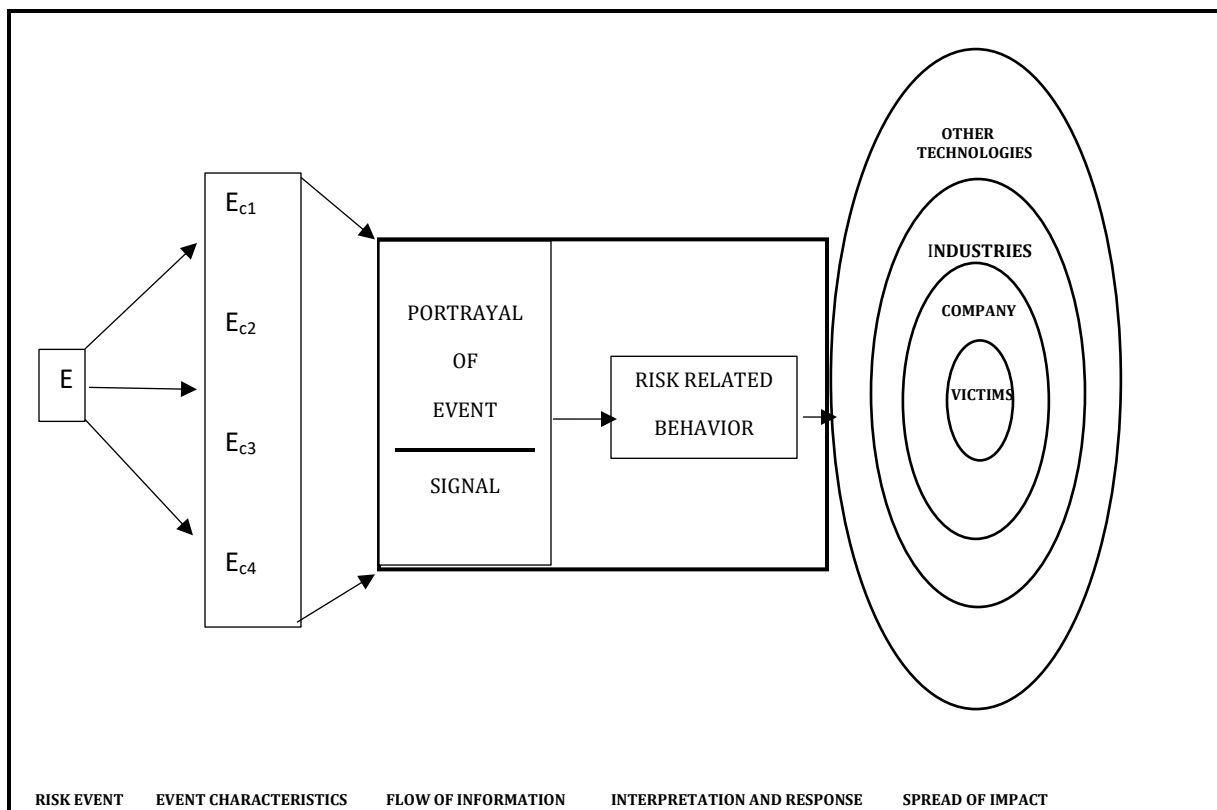


Figure 2.2 Simplified representation of social amplification of risk and potential impacts.

Adapted from Kasperson et al. 1988

At the beginning of SARF is the threat or occurrence of an event. Different events have different characteristics; for example, a main characteristic of floods is the surplus of water compared to the characteristics of a volcano which involve the explosion of lava/magma. It is these characteristics that will influence how an event is portrayed. The onset of a hazard can also influence perception. For example, a flood is a much slower onset event compared to a tornado. As a result of this, individuals may amplify a tornado threat because of the speed at which the event occurs. Nevertheless, amplification may result from several sources such as personal experience or direct and indirect communication. In many cases, direct experience with bad accidents and risk events increases the likelihood of the hazard to be remembered, thereby increasing the perception of risk (Slovic 1986). In other cases where direct experience is not sufficient or lacking then it is the information that the media presents from which individuals gain their knowledge. This brings into light the importance of communication in the context of risk perception, in that the signal produced based on the characteristics of a risk event coupled with the source of amplification will result in behavioral change (response). A signal can be interpreted differently based on several individual factors such as age, experience, location, socio-economic status and educational background. These factors play a vital role in whether or not a threat is amplified or attenuated. For example, it is assumed that an individual who is educated and is financially stable may react differently to a threat compared to a less educated poor individual. So, in a community of wealthy individuals, the threat of flooding may be lessened due to the presence of flood insurance, while in an impoverished community with poorly constructed homes, the threat of flooding may have amplified due to fear of direct impacts.

2.2 Experience

Population trends in the United States and other countries indicate that increasing numbers of people are moving into regions that are vulnerable to recurring natural disasters (Norris & Murrell 1988; Phifer and Norris 1989). The chance of an individual throughout his or her lifetime experiencing more than one hazard is not uncommon, however, there have been limited studies that explore the effects that repeated exposure to natural disasters has on its victims. “This is an important gap in the literature because being threatened repeatedly by or experiencing multiple disasters may influence the way in which people perceive and prepare for disaster threats, experience psychological distress, and assist survivors” (Sattler et al. 1995, p. 1397). Persons who have experienced a natural disaster may accumulate definite benefits that encourage preparatory actions to lessen loss of possessions throughout successive disaster threats. Sattler et al. (2000, p. 1398) maintain that, when confronted with a new disaster threat, “persons with disaster experience specifically those who experienced higher levels of resource loss and psychological distress would (a) be more likely to acknowledge a disaster threat, (b) readily experience psychological distress, and (c) efficiently choose appropriate courses of action than persons who have experienced lower levels of resource loss or distress as a result of a disaster, or persons who do not have disaster experience.”

However, disaster experience may have a negative feedback which could create optimistic bias. Individuals with this bias may fail to prepare or may even assume that a new threat will be similar to the previous one and will result in similar damage. This could prove detrimental especially if the individual believes that he or she has been around long enough and has seen the worst. They believe they have survived that long and so they will survive anything to come. For example, Lindell and Perry (1992) found that some people who were threatened by

a flood refused to evacuate because two previous floods came only as high as their driveways. This perceptual bias may be especially common with hurricane threats because of the great variability in the size and strength of these storms; however, this does not mean that adequate preparation is not necessary. Interestingly, the gambler's fallacy is another important issue to explore with respect to experience and risk perception. Tune (1964) refers to the gambler's fallacy as the belief that a streak is more likely to end than chance would dictate. Within this concept, people possess the bias that results in them making decisions about future events solely on the outcome of past events. This notion could be a result of the variation that may occur in perception among individuals living in regions vulnerable to recurrent disasters.

According to Horowitz (1976), the very essence of a traumatic event is that it is outside the realm of an individual's experience. Due to the fact that it is outside an individual's experience, a disaster victim may not be able to process the meaning of the event. The inability to process this information results in sporadic experiences of the trauma in dreams and disturbing images depending on how traumatic the event was. The reoccurrence of these images according to Norris and Murrell (1988) may lead to the victim wanting to assimilate them and, as such, these images become incorporated in the victim's worldview.

A threat can be "normalized" in areas where disasters occur frequently, where events that the majority may consider unusual, are placed within a particular period that offers some amount of meaning and understanding (Anderson 1968). Because of this, "recurrent hazards are generally assumed to be less disturbing psychologically than are disasters that occur with less frequency and therefore unfamiliar to stricken populations" (Bolin 1985, p. 5). An approach then to study any particular stressor is that the effects of a disaster should be comprehended best when examined in the context of the life progression of the exposed individual. This brings into light

the issue of age and the relevance of the theory of inoculation. Norris and Murrell (1988) stated that in comparison to younger adults, older persons have a lot more history of experience to rely on in any crisis. In fact, it is this wealth of experience and the ability to admit loss and suffering that accounted for the resilience of older individuals following the 1975 Omaha Tornado (Bell et al. 1978). In many cases, older persons are either not affected seriously or affected less than younger victims are. A study conducted on a flood prone area in Kentucky where two floods affected the area in 1981 and 1984 revealed that experience when an individual was younger lessened the impact of disasters when they were older (Norris and Murrell 1988). The study showed that more experienced adults accepted their losses one step at a time. These adults exuded little to no anxiety signs while, on the other hand, less knowledgeable older adults were more strongly affected. An interesting thing to note is that there needs to be some amount of distinguishing between age and experience. Older adults are not always invulnerable to all aspects of disasters. In other words, one could be old but that does not mean the right decision is made or that the effects of a disaster will be less. Age in some cases could prove to be a disadvantage especially in mitigation efforts in that one may believe, because they have been around a long time and they may have seen the worst there is, they do not need to take precautionary or mitigation measures.

Despite the fact that age and experience are not one and the same, the opportunities for the latter certainly must increase with the former (Norris and Murrell 1988). Even when an event is specific to a particular area, individuals who encounter other events during their lifetimes may have a reasonable perception of what risk is and will react most times in a positive way. Simply put, prior experience in older adults may commonly offer inoculation against repeated, but nonetheless severe, stressors, but may not defend them from the damage associated with a threat.

Another noteworthy advantage of experience is sharing experience and coping tactics. Older adults living in disaster-prone communities might provide a means of relating to or conducting pre-event interventions and in doing so help others cope during and in the aftermath of natural disasters. The mere fact that safety nets like these exist for the public surely affects how individuals perceive risk even if they do not understand the vulnerability to a hazard, as explained by Cutter (1996).

Direct experience with risky events can be either reassuring or alarming. Generally, experience with dramatic accidents or risk events increases the memorability and imaginability of the hazards, thereby heightening the perception of risk (Slovic 1986). While experience may heighten the perception of risk, it can also offer a response on the type, magnitude and manageability of the hazard, which in turn provides a more in-depth perspective and improves competence for avoiding risk. Kaspersen et al. (1988) argued that while personal experience may serve as a risk amplifier, it can also act to attenuate risk. In many cases, people do not experience risk directly; in such cases, the public learns about risk from other individuals or the media. For reasons such as this, the flow of information is vital and serves as a key component in response and amplification. Kaspersen et al. (1988, p. 184) quoted Mazur (1984) and argued that “the massive quantity of media coverage not only provides coverage of the events but also defines and shapes response.”

2.3 Vulnerability

Being vulnerable can result in higher physical risk and risk may increase vulnerability. In an in-depth review of vulnerability in regards to hazards, Cutter (1996) highlighted three thematic themes: the misperception and ambiguity of the meaning of the term, how vulnerability is measured, and the issue of scale related to this complex term (vulnerability). The examination

of these three areas resulted in the hazards of place model. This model sought to pacify the many inconsistencies that lingered in existing literature. For many, the starting point of the disagreement begins with making a clear distinction between the roots of vulnerability. Cutter (1996, p. 530) argued that “while the broad definition of vulnerability infers a potential for loss, it never clearly articulates what type of loss” and whose loss is being described. Pelling and Uitto (2001) describe vulnerability similar to Cutter as the physical exposure of humans to disasters while highlighting a very important issue which is the ability of “at risk” individuals to not only prepare, but also to mitigate and cope with any negative influences of a natural disaster. Cutter (1996) maintains that due to the diversity of hazards themselves and the influence that a geographic region may have on them or vice versa, a single approach to understanding vulnerability would be illogical. Instead, if we are to understand the academic and real-world situation of how and why people and places are susceptible to environmental hazards then some amount of uniformity and interpretation must first be established.

Despite the different categorizations by different authors, Cutter (1996, p. 530) “proposed that there are three distinct themes in vulnerability namely: risk/hazard exposure, vulnerability as social response, and vulnerability of places.” In understanding risk perception in any geographic region, then it would be beneficial for one to understand the risk/hazard exposure theme of vulnerability. Geographic studies pay keen attention to the distribution of more or less risky conditions, coupled with demographic characteristics and the damage (loss of life or property) associated with the incidence of a specific event. In exposure or biophysical vulnerability studies, “magnitude, duration, impact, frequency and rapidity” of onset play a major role in the experience of an individual and in turn how he or she perceives risk (Cutter 1996, p. 532). In many cases “vulnerability to threats is not solely a function of a person or groups’ physical

exposure to hazards or the nature of the hazards themselves, but also the social and human conditions of the exposed population” (Lopez-Marrero and Wisner 2012, p. 132).

In the context of this study, the Caribbean is a region that has experienced frequent hazards, most notably, hurricanes, landslides and earthquakes (Collymore 2011). The destruction from these hazards has not only affected the economic status of Caribbean islands but has also left vulnerable populations with the onus of recovering. Pelling and Uitto (2001) explored five features of small island developing states (SIDS) that influence their vulnerability, specifically, their size, governmental structure, environment, remoteness and insularity. This is further validated by Lopez-Marrero and Wisner (2012) who stated that due to the mere location and geology of Caribbean islands, they are susceptible to natural hazards. Jamaica is located in the general direct path that hurricanes and other storm systems travel and since most of the important infrastructure is located on the coast, vulnerability is further exacerbated by the location of the island. Jamaica practices a democratic form of government a system adopted from England, its former colonizers. As Pelling and Uitto (2001) mention, government structure can influence vulnerability and a prime example is observed in Jamaica. Jamaica has two dominant political parties: the People’s National Party (PNP) and the Jamaica Labor Party (JLP). Each party has different objectives but keen among the JLP is economic growth, while for the PNP, their major objectives are to provide jobs and education growth. With that said, every five years a general election is called and a new ruling party is decided. The vulnerability of several communities can either be decreased or increased based on the winning party. An example of this is the Jamaica Emergency Employment Program (JEEP) that was implemented by the PNP government on September 18, 2011. Despite being a means of income, it also served the environment. Individuals employed under this program would clean drains and dispose of garbage. For many

communities, cleaning the drains is believed to mitigate flood risk. This proves true for the case of Annotto Bay and Port Maria. Once the JLP took power in 2016 the program was halted. So, individuals and the environment that used to benefit from this program no longer do. In other words, work that may reduce vulnerability such as cleaning of drains may continue or it may stop, depending of whichever party is in power. With this governmental structure and the continued starting and stopping of environmental projects, individuals become vulnerable not out of choice but solely due to the location in which they reside.

The natural phenomenon of a hazard does not make it a disaster. The human to environment aspect is a key determinant in how devastating an event (hazard) can be. With that said, vulnerability as probable exposure or social response has received great emphasis in recent literature (Weichslegartner 2001 and Birkmann 2006), however, a third trend is emerging which contextualizes vulnerability by combining potential exposure and social response. In other words, the vulnerability of at-risk communities may be better understood due to fact that a more human oriented approach is involved. This may allow for new findings that may seek to explain past and previous associations. Even though this third approach brings the two together, what makes it special is that the environment is not neglected and at-risk locations can be properly explored despite the social approach. To address vulnerability and increase resilience, key policies must be implemented.

2.4 Mitigation

According the UNISDR (2011, p. 19), mitigation is defined as “the lessening or limitation of the adverse impacts of hazards and related disasters.” There is no set way of reducing the impacts of hazards, but their severity can be significantly lessened by various strategies and actions. With the frequency of floods increasing (Mandal & Maharaj 2013), it is

imperative that some sort of mitigation especially to coastal communities be implemented as flood related costs are also increasing (Kron 2005). Implementing such measures is a challenge for emergency managers as hazard mitigation is further exacerbated by social issues such as poverty, residing in high-risk areas, and instances of poorly constructed infrastructure and housing which are characteristics of the study sites (ODPEM 2008). While there is no set routine for achieving successful mitigation programs, understanding the vulnerability of at-risk communities is a key aspect. As Cutter (1996) mentions, the diversity of hazards can influence perception, and such diversity can also influence vulnerability which in turn can complicate mitigative efforts. The need to reduce hazard costs and impacts on vulnerable communities is being promoted as a priority in Jamaica's policy agenda due to the fact that there is an increasing recognition that hazard-risk mitigation can contribute to development (ODPEM 2008). It is with that in mind that Jamaica's government, by way of the ODPEM, implemented a policy aimed at mitigating hazards. They also realized that in order for the policy to have any sort of impact, individual involvement at the community level is key. As such, the ODPEM has embarked on community-based studies in an effort to highlight the main threat to communities and what can be done to mitigate risk (ODPEM 2008). These community based studies provided a brief history of the community, its flood history and a list of individuals who are responsible for disaster related work in at-risk communities. Additionally, these studies highlight the main threats to the communities and what they recommend to mitigate the threat.

Mitigation work done by the ODPEM falls into three categories: 1) hazard mitigation and planning; 2) project development and implementation; and 3) public education and training. A key area that needs attention is the creation of hazard maps. Mapping portions of at-risk communities is a crucial step in mitigating risk and the ODPEM falls short on doing this. There

are very few maps and the ones that exist are somewhat outdated. However, with GIS gaining popularity in Jamaica, this should change. Educating individuals is a key challenge for emergency managers, and in Jamaica it is no different. This study shows the desperate attention needed in educating the public on the non-structural ways of mitigating flood risk. The plans and articles posted by government officials highlight non-structural ways of reducing risk but results from Chapter Five show that the public (residents of Annotto Bay and Port Maria) do not perceive any of them as a way of mitigating flood risk.

2.5 Summary

Understanding how people perceive risk and their vulnerability to hazards is central to developing mitigative measures. This entails the identification of at-risk populations and their readiness or capacity to assume protective action, which in turn requires an understanding of their perceptions and the factors that influence those perceptions

CHAPTER 3: STUDY AREAS

3.1 Introduction

The towns of Annotto Bay and Port Maria were chosen for this research due to their geographic locations. Both towns are located in the parish of St Mary and are therefore subject to more or less the same governmental structure, demographic characteristics, flood exposure and economic capacity (Figure 3.1). Located on the narrow coastline of the island, these towns share similar flood histories which are heavily influenced by hurricanes or intense rainfall events. It is characteristics like these which make them suitable study sites. Being influenced by similar factors makes these towns ideal to examine flood risk perception and the role of experience in decision making.

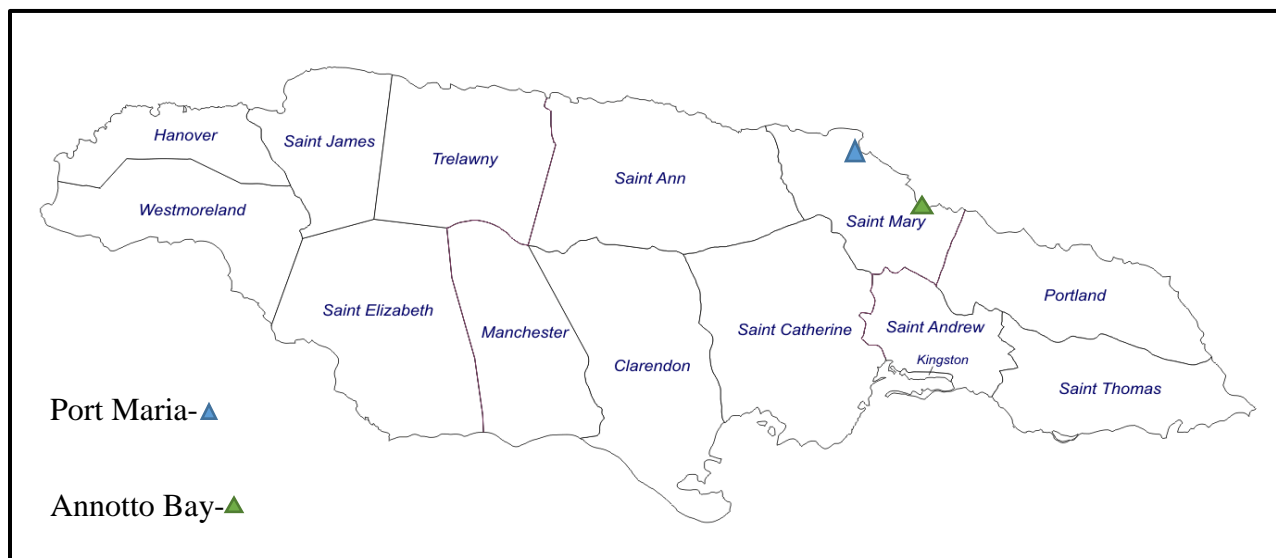


Figure 3.1 Location of Study Sites

3.2 Annotto Bay St. Mary

One of the study areas chosen for this research is Annotto Bay, St. Mary (Figure 3.2). This small coastal town serves as a useful study area because it encompasses a mix of hazards, from flooding to landslides, which may influence perception and vulnerability. In a study conducted by the ODPPEM (2012a), it was concluded that flooding is the main hazard experienced by the town. Floods have continuously damaged Annotto Bay in the past, with two of the most destructive being as a result of Hurricane Gilbert 1988 and heavy rainfall in 2001. However, in recent years, Annotto Bay has also experienced major flooding from Hurricanes Ivan 2004, Dennis 2008, Gustav 2008 and Sandy 2012 (Table 3.1).

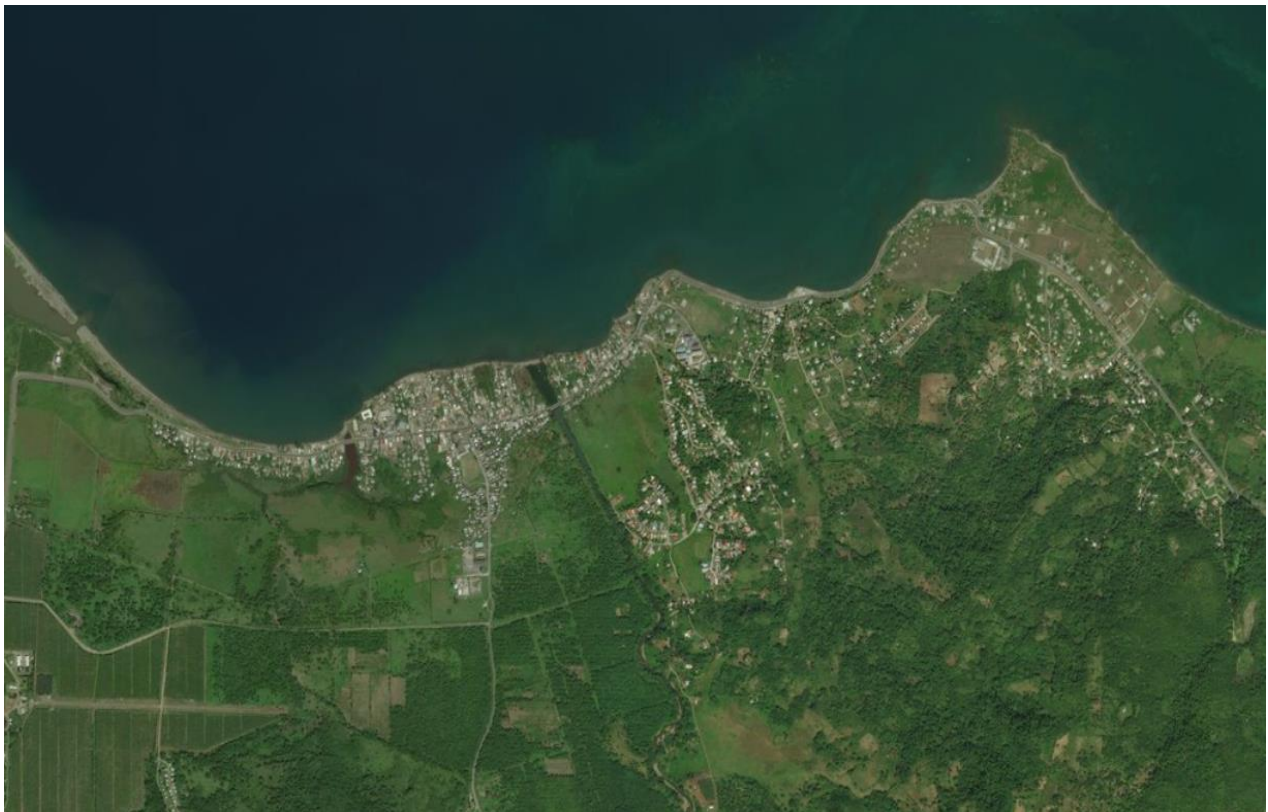


Figure 3.2 Location and Layout of Annotto Bay St. Mary Jamaica

Source: Google Earth

Located in the north-eastern portion of the island. Annotto Bay has approximately 6,017 people (Statistical Institute of Jamaica, 2011). The town is a major urban center in the parish of St. Mary and serves as a prime spot for commerce. Annotto is comprised of grocery stores, churches, haberdasheries, a police station, a post office, primary and high schools, and residential dwellings. Most of these residential structures are made of wood and concrete.

Table 3.1 Flood History of Annotto Bay 1980-2012

Hazard	Date of flood
Hurricane Allen	1980
Hurricane Gilbert	1988
Heavy Rains	2001
Hurricane Ivan	2004
Hurricane Dennis and Emily	2005
Heavy Rains	2006
Hurricane Dean	2007
Tropical Storm Gustav	2008
Hurricane Sandy	2012

Source: Office of Disaster Preparedness and Emergency Management (ODPEM, 2012a)

With an approximate elevation of 48 meters, high drainage density coupled with the topography creates a high-risk situation for the town (Figure 3.3). This is further complicated by the presence of four rivers: the Annotto, Pencar, Motherford and Crooked rivers (ODPEM, 2012a). Annotto Bay is particularly vulnerable to floods due to the fact that the town is situated in close proximity to the coast and also because of the location of homes in closeness to the river (Figures 3.4 and 3.5)



Figure 3.3 Topographic map of Annotto Bay

Source: <http://www.lib.utexas.edu/maps/ams/jamaica/>



Figure 3.4 Example of River-Side House Location in Annotto Bay
Source: Authors field work 2016/2017



Figure 3.5 Example of Ocean-View House Location in Annotto Bay
Source: Author's field work 2016/2017

Flooding in Annotto Bay is mainly a result of the river overflowing its banks. The town is relatively flat and as such the rivers that traverse the area do not possess steep gradients. As a result of this, the onset of floods in Annotto Bay is somewhat slow. One survey respondent stated that in most cases the height of flood water ranges from 1- 6ft. (Figure 3.6), but in extreme instances water can get up 10-15ft.



Figure 3.6 Flooding in Annotto Bay

Source: Dean Dixon photos

3.3 Port Maria St. Mary

Port Maria serves a useful study area because it includes a variety of hazards from flooding to droughts, which may influence risk perception. Similar to Annotto Bay, floods are considered the most common natural hazard for the town of Port Maria and thus are the hazard under study. Port Maria is a small town located on the north-coast of the island of Jamaica in the parish of St. Mary (Figure 3.7). With an approximate population of 8,000 (Statistical Institute of

Jamaica Census 2011) and an average elevation of 13 meters, the entire town is located on the floodplains of the Outram River (Mandal and Maharaj 2013) (Figure 3.8).

This town consists of several government and privately-owned businesses, wholesaling, furniture stores, supermarkets, local markets and restaurants. Flood data available (ODPEM, 2012b) indicates that the town experiences frequent flooding with two of the most catastrophic floods occurring on November 26 and 27 2006 and November 11, 2012.

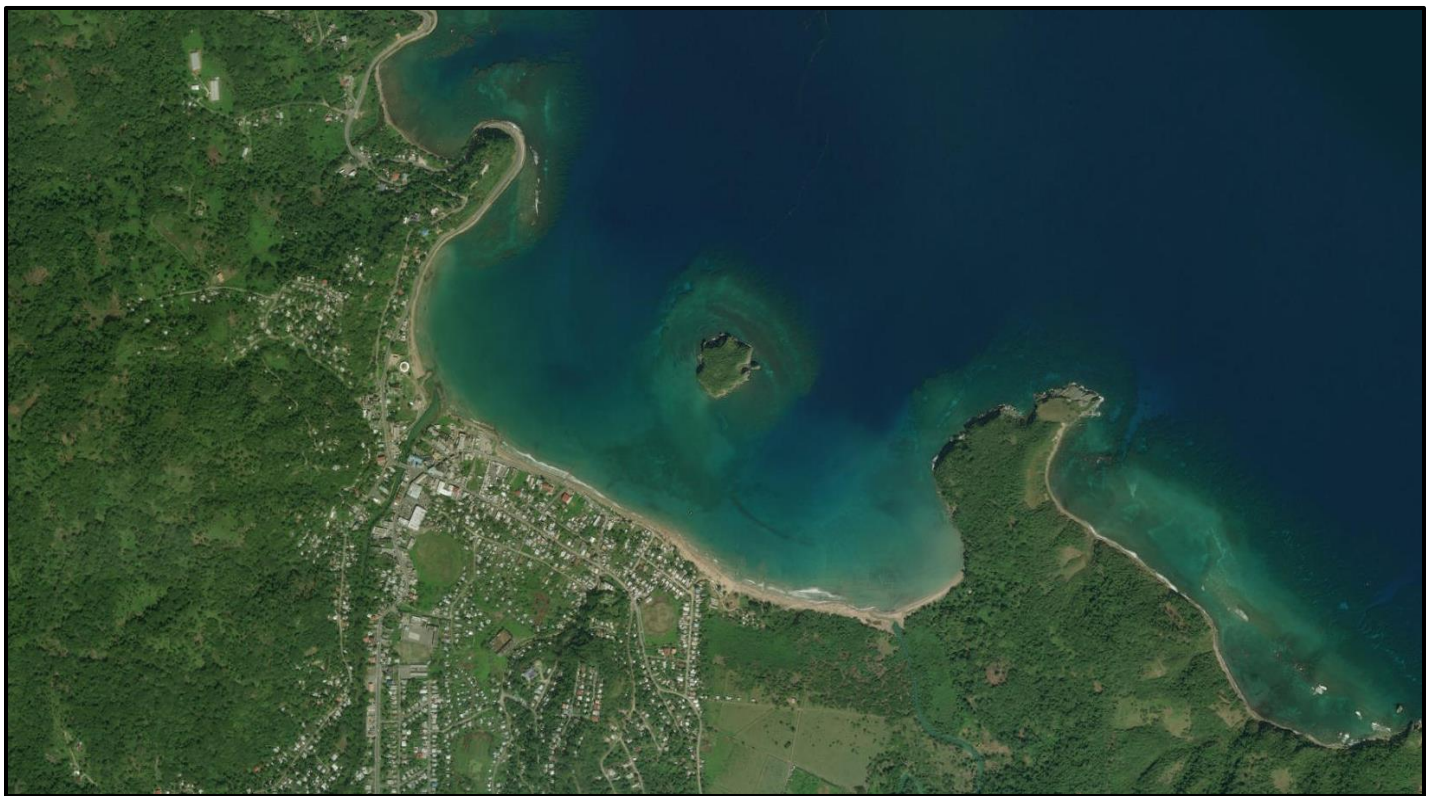


Figure 3.7 Location and Layout of the Town of Port Maria Jamaica

Source: Google Earth

The majority of the floods that occur in Port Maria are associated with hurricanes or tropical storms during the months of August to November (Table 3.2). The town is relatively flat in comparison to its surroundings and is prone to the effects of storm surge associated with these meteorological events.

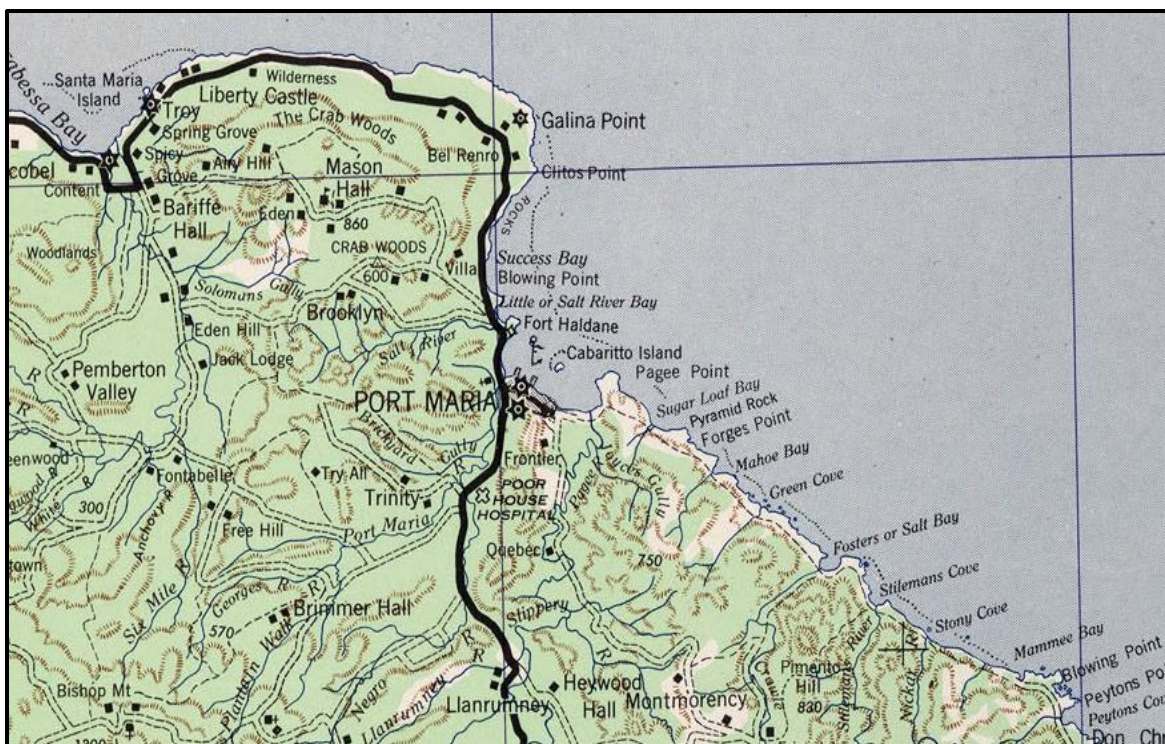


Figure 3.8 Topographic Map of Port Maria

Source <http://www.lib.utexas.edu/maps/ams/jamaica/>

Table 3.2 Flood History of Port Maria 1980-2012

Hazards	Date of flood
Hurricane Allen	August 6, 1980
Hurricane Gilbert	September 12, 1988
Hurricane Ivan	September 2004
Hurricane Dennis	August 2005
Heavy Rains	November 26 & 27 2006
Hurricane Dean	August 20 2007
Tropical Storm Gustav	September 4, 2008
Heavy Rains	November 11, 2012

Source: Office of Disaster Preparedness and Emergency Management (ODPEM, 2012 b)

Similar, to Annotto Bay Port Maria shares the same proximity to the river (Figure 3.9). The Outram River flows through the relatively flat town. Due to the basin like shape of the community coupled with the narrow river outlet and clogged drains, flooding is a major concern for this community. Following the flood in 2006 the residents have developed a fear of experiencing any sort of rainfall event while being in the town.



Figure 3.9 Example of River-Side House Location in Port Maria

Source: <http://www.jamaicaobserver.com>

Flooding in Port Maria is a lot faster than in Annotto Bay. The town is flat; however, it is surrounded by highlands and as a result serves as a drainage outlet point for the higher terrain. The Outram River may not have a steep gradient but a key reason for flooding in the town is the gradual buildup of water that damages the property and homes of individuals (Figure 3.10). The river flows into the Caribbean Sea and studies have shown that several times floods occur

because the water cannot exit the town (Mandal and Maharaj 2013). Floods in this community affect the livelihood of the residents.



Figure 3.10 Flooding in Port Maria

Source: <http://www.jamaicaobserver.com/news>

CHAPTER 4: DATA AND METHODS OF RESEARCH

4.1 Introduction

There are several purposes for conducting this research at the local level in Annotto Bay and Port Maria. First, it provides information comparing demographic characteristics versus risk and perception. This has direct implications for the residents of both coastal communities. Second, it examines the risk perceptions and attitudes of the residents which can possibly aid emergency managers with decision making and policy implementation. Finally, and most importantly, this study furthers our understanding of risk perception and the role of experience on a local scale where limited information on the topic exists.

4.2 Data Needs and Acquisition

In order to examine the research questions, both secondary and primary data were employed for this study. The secondary data were acquired from several sources locally, including the following: Office of Disaster and Preparedness Emergency Management, Statistical Institute of Jamaica, National Works Agency, and a local newspaper called The Gleaner. The frequency of occurrence for floods was derived from a community disaster risk management document facilitated through the Building Disaster Resilient Communities Project funded by the Canadian International Development Agency in collaboration with the St Mary Parish Council. Flood dates and number of individuals impacted were derived from Gleaner articles.

4.2.1 Sample Size and Method of Data Collection

To collect primary data for this study, the use of surveys was employed. Forty-four respondents were surveyed from Annotto Bay and 42 respondents from Port Maria. The objective of the questionnaires is to understand if flood perception differs between these two communities with different flood risks and experiences, and how experience influences perception. Data was collected from December 13, to January 12, 2017 between the hours of 9 am to 5 pm. The survey was administered throughout the town borders by walking from house to house and interviewing individuals who were willing to take part in the research. Respondents for this research should preferably have experienced a flood, so areas that are close to the river and ocean were targeted. The surveys also targeted the household heads and business owners who are the chief decision makers. However, in cases where the head of the household or managers are not present, then a responsible member from the family or the business was surveyed.

4.2.3 Survey Structure

Part 1 of the survey collected demographic information, for example, the respondent's age, gender, length of residence in the community and number of individuals in the household. Part 2 collected information on flood experience and contained questions such as how many times the respondent has experienced a flood, which flood was most dangerous and what protective measures were taken. Part 3 of the survey gathered information on the attitudes of the respondents towards floods. Questions asking about the extent to which they think the community is at risk of flooding features a 5 point Likert scale (1= very low to 5 = very high). This scale was used to measure levels of agreements for questions such as how devastating were the damages incurred (1= not serious to 5=very serious). Part 4 collected information on the role

of experience in regards to flood risk, such as if experience influences flood behavior, and if it prevents or promotes proper decision making. The relationship between survey questions and research questions is shown in Table 4.1

Table 4.1 Research Questions and Variables Used to Test Relationships

Research Questions	Variables used to test relationships
1. To what extent do the demographic factors of age, gender, length of residency, and socio-economic status influence flood risk perception in the communities of Port Maria and Annotto Bay, St. Mary, Jamaica?	<p>Demographics</p> <p>1. In which of the following age categories do you belong?</p> <p>2. Gender: __Male __Female</p> <p>3. How long have you lived in this community? _____</p> <p>4. What is your estimated monthly earnings in JMD?</p> <p>Perception</p> <p>16. How high a risk is flooding to the community?</p>
2. Does perceived risk differ in the two communities; if so how and if not why not?	<p>Perception</p> <p>18. Which threat concerns you more?</p>
3. To what extent does the experience of floods influence flood risk perception in the communities of Port Maria and Annotto Bay, St. Mary, Jamaica?	<p>Experience</p> <p>Q 7. Have you ever experienced a flood? __Yes __No. If yes, How many times? _____</p> <p>Q 9. On a scale of 1-5 with 5 being the highest, how devastating were the damages incurred to your place of residence/business</p> <p>Q 11. Did you take any actions to protect yourself before, during or after a flood? __Yes __ No If yes what did you do? If not why?</p> <p>Perception</p> <p>Q 16. How high a risk is flooding to the community? __No risk __Little risk __Somewhat of a risk __High Risk __Very high risk</p> <p>Q 20. Do you believe that your home/business place will get flooded in the near future? __Yes __No</p> <p>Q 21. If warned about a flood, how likely are you to take protective measures</p>

	Q 23. Have you considered moving away from the community because of the flood hazard? __Yes __No
4. What are the perceptions of what can/should be done to mitigate flood risk?	Perception Q 24. To your knowledge, are the local authorities taking actions to reduce flood risk in the community? __Yes __No Q 25. Do you believe the relevant authorities are doing enough to reduce the risk of flooding to your community? __Yes __No

4.3 Statistical Analysis

To analyze the survey, descriptive statistics were used to reach decisions about the differences if any in the risk perceptions between Annotto Bay and Port Maria. The Chi-square test was chosen because it is a non-parametric test that deals with categorical data which is the case in this study. More specifically, this statistical technique measures if an association exists between the data collected from the two communities. A few assumptions for the Chi-Square Statistical Test are as follows: (1) random sample data are assumed; (2) the data measurement must be nominal (3) the data must be in frequencies, rather than percentages; and (4) the categories of variables must be mutually exclusive and exhaustive (Kachigan, 1986). The data used in this research adhere to these assumptions. SPSS was used to assist in coding the data and performing and analyzing the statistical information from the data collected.

4.4 Summary

The methodology provides a means of combining the geographic context of an area with its social fabric in an effort to understand flood risk and perception and the role of experience more fully. The survey and statistical analysis allow for actual risk and perceived risk of two communities to be compared and conclusions drawn from the results.

CHAPTER 5: ANALYSIS AND DISCUSSION OF RESULTS

In this chapter, the results of the survey are presented. The analysis is done by presenting key information about the survey respondents such as personal characteristics, flood damages and flood experience. Additionally, the remaining analysis is done in four parts mirroring the four research questions outlined in Chapter One. The first part presents the demographic factors such as age, gender and length of residency in both communities. The extent to which each factor influences flood risk perception was examined. The second part presents the results of actual risk versus perceived risk between the communities of Annotto Bay and Port Maria to understand if there is any difference and if not why. Part three presents the results of the analysis relating to the extent to which experience with floods influences risk perceptions in both communities. Finally, part four presents the perceptions of the residents of Annotto Bay and Port Maria in regards to what can be done to mitigate flood risk.

5.1 Personal Characteristics of Survey Respondents

The overall sample size of this research was 86 individuals, 44 from Annotto Bay and 42 from Port Maria. In order to gain a better understanding of the sample of survey respondents, it is essential to briefly discuss some of the personal characteristics of the population, such as gender, age, number of years at current residence, number of individuals residing in household and socio-economic status. These characteristics may have an impact on the respondent's flood perceptions.

Most of the survey respondents are women (59.3 %) compared to 40.7% of males. Annotto Bay had 17 (38.6%) males and 27 (61.4%) females and Port Maria had 18 (42.9%) males and 24 females (57.1%) as shown in Figure 5.1. This deviated slightly compared to the

general census for the parish which indicated 57,029 (50.19%) males and 56,586 (49.81%) females (Statistical Institute of Jamaica 2011). Most of the respondents in both communities have resided in the community and at their current address for a long time with 65.4% indicating that they have lived there for 20 years or more.

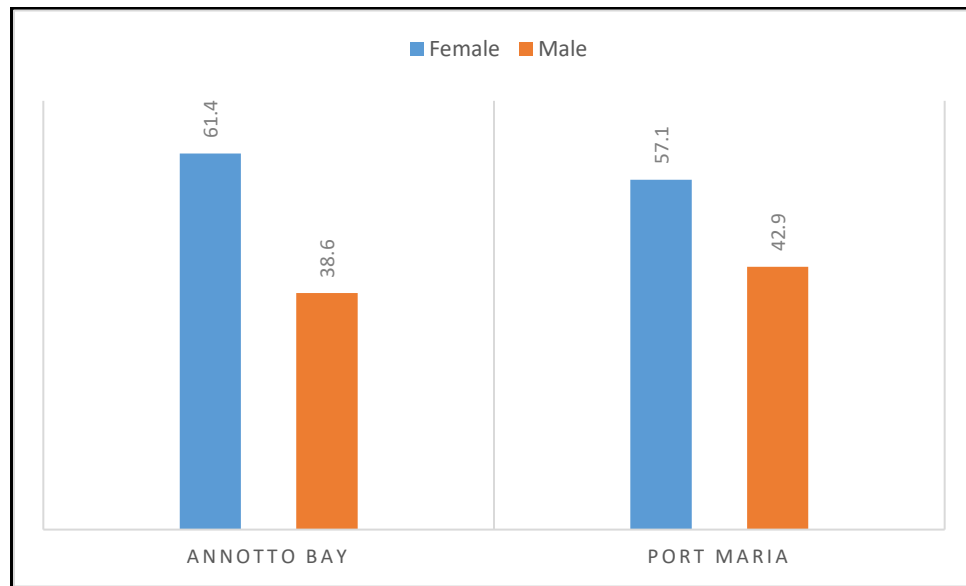


Figure 5.1 Gender Distribution of Respondents

The age distribution of the respondents resembled the general census of the parish of St. Mary, Jamaica. Based on the 2011 census prepared by the Statistical Institute of Jamaica of the age groups of the parish of St. Mary (Table 5.1), the results of the survey mirrored those numbers closely. However, the categories used by Statin (2011) were different from those of the survey which made it impossible to compare. A majority of Annotto Bay respondents were between the ages of 25-57 years old. There was a slight deviation in the case of Port Maria where majority of the respondents were between the ages of 36-68 years old (Table 5.1).

Table 5.1 Age Distribution of Respondents

Age Categories	Freq. Annotto Bay	% Annotto Bay	Freq Port Maria	%Port Maria
25-45	23	52	16	38.1
46-68	18	40.9	23	54.8
69-80	3	6.8	3	7.1
Total	44	100	42	100

The Statistical Institute of Jamaica (2011) reported that the average household size for Jamaica is three individuals. Data from both communities indicate that their average household size is three individuals, however there is a wide range of household sizes in the communities (Table 5.2).

Table 5.2 Household Size Distribution

Number of Individuals living in household	Parish (%)	Annotto Bay (%)	Port Maria (%)
1	9.50	9.1	16.7
2	12.08	22.7	14.3
3	15.71	22.7	23.8
4	17.67	25.0	11.9
5	15.29	4.5	14.3
6	10.63	13.6	16.7
7	7.08	0.0	2.4
8	4.60	2.3	0.0
9	2.56	0.0	0.0
10	4.87	0.0	0.0
Total	100	100	100

5.1.1 Flood Experience of Survey Respondents

Flood experience among the respondents was constant as 100% of the sample experienced some sort of flooding event. However, the number of floods experienced by each community and household varied. The majority of residents residing in Annotto Bay reported experiencing two to four floods (Table 5.3). More specifically, 22.7% reported experiencing two floods while 36.4% reported experiencing three floods. A similar situation was revealed for Port Maria were 21.4% reported experiencing two floods and 19.0% reported experiencing three floods. Interestingly, 28.6 % of Port Maria residents reported that they experienced four floods, which is the highest percentage of the overall sample.

Table 5.3 Flood Experience Between Communities

Name of Community	Breakdown	Number of Floods Experienced							
		1	2	3	4	5	6	7	8
Annotto Bay	Count	4	10	16	7	2	5	0	0
	Percentage	9.1%	22.7%	36.4%	15.9%	4.5%	11.4%	0.0%	0.0%
Port Maria	Count	6	9	8	12	3	2	1	1
	Percentage	14.3%	21.4%	19.0%	28.6%	7.1%	4.8%	2.4%	2.4%

Approximately 4.6 % of the respondents experienced flooding at a previous residence and current business. Damage experienced by residents was measured on a Likert scale from 1-5, with 1 representing little or no damage and 5 devastating damage. When asked about the damage they experienced, roughly 11.4% of Annotto Bay residents rated the damage at 3 on the Likert scale, 45.5% rated it at 4 on the scale, while 43.2% reported 5 (Table 5.4). Port Maria had

somewhat the same perception of damage as Annotto Bay. Roughly 14% of the residents of Port Maria reported a 3 on the scale, while 42.9% and 42.9% reported 4 and 5 respectively.

Table 5.4 Overview of Perception of Damage Experienced

Name of Community	Breakdown	Likert Scale (3) Moderate Damage	Likert Scale (4) Badly Damaged	Likert Scale (5) Devastating Damage	Total
Annotto Bay	Count	5	20	19	44
	Percentage	11.4%	45.5%	43.2%	100%
Port Maria	Count	6	18	18	42
	Percentage	14.3%	42.9%	42.9%	100%

A more detailed breakdown is shown in Figure 5.2 with respect to the different communities, indicating that the categories of losses to floods do not differ a great deal.

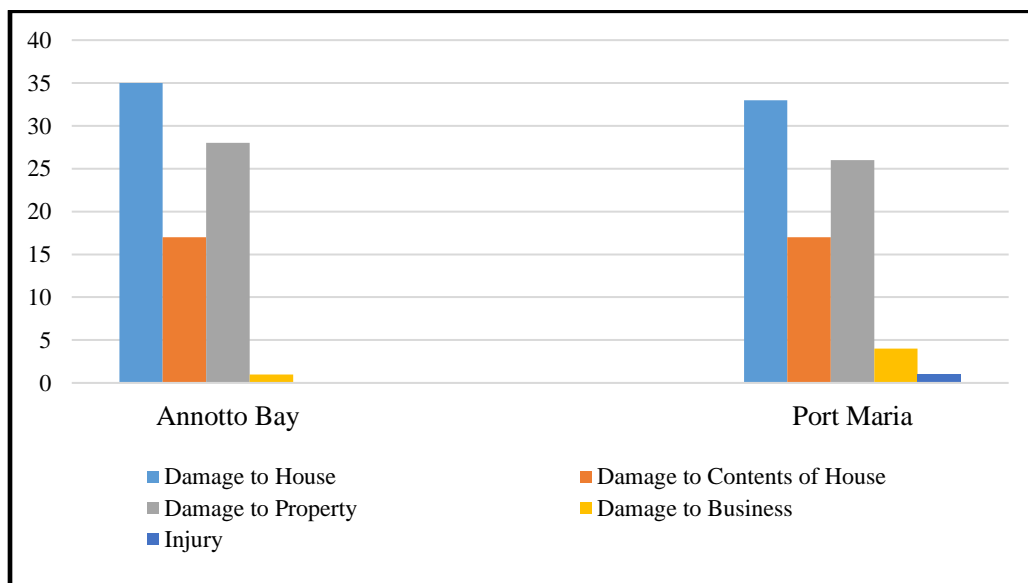


Figure 5.2 Damages Reported by Respondents in Annotto Bay and Port Maria

Over 60% of the respondents reported that hurricanes were responsible for the flood events experienced. This is not surprising due to Jamaica's location and climate; tropical storms

and hurricanes result in more flooding than any other meteorological event. Roughly 38% of the survey respondents reported that heavy rain accounted for the flooding they experienced. When asked when the most devastating flood a respondent could remember was, the results varied with the frequency and percentages shown in Table 5.5. More than 35% of Port Maria residents reported the flood of 2006 influenced by heavy rainfall was the worst they could remember compared to the 4.5% reported by the residents of Annotto Bay. Also, 26.2 % of the residents from Port Maria indicated that the flood of 2012 was the most devastating event remembered. Interestingly, no respondent from Annotto Bay reported the 2012 floods. The most devastating hurricane reported by the respondents of Annotto Bay was Hurricane Sandy (20.5%), while for Port Maria it was Hurricane Ivan in 2004 (11.9%).

Table 5.5 Most Devastating Event Remembered

Hazard Name	Date Occurred	Annotto Bay %	Port Maria %
Flood	November 2006	4.5	35.7
Ivan	September 2004	18.2	11.9
Sandy	October 2012	20.5	7.5
Flood	November 2012	0.0	26.2
Gilbert	September 1988	15.9	7.1
Dennis	August 2005	13.6	4.8
Nicole/Flood	October 2001	15.9	0.0
Gustav	September 2008	6.8	4.8
Emily	July 2005	2.3	0.0
Dean	August 2007	2.3	0.0
Mathew	October 2016	0.0	2.4
Total	-	100	100

Based on Port Maria's location and accounts from residents, it does not have to rain in the town itself for it to be flooded. The town is relatively flat and surrounded by higher land. As a result of this, if rain falls in the neighboring communities due to the topography of the area, that water travels into the town and sometimes results in minor flooding.

The town serves as the outlet not just for itself but also its neighboring communities. Flash flood events are responsible for most of the floods experienced without a warning (Mandal & Maharaj 2013). Warning systems play a very important role in decision making based on the PADM and SARF models in the literature. It is the warning received by an individual that may prompt a decision to evacuate or stay during an event. When asked if they were warned about any of the floods experienced, 97.7% reported yes.

The medium of warning varied among the respondents, but most were warned by way of television and radio (Table 5.6). (The percentages reported in Table 5.6 total to more than 100% because this was a multi-answer question). When asked if they have ever experienced a flood without warning, 40.7% said Yes and 59.3% said No.

Table 5.6 Media by Which Respondents were Warned

Medium	Frequency	Percent %
Television	73	84.9
Radio	61	70.9
Facebook	10	11.6
Newspaper	0	0
Word of Mouth	0	0

Over 51% reported that they were confident in the flood warning systems. The confidence level in current hazard warning systems varied slightly between communities. The respondents from Annotto Bay reported 45.3% high and 42% very high confidence in warning systems (Figure 5.3). A different picture was seen in Port Maria where 57.1% reported high confidence and 28.6% reported very high confidence.

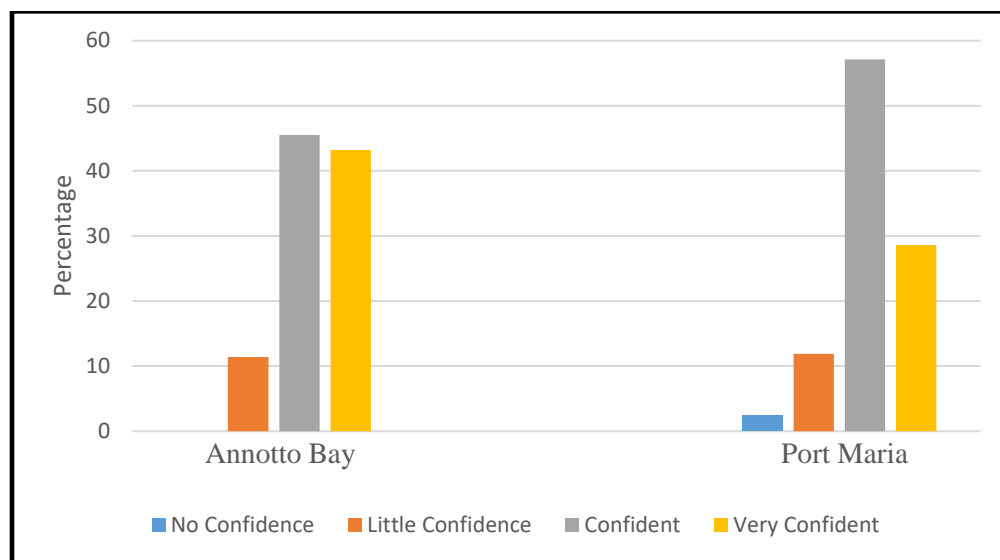


Figure 5.3 Confidence Level in Warning Systems

5.1.2 Action

When asked if they took any protective measures before, during or after a flood, more than 70% of the respondents from both communities reported that they had taken some sort of protective measure (Table 5.7). It can be concluded then that residents of both communities understand their risk and are taking actions to reduce damage experienced. This is evident in the high number of individuals who answered yes (37 of 44 from Annotto Bay and 32 of 42 from Port Maria). Over 17% of the total number of respondents evacuated and 55.8% elevated their furniture/valuables. Approximately 40 % of the total number of respondents reported that they went to a shelter, 29% going to a public school. Others reported that they went to churches

(15.1%) and the courthouse (7%), and 9.3% stayed to watch their homes and property. Of the 19.8 % who did not take any protective measures, 12.8% reported that they did not think the flood would affect them, 4.7% did not have the time and 2.3% were not home.

Table 5.7 Protective Action Taken

Name of Community	Breakdown	Did you take any protective measure?		Total
		Yes	No	
Annotto Bay	Count	37	7	44
	Percentage	84.1%	15.9%	100%
Port Maria	Count	32	10	42
	Percentage	76.2%	23.8%	100%

Based on this discussion of the personal characteristics of the respondents, more specifically flood experience and household attributes, it is only fitting to explore some of the respondents' perceptions to flooding by means of attitudinal questions in both Annotto Bay and Port Maria before looking at any statistical associations that may exist.

5.1.3 Perceptions of Survey Respondents

Understanding the perception (the way people think/express themselves) of a community is crucial when implementing programs and policies. Throughout this research, perception was measured using attitudinal questions to get a sense of how individuals feel about their flood risk (Table 4.1). Table 5.8 shows the complete list of the perception questions used throughout this chapter. A key perception question is question 16 on the survey which asks, how high a risk is flooding to the community? The respondents were given five options to choose from, more specifically: no risk, little risk, somewhat of a risk, high risk and very high risk. None of the respondents from the sample indicated that their community is at no risk or little risk in regards

to flooding. The results from this question are probably a reflection of the sample's personal characteristics and damage incurred to their places of residence/business. This means that the respondents perceive their community to be at high to very high risk, which is not surprising given the experience characteristics presented in the previous section (Figure 5.4)

Table 5.8 Perception Questions

Perception questions used throughout the research	Question 16- How high a risk is flooding to the community?
	Question 18- What threat concerns you more?
	Question 20- Do you believe that your home/business place will get flooded in the near future?
	Question 21- If warned about a flood, how likely are you to take protective measures?
	Question 23- Have you thought about moving away from the community because of the flood hazard?

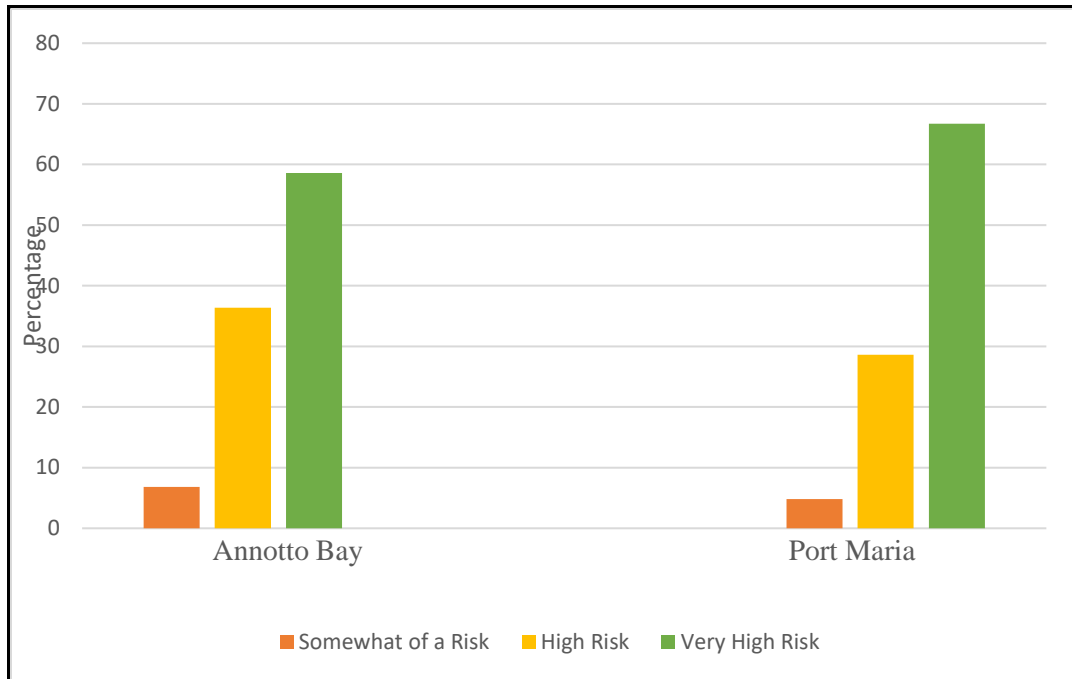


Figure 5.4 How High a Risk Is Flooding to the Community?

The tables below illustrate the general perception of the respondents from both communities, based on their responses to the questions in Table 5.8. The data in these tables suggest that perception is high and residents understand the need to take protective action.

Table 5.9 What Threat Concerns You Most?

Variables	Count	Percentage
Coastal flooding	18	20.9
River overflowing its banks	51	59.3
Ocean restricting water from leaving	17	19.8
Total	86	100.0

Table 5.10 Do You Believe Your Home or Business Will Get Flooded in The Future?

Variables	Count	Percentage
Yes	84	97.7
No	2	2.3
Total	86	100.0

Table 5.11 If Warned Would You Take Protective Measures?

Variables	Count	Percentage
Not Likely	2	2.3
Somewhat Likely	15	17.4
Very Likely	69	80.2
Total	86	100.0

Table 5.12 Have You Thought about Moving from this Community due to Flooding

Variables	Count	Percentage
Yes	52	60.5%
No	34	39.5%
Total	86	100.0%

5.2 Demographic Factors and Perception-Research Question #1

As mentioned earlier, Chi-Square tests were used in this study to detect if independence exists between several variables including the following: age and perception, gender and perception and length of residency and perception. Several demographic questions were tested against perception to determine if any significant associations exist. To accomplish this, several variables were collapsed to allow for proper analysis (to ensure expected counts greater than 5), specifically the length of residence and age variables. Of these questions, none yielded significance (Table 5.13). It can be concluded that for this case study, demographic factors are not associated with differences in perception. Please see appendix B for a more detailed view of these associations.

Table 5.13 Demographic Factors and Perception (Question 16)

Variable Tested	Chi-Square Value	p-value
Age vs Perception	2.638	.620
Gender vs Perception	4.551	.103
Length of residence vs Perception	9.055	.060
Monthly JMD income vs Perception	13.977	.302

In an attempt to understand how the residents feel about the local authorities mitigating flood risk in their respective communities, several cross-tabulation tests were conducted. Variables such as age, gender, length of residency and monetary earnings were tested against questions 24 and 25 which examine the residents' perceptions of local authorities and what is being done to reduce flood risk in the communities of Annotto Bay and Port Maria. Of the eight

tests conducted, only one had statistical significance, shown in Table 5.14. More specifically, the respondent's age is significantly associated with their knowledge of local authorities taking any actions to reduce flood risk. Despite the results having a relatively weak association, nevertheless the association is significant, suggesting that those 47 to 68 years of age were more likely to believe that the local authorities are taking some form of action to reduce flood risk.

Table 5.14 Respondent's Age and Knowledge of Local Authorities Taking Action to Reduce Flood Risk

Age Categories	Breakdown	Knowledge of local help		Total
		Yes	No	
25-46	Count	11	28	39
	Percentage within knowledge	28.9%	58.3%	45.3%
47-68	Count	22	19	41
	Percentage within knowledge	57.9%	39.6%	47.7%
69-80	Count	5	1	6
	Percentage within knowledge	13.2%	2.1%	7.0%

$$X^2=9.259$$

$$\text{Significance}=.010$$

Question 20 of the survey asks the respondent to indicate whether or not they believe their home or business will get flooded in the future. Demographic factors were tested against this question to identify if any association exists. Of the four tests conducted, none yielded any significant association (Table 5.15). This means that perception of future flood threat is not influenced by the demographic factors.

Table 5.15 Demographic Factors vs Perception (Question 20)

Variable Tested	Chi-Square Value	p-value
Age vs Perception	.155	.925
Gender vs Perception	.407	.816
Length of residence vs Perception	.073	.786
Monthly JMD income vs Perception	4.025	.673

Question 23 of the survey sought to get an idea if individuals were willing to move away from their community because of the flood hazard. Of the four tests conducted, no significant association exists between demographic factors and the decision to move away due to the flood hazard (Table 5.16). In other words, in this case, demographic factors have no association with the decision to reside or leave their respective communities.

Table 5.16 Demographic Factors vs Perception (Question 23)

Variable Tested	Chi-Square Value	p-value
Age vs Perception	4.156	.125
Gender vs Perception	1.680	.432
Length of residence vs Perception	1.622	.203
Monthly JMD income vs Perception	8.342	.214

5.3 Perceived Risk-- Research Question #2

To provide an answer for the second research question, it was necessary to conduct crosstabulations to determine whether or not perceived risk differs between the two communities (Annotto Bay and Port Maria). Each community was tested against question 18 of the survey which asked which threat concerns them more, with the community results in the response shown earlier in Table 5.9. This test yielded a statistically significant association, with a X^2 of 22.226 (significance = .000).

Table 5.17 Flood Threat between Communities

Threat Concern	Breakdown	Coastal Flooding	River overflowing its banks	Ocean restricting water
Annotto Bay	Count	11	33	0
	Percentage	25%	75%	%0
Port Maria	Count	7	18	17
	Percentage	16.7%	42.9%	40.5%

Due to the closeness of the towns to the ocean, especially Annotto Bay, it was anticipated that coastal flooding would be seen as the greatest threat. However, based on the crosstabulation results, the river overflowing its banks was reported as the threat that concerns them most (75%) compared to the 25% who reported that coastal flooding concerned them most. On the other hand, Port Maria painted a different picture. When asked which threat concerns them most, it was somewhat equal between the threat of the river overflowing its banks and the threat of the ocean restricting the water from leaving the town. Port Maria had a lower percentage concerned about the threat of coastal flooding. The town of Annotto Bay does not have the stone barriers that are present in Port Maria and that may explain the 25% of the respondents who reported

coastal flooding as the threat that concerns them most. The Pearson Chi-Square value of 22.266 indicates that a significant association exists between the community of residence and flood threat concern and that the type of risk also differs.

To offer an explanation for the differences between communities in perception about the greatest flood threat, perceived risk (Question 16) was tested against the scale of damages incurred and the impacts experienced to see if a significant association was present. The test between perceived risk and scale of damage did not yield any significance. When perceived risk was tested against specific impacts experienced, two of the five yielded significance, damage to contents of house and damage to the house. Tables 5.18 and 5.19 show the association between perceived risk and question 10 of the survey which asked respondents to report the impacts they experienced. For the analysis, since nobody reported little or no risk, it was not necessary to include those variables in the analysis. The categories of somewhat of a risk and high risk were combined and are shown as some risk in the tables, while the very high risk category is shown as such. In Table 5.18, 76.5% of the overall sample who experienced damage to contents during a flood event perceived their community to be at high risk, while those with a smaller percentage experiencing no damage indicated that they perceived their community to be at high risk. The same picture was painted for individuals who experienced damage to their homes during a flood event (Table 5.19). More specifically, those whose homes were damaged perceived a greater risk compared to those with no damage. Over 66% of the overall sample who reported having experience with flood water damaging their homes perceived that the community is at high risk. In these two cases, it can be concluded that while the overall damages did not yield a significant result, more specific experiences can influence risk perception, in these cases damages experienced to the homes and the contents thereof.

Table 5.18 Perceived Risk (Question 16) and Damage to Contents of Home

		Damage to contents		Total
		Yes	No	
Some Risk	Count	8	25	33
	Percentage within damage	23.5%	48.1%	38.4%
Very High Risk	Count	26	27	53
	Percentage with damage	76.5%	51.9%	61.6%

$$X^2= 5.238$$

$$\text{Significance}= .022$$

Table 5.19 Perceived Risk (Question 16) and Damage to Home

		Damage to house		Total
		Yes	No	
Some Risk	Count	22	11	33
	Percentage within damage	32.4%	61.1%	38.4%
Very High Risk	Count	46	7	53
	Percentage within damage	67.6%	38.9%	61.6%

$$X^2= 4.978$$

$$\text{Significance}=.026$$

Some 95% of the respondents from Port Maria, and 100% from Annotto believe that their homes or businesses will be flooded in the future (Table 5.20). Both communities shared a similar view that flood magnitudes and frequency have increased over time with almost 80% of respondents from Annotto Bay reporting yes and 86% from Port Maria doing the same (Table 5.20). Thus, respondents appear to see flood risk as a community and a personal risk.

Table 5.20 – Perception (Question 20) and Future Flooding

Name of Community	Breakdown	Do you believe your home or business will get flooded in the future?		Total
		Yes	No	
Annotto Bay	Count	44	0	44
	Percentage	100%	0.0%	100%
Port Maria	Count	40	2	42
	Percentage	95.2%	4.8%	100%

Table 5.21 Perception of Increased Flood Frequency and Magnitude

Name of Community	Breakdown	Have the frequency and magnitudes of floods increased over the years?		Total
		Yes	No	
Annotto Bay	Count	35	9	44
	Percentage	79.5%	20.5%	100%
Port Maria	Count	36	6	42
	Percentage	85.7%	14.3%	100%

All 86 respondents reported that the threat of flood concerns them (Question 17). However, 40% of the respondents indicated that they have not thought about leaving the town in which they reside (Question 23). This is surprising considering that 100% of the respondents perceive the flood threat to be important especially with the personal experiences and damages incurred over the years. The other 60% of the sample indicated that they have thought about leaving. Comments offered by the respondents led to the conclusion that younger individuals, typically those 25-35, have thought about moving more than their older counterparts, perhaps because of mobility or because income was a limiting factor. Given this understanding of the

overall patterns, it is important to assess statistical analyses in order to elucidate any association between these factors.

5.4 Associations between Past Experience and Flood Perception-Research Question #3

In keeping with the literature, it is suggested that older people will be less likely to take protective measures during a flood (Norris and Murrell 1988). It is believed that they have the notion that they have experienced so many floods before, this one will not be any different. In other words, whatever damages occur, they believe they can survive them. The test between ages of the respondents and whether or not they took protective measures (Question 11) yielded significance, shown in Table 5.22. In order to analyze these results, the original age groups in the survey had to be collapsed due to the fact that there were too many original categories and thus yielded expected counts less than 5. The results show that 61.5% of respondents between the ages of 25-46 reported taking a protective measure, while 95.1 of the respondents between the ages of 47-68 reported that they took protective measure during flood events. Individuals between the ages of 69 to 80 (100%) of the individuals reported taking protective measures. Based on the results it can be concluded that the older the individual, the more likely they are to take protective measures.

Table 5.22 Age and Whether or Not Protective Measure Taken

Age Categories	Yes	No	Total
25-46	61.5%	38.5%	100%
47-68	95.1%	4.9%	100%
69-80	100%	0.0%	100%

$$X^2=15.803$$

Significance=.000

Experience was measured in terms of the number of times one experienced a flood, damages incurred and whether or not a protective action was taken. So, three separate questions were used to determine the presence of association between experience and perception (Questions 16,20,23). Of the tests conducted (Tables 5.23, 5.24 and 5.25), none were significant. It can be concluded then that experience with floods in this context is not associated with the perceptions of the residents of Annotto Bay and Port Maria.

Table 5.23 Flood Experience and Perception (Question 16)

Flood Experience and:	Pearson's Chi-Square	p-value
Q16: Flood risk to community	14.304	.427
Q20: Future flooding	4.672	.700
Q23: Moving from area	7.427	.386

Table 5.24 Flood Experience and Perception (Question 20)

Flood Experience and:	Pearson's Chi-Square	p-value
Q16: Flood risk to community	4.672	.070
Q20: Future flooding	3.113	.211
Q23: Moving from area	1.180	.277

Table 5.25 Flood Experience and Perception (Question 23)

Flood Experience and:	Pearson's Chi-Square	p-value
Q16: Flood risk to community	7.427	.386
Q20: Future flooding	.813	.666
Q23: Moving from area	3.298	.069

The associations between damages experienced and perception also yielded no significance. Question 10 explored the damages experienced by the residents of both towns. This was a multi-answered question with these specific impacts asked: did you receive damage to house, contents of the house, property, business and injury. The overall the results shown in Table 5.26 indicate that no significant association exists between the damages received by respondents and their perceptions.

Table 5.26 Chi-Square Results of Damages Experienced and Perceptions

Damages Experienced and:	Pearson's Chi-Square	p-value
Q16: Flood risk to community	5.318	.256
Q20: Future flooding	3.113	.211
Q23: Moving from area	.813	.666

In keeping with the literature of the PADM adapted from Lindell & Perry (2012), warning messages play a vital role in pre-event actions and threat perception. A notion generally accepted throughout research is that individuals who are warned should take some sort of action

to protect themselves (Lindell & Perry 2012). In most cases, the knowledge and experience an individual has of a particular hazard may not only influence the type of protective behavior they seek but also the overall perception of hazards. Of the four tests conducted, only one yielded significance which is that individuals who took an action believe that the community is at risk (Table 5.27). In regards to the decision to take action, future flooding and moving from the area, there was no statistical significance. Overall, the relationships were relatively weak, however significant, indicating that there is an association between the taking a protective action and flood perception.

Table 5.27 Protective Action and Perception Question 16

Protective action and:	Pearson's Chi-Square	p-value
Q16: Flood Risk to community	19.132	.000
Q20: Future flooding	1.180	.227
Q23: Moving from area	3.298	.069

Respondents who reported yes to taking protective action were more likely to perceive the community to be at very high risk (71%), while less than 27% that said no indicated the same (Table 5.28). These results indicate that the residents of Annotto Bay and Port Maria understand their risk and are willing to take action. Even though some 60% of the overall sample said they have thought of moving away due to flooding, the results from the crosstabulation between communities yield no significance ($X^2=1.117$ and p-value of .291). In other words where the residents reside does not influence their decision to move away due to flooding.

Table 5.28 Protective Action and Perceived Flood Risk

	Respondent's answer	Breakdown			Total
			Some risk	High risk	
Did you take any protective measure?	Yes	Count	19	49	69
		Percentage	27.3%	71.0%	100%
	No	Count	9	4	17
		Percentage	52.9%	23.5%	100%

$$X^2=19.132$$

Significance=.000

5.5 Perceptions of Mitigative Actions-Research Question #4

In keeping with the fourth research question, the respondents were asked about their perceptions of mitigative measures to address the issue of flooding in these coastal towns. To understand what their perceptions are, two questions were asked. The first question (#24 on survey) was: to your knowledge, are the local authorities taking actions to reduce flood risk in the community? A Chi-square analysis revealed no association. Table 5.29 shows the results reported by the respondents.

Table 5.29 Perception of Local Authority Taking Actions to Reduce Flood Risk

Name of Community	Breakdown	Knowledge of local help		Total
		Yes	No	
Annotto Bay	Count	22	22	44
	Percentage	50.0%	50.0%	100.0%
Port Maria	Count	16	26	42
	Percentage	38.1%	61.9%	100.0%

It can be concluded that location (Annotto Bay and Port Maria) is not associated with knowledge of local authorities' actions to mitigate flood risk.

The results for Annotto Bay indicate that 50% of the respondents believed that the local authorities are indeed taking some sort of action to reduce flood risk to the community while the other half said no. Port Maria showed a difference in that 38.1% reported yes while 61.9% reported no. Both towns are in the parish of St Mary and are governed by the St. Mary Parish Council and are therefore subject to the same policies and plans. Such a perception could leave residents to believe that they are on their own and this could create somewhat of a detached attitude towards flood perception and protective measures despite the repeated damages experienced. Question 25 on survey then asked if they believe that the relevant authorities are doing enough to reduce the risk of flooding in the respective communities. Table 5.30 shows the results reported by the residents. These results somewhat followed the trend of the previous question with the exception that 93% believed that the authorities are not doing enough, suggesting perhaps that the authorities are taking some sort of action but not enough.

Table 5.30 Perception of Local Authorities Doing Enough to Reduce Flood Risk

Name of Community	Breakdown	Relevant authorities help		Total
		Yes	No	
Annotto Bay	Count	4	40	44
	Percentage	9.1%	90.9%	100.0%
Port Maria	Count	2	40	42
	Percentage	4.8%	95.2%	100.0%

Finally, question 26 asked the residents about their own perception of what can be done to mitigate flood risk. In other words, if given the authority to reduce flood risk, what would they do? Every respondent chose some sort of structural/technological fix to mitigate flood risk as shown in Figure 5.5. The study conducted by the ODPEM concurred with the results from the residents where implementing some sort of structural fix, in this case constructing stone/gabion baskets as well as cleaning the drains, were among the mitigative measures listed (Table 5.31).

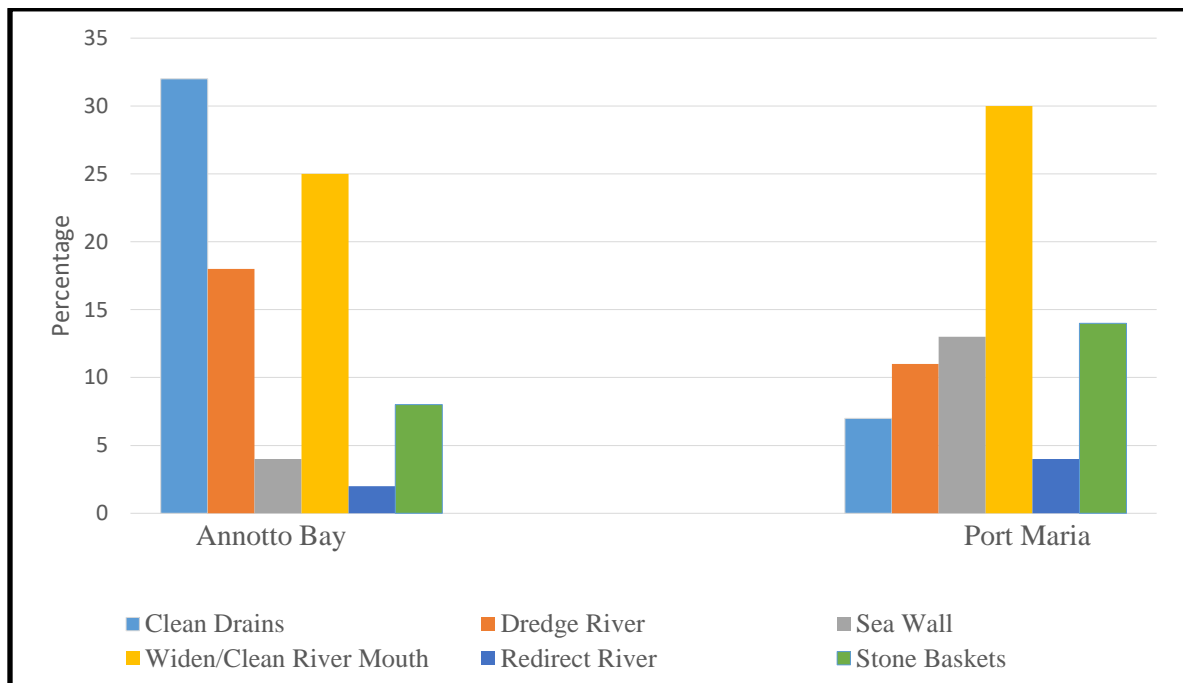


Figure 5.5 Residents' Perceptions of What can be Done to Mitigate Flood Risk

Table 5. 31 Hazards and Corrective Actions

Hazard	Vulnerable Assets	Corrective Actions
Flooding	Flooding Infrastructural damage; damage to agriculture; affects the livelihood of community members	<ul style="list-style-type: none">• Gabion Basket• Early warning systems• Maintenance of drainage systems• Keep keys and important documents in safe and easily accessible areas
Hurricanes	Destruction of property. Loss of lives	<ul style="list-style-type: none">• Enforce building codes• Heed early warnings -Evacuative if necessary -Stock up and secure emergency materials• Secure property and livestock• Generators• Keep keys and important documents in safe and easily accessible areas.

Source: Office of Disaster Preparedness and Emergency Management (ODPEM 2012a)

There are some interesting differences between the communities. In an effort to explain the mitigative options chosen by the residents, a qualitative comparison was done. Crosstabulations tests were conducted regarding flood threat and mitigation recommendations between the two communities. Of the seven tests conducted, only three yielded significant associations, specifically, flood threat, cleaning of drains and building a sea wall (Table 5.32). The residents of Annotto Bay mostly preferred cleaning the drains and dredging the river to reduce flood risk which is not the case for Port Maria (Figure 5.5). Both towns reported the belief that widening/cleaning the river mouth will mitigate flood risk. Cleaning the drains, dredging the river, widening or cleaning the mouth of the river and putting in stone baskets along the river are options also listed by the ODPEM (Table 5.31). The other mitigation

recommendations did not have an association, nevertheless they align fairly well with the specific hazard concerns.

Table 5.32 Perceived Flood Threat and Mitigation Recommendation

Perceived Flood Threat and Mitigation Recommendations	Pearson's Chi-Square	p-value
Flood Threat	22.266	.000
Clean drains	31.507	.000
Widen/clean river mouth	.699	.403
Dredge river	3.066	.080
Build sea wall	5.431	.020
Redirect river	.620	.431
Stone Baskets	1.841	.175

None of the residents talked about early warning systems or securing important documents which is a mitigative measure in the study conducted for each community by the ODPEM (2012 a/b). This reinforces the need for information about non-structural means of reducing flood risk. The residents mentioned several structural actions that were not mentioned in the ODPEM plan and this could explain the observed results.

5.6 Summary

The findings seem to indicate that demographic factors are not associated with perception or differences between the two communities. The literature gives the general notion that age should influence perception and in this case, it was associated with taking protective action. Port Maria results yielded what was expected that both the river and the water leaving the town were

perceived as the greatest risks. Flood experience, in terms of number of floods experienced, damages incurred and the decision to take protective measures are associated with the perceptions of the residents. It was expected that the number of floods and damages incurred would provide some statistical association towards perception, however when the tests were conducted, no association was found. Finally, the residents seem to have a good local knowledge of structural ways to reduce the risk of flooding in the towns of Annotto Bay and Port Maria. Most believed that cleaning the drains, widening the mouth of the river, dredging the river and putting stones baskets along the river would mitigate flood risk tremendously.

CHAPTER 6: CONCLUSIONS

The purpose of this chapter is to summarize the results of research and to discuss the implications of these findings. This research focused on flood risk perception and the role of experience in the communities of Annotto Bay and Port Maria, both located in the parish of St. Mary in Jamaica. A brief survey was used to collect demographic information and measure flood perceptions. The objectives of this research were to determine what demographic factors if any influenced flood perception among the residents, paying close attention to the role of past experience with floods in the form of the following: number of times respondents experienced a flood, whether or not a protective action was taken, and damages incurred as a result of floods. Also, a key objective was to identify whether perceived risk differs between the two communities. The results indicated some significant associations.

6.1 Overview of Findings

The first research question addressed the issue of whether or not demographic factors are associated with flood perception. It was expected that age and socio-economic status would influence flood perception. However, of the demographic factors tested, none yielded a significant association. So, demographic factors in this instance do not influence perception.

Another interesting finding was revealed in the community of Annotto Bay. Based on the flood history provided by the ODPEM (2012a), ocean flooding of the town is seen as the greatest threat; however, 75% of the respondents reported that they were concerned more about the river overflowing its banks than the ocean flooding the town. The floods of 2006 and 2012 in Port Maria were exacerbated by the narrow outlet at the river mouth and the ocean restricting the water from leaving the town. Nevertheless, residents made it clear that the two threats that

concern them most are the river overflowing its banks and the ocean restricting the water from leaving the town.

To address the social fabric, the third question considered in this research dealt with past experience and whether or not it influenced perception. It was expected that the age of the residents would be associated with flood perceptions. The results did indicate that older individuals perceived the flood threat much more than the younger populous. Overall it was expected that past experience with floods would be a significant indicator of hazard perception. While less than half of the variables tested had significant associations, one cannot ignore the associations that were in fact significant, such as experience and flood perception and damage and flood perception. Another key result revealed that those individuals who received damage to their homes and the contents of their homes were likely to take some sort of protective measure and had a greater perception of their risk. Drawing from the PADM, it was expected that information sources should influence decision making. Of the four variables tested, only one yielded significant associations. More specifically, individuals who took protective measures also believed that the community was at risk to flooding.

6.2 Link to Theoretical Models

The residents of both Annotto Bay and Port Maria used their experience with floods to make a decision. For some, it was the damages experienced or the location of their homes with respect to the ocean or river. In other words, this research has found through statistical analyses that individuals that have previous experience with a threat will use that experience as a means of making a decision whether to take protective measures or not in the case of a flood threat.

On the other hand, the relationship between the SARF and the results obtained paint a different picture. The main argument presented by Kasperson et al. (1988) is that, based on cultural, social and cognitive processes, individuals may increase or attenuate the perception of risk. There is no clear indication of amplification or attenuation of risk by the respondents. Most recognized the level of risk to which they were exposed. In cases like this, it is safe to say that respondents understood the danger of the risk but probably due to sense of place, financial capacities or mobility, they cannot remove themselves from such risks.

6.3 Contributions of the Research

This research investigates the differences in risk perception in two communities with different flood frequencies, sizes and magnitudes. Since most of the existing research within the literature has been conducted in the United States and Europe, this study being done in the Caribbean and in a country with a smaller populous, different climatic conditions and socio-economic status not only tests the applicability of the various models and theories but also creates a platform for future risk perception research not just in Jamaica but in the Caribbean at large. Typically, the role of experience and perceived risk would have been examined separately, but this study combines the two and examines both factors in two topographically different locations. This study examines risk perception that incorporates ideas from a variety of disciplines. With that in mind, the study seeks to fill the gaps that exist within the literature and provide a thorough knowledge of risk perception in the context of a developing country and in doing so will influence proper policy making and implementation.

Due to the fact that the research is a case study and only had eighty-six respondents between the two communities, it is somewhat problematic to generalize and relate these results on a larger scale. Nevertheless, the importance of case studies should not be underestimated in hazards

research. Although the relationship between demographic factors and flood perception was not as straightforward as expected, the significant findings are still quite instructive, and more research on other specific areas probably with a larger sample group in the future may yield even more explanation for the associations found. Dominant factors such as length of residency and whether or not a warning was received seemed to play more of a role in perception than the overall damages, which eventually directly results from past flood experience.

The study demonstrated the relevance of experience in flood perception with length of residency while undermining the role of age in influencing perceptions. Perceptions of community risk and personal risk vary among residents. This was shown in the case of perceived risk differing between communities. More specifically, respondents viewed flooding as a risk to the community, however they did not necessarily personalize it. The residents also perceived that structural fixes are the best way to mitigate flood risk. This suggests a perception that someone else should be doing something (the onus is on the government). It also identifies the areas on which local authorities must focus.

6.4 Shortcomings of the Research

For future research, much better results may be obtained if a larger sample size is surveyed. However, due to time, monetary, and location constraints, it was not possible for this research. A better response rate may serve to validate existing associations and elucidate the associations that were not significant, such as damages incurred and flood risk perceptions. Also, the last census was taken six years before the research was conducted, thus, significant changes in the population may have occurred that would not be represented in the secondary information used.

In the future, it probably would be beneficial to address perception with physical vulnerability. Although such a link is not addressed in this research, it may be of interest to examine the presence of differences among residents in an inland area versus a coastal area. Also, it may be useful to examine differences between residents in urban versus rural areas.

6.5 Conclusions

Meteorological events have increased over the years and as such vulnerability to flooding has also increased. Jamaica is a developing country and is located in the general location of hurricanes that pass through the Caribbean. The damages experienced as a country have tremendously affected the economy and residents' livelihoods and as such it is important to examine vulnerability. This is even more important since individuals are making decisions that increase their vulnerability. In some cases, individuals are taking more risk than they need to, such as continuing to increase development in hazard prone areas. However, an important issue to consider is the underlying issue behind these perceptions: to what extent does one consider flooding a risk?

Ultimately, local officials should be concerned with educating in disaster preparedness and mitigative measures. Over and over Jamaica experiences hurricanes and tropical storms that create devastating damages, especially in coastal towns. A hurricane like Ivan in 2004 left the agricultural and tourism sectors at a huge disadvantage which are the main economic drivers of the country. Perceptions that individuals had concerning a hurricane of that magnitude have not been considered for years despite the fact that greater magnitude hurricanes have occurred but they have not led to the type of damage that Ivan did. Experience will eventually play a role in changing perceptions and as such we cannot wait until a disaster strikes to prepare, despite the high confidence in the warning systems. Government officials must place greater emphasis on

disaster planning and work closely with the community members to reduce loss early and implement more effective mitigation measures. In addition, this will help to identify vulnerable populations so proper measures can be taken to reduce the overall vulnerability of the community.

REFERENCES

- Anderson J. W. (1968). Cultural Adaptation to Threatened Disaster. *Human Organization*, 27, 298-307.
- Bell, B. D., Kara, G., & Batterson, C. (1978). Service Utilization and Adjustment Patterns of Elderly Tornado Victims in American Disaster. *Mass Emergencies*, 3, 71-81.
- Birkmann, J. (2006). Measuring Vulnerability to Promote Disaster-Resilient Societies: Conceptual Frameworks and Definitions. *Measuring vulnerability to natural hazards: Towards Disaster Resilient Societies*, 1, 9-54.
- Bolin, R. (1985). Disaster Characteristics and Psychosocial Impacts. In B. Sowder (Ed), *Disasters and Mental Health: Selected Contemporary Perspectives* (pp. 3-28) Rockville, MD National Institute of Mental Health.
- Collymore, J. M. (2011). Disaster Management in The Caribbean. Perspectives on the Institutional Capacity Reform and Development. *Environmental Hazards*, 10(1), 6-22.
- Cutter, S. L. (1993). *Living With Risk*. London: Edward Arnold.
- Cutter, S. L. (1996). Vulnerability to Environmental Hazards. *Progress in Human Geography*, 20(4), 529-539.
- Dostál P. & Langhammer J. (2006). Geographic Approaches to Flood Risk Modelling. In: Dostál P. & Langhammer J., Eds, *Modelling Natural Environment and Society* (pp. 81–99). Czech Republic: Prague Publishers.
- Horowitz M. J. (1976) *Stress Response Syndromes*. New York: Jason Aronson.
- Kachigan, S. K. (1986). *Statistical Analysis: An Interdisciplinary Introduction to Univariate and Multivariate Methods*. New York: Radius Press.
- Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Globe, R., Kasperson, J.X., & Ratick, S (1988). The Social Amplification of Risk: A Conceptual Framework. *Risk Analysis* 8(2), 177-87.
- Kron, W. (2005). Flood Risk, Hazard, Values, Vulnerability. *Water International*, 30(1), 58-68.
- Lindell, M. K. & Perry, R. W. (1992). *Behavioral Foundations of Community Emergency Planning*. Washington, DC: Hemisphere.
- Lindell, M. K. & Perry, R. W. (2012). The Protective Action Decision Model: Theoretical Modifications and Additional Evidence. *Risk Analysis*, 32(4), 616-632.
- Lion, R., Meertens, R.M., & Bot, T. (2002). Priorities in Information Desire about Unknown Risk. *Risk Analysis* 22, 765-776.
- Lopez-Marrero, T. & Wisner, B. (2012). Not in the Same Boat: Disasters and Differential Vulnerability in the Insular Caribbean. *Caribbean Studies*. 40(2), 129–16

- Mandal, A., & Maharaj, A. (2013). Flooding in Jamaica With Assessment of Riverine Inundation of Port Maria, St Mary. *Bulletin de la Societe Geologique de France*, 184(1-2), 165-170.
- Mazur, A. (1984) The Journalist and Technology: Reporting About Love Canal and Three Mile Island. *Minerva* 22, 45-66.
- Nandi, A., Mandal, A., Wilson, M., & Smith, D. (2016). Flood Hazard Mapping in Jamaica Using Principal Component Analysis and Logistic Regression. *Environmental Earth Sciences*, 75, 465.
- Norris, F. H. & Murrell, S. A. (1988). Prior Experience as a Moderator of Disaster Impact on Anxiety Symptoms in Older Adults. *American Journal of Community Psychology*, 16, 665-683.
- O'Connor, R. E., Yarnal, B., Dow, K., Jocoy, C. L., & Carbone, G. J. (2005). Feeling at Risk: Managers and The Decision to Use Forecast. *Risk Analysis*, 25 (5), 1265-1275.
- Office of Disaster Preparedness and Emergency Management (ODPEM) (2012a), *Community Disaster Risk Management Plan Annotto Bay*, St. Mary.
http://www.odpem.org.jm/Portals/0/Annotto%20Bay%20_CDRM.pdf.
- Office of Disaster Preparedness and Emergency Management (ODPEM) (2012b), *Community Disaster Risk Management Plan Port Maria*, St. Mary.
<http://www.odpem.org.jm/Portals/0/Port%20Maria.pdf>.
- Office of Disaster Preparedness and Emergency Management (2008) *How Does the ODPEM Actively Prepare Jamaica for Disasters*. Retrieved from:
<http://www.odpem.org.jm/BePrepared/HowODPEMPreparesJa/HazardMitigationPlanning/tabid/71/Default.aspx>.
- Paton, D. & Bishop, B., (1996) Disasters and Communities: Promoting Psychosocial Well-Being. In: Paton D. & Long, N. (Eds.), *Psychological Aspects of Disaster; Impact, Coping, and Interventions*. Palmerston North, New Zealand: Dunmore Press.
- Paton, D., Smith, L., Daly, M., & Johnston, D. (2008). Risk Perception and Volcanic Hazard Mitigation: Individual and Social Perceptive. *Journal of Volcanology and Geothermal Research*, 172, 179-188.
- Pelling, M. & Uitto, J. I. (2001). Small Island Developing States: Natural Disaster and Global Change. *Environmental Hazards*, 3, 49-62.
- Phifer, J., & Norris, F. H. (1989). Psychological Symptoms in Older Adults Following Natural Disaster: Nature, Timing, Duration, and Course. *Journal of Gerontology*, 44, 207-217.
- Sattler, D. N., Sattler, J. M., Kaiser, C., Hamby, B. A., Adams, M. Love, L., Winkler, J. M., Abu-Ukkaz, C., Watts, B. & Beatty, A. (1995). Hurricane Andrew: Psychological Distress Among Shelter Victims. *International Journal of Stress Management*, 2, 133-143.
- Sjoberg, L. (2000). Factors in Risk Perception. *Risk Analysis*, 20 (1), 1-11
- Slovic, P. (1986). Informing and Educating the Public About Risk, *Risk Analysis* 6 403-415.
- Starr, C. (1969). Social Benefits versus Technological Risk. *Science* 165, 1232-1238.

Statistical Institute of Jamaica. (2011). Demographic Census 2011. *Statistical Institute of Jamaica*.

Sullivan, M. P. (2006, February). Jamaica: Political and Economic Conditions and Us Relations. *Library of Congress Washington Dc Congressional Research Service*.

Taylor M.A., Mandal A., Burgess C., & Stephenson T. (2014). Flooding and Climate Change: Sectorial Impacts and Adaptation Strategies for The Caribbean Region, Chap 10. In: Chadee, D.D., Sutherland, J.M., & Agard, J.B. (Eds) *Flooding in Jamaica: Causes and Controls*, (pp. 163-187). New York: Nova Science Publishers Inc.

Triandis, H. C. (1980). Values, Attitudes, and Interpersonal Behavior. *Nebraska Symposium on Motivation*, Vol. 27. Lincoln, NE: University of Nebraska Press, pp. 195-259.

Tune, G. S. (1964). Response Preferences: A Review of Some Relevant Literature. *Psychological Bulletin*, 61, 286-3012.

UNISDR (United Nations Office of Disaster Risk Reduction). (2011). *Global Assessment Report on Disaster Risk Reduction*. Geneva: United Nations International Strategy for Disaster Reduction.

Weichslegartner, J. (2001) Disaster Mitigation: The Concept of Vulnerability Revisited. *Disaster Prevention and Management: An International Journal*, 10(2), 85-95.

APPENDIX A: SURVEY OF HAZARD PERCEPTION

PART I: DEMOGRAPHICS

1. In which of the following age categories do you belong?
☐ 25-35 ☐ 36-46 ☐ 47-57 ☐ 58-68 ☐ 69-79 ☐ 80+
2. Gender: ☐ Male ☐ Female
3. How long have you lived in this community? _____
4. How long have you lived at your current residence? _____
5. What is your estimated monthly earnings in JMD?
☐ 20,000-40,000 ☐ 41,000-61,000 ☐ 62,000-82,000 ☐ 83,000-103,000
☐ 104,000-124,000 ☐ 125,000-145,000 ☐ 146,000-166,000 ☐ 167,000+
6. How many people live in your home? _____

PART II: FLOOD EXPERIENCE

7. Have you ever experienced a flood? ☐ Yes ☐ No. If yes, How many times? _____
8. Where did you experience this flood?
☐ At your current residence
☐ At current business
☐ At previous residence
☐ At previous business
☐ Other (specify) _____
9. On a scale of 1-5 with 5 being the highest, how devastating were the damages incurred to your place of residence/business
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
10. What impacts did you experience?
☐ Damage to my house
☐ Damage to the contents of my house
☐ Damage to my property
☐ Damage to my business
☐ Injury
11. Did you take any actions to protect yourself before, during or after a flood? ☐ Yes ☐ No
If yes what did you do?
☐ Evacuate
☐ Move to higher grounds
☐ Elevate furniture/valuables
☐ Move to shelter (which one) _____
☐ Another action (specify) _____
If No, why not?
☐ I didn't think it would affect me
☐ I didn't have time
☐ I was not at home

Other _____

12. When was the most devastating flood you can remember? _____

13. What meteorological event contributed to this flood?

- ☐ Hurricane
- ☐ Tropical Storm
- ☐ Heavy Rains
- ☐ Other cause (specify)

14. Were you warned about any of the floods you have experienced? ☐ Yes ☐ No. If Yes by what medium?

- ☐ Radio
- ☐ Television
- ☐ Newspaper
- ☐ Word of mouth
- ☐ Social Media (which one) _____

15. Have you ever experienced a flood without any warning? ☐ Yes ☐ No

PART III: ATTITUDES

16. How high a risk is flooding to the community? ☐ No risk ☐ Little risk ☐ Somewhat of a risk ☐ High Risk ☐ Very high risk

17. Does the threat of floods concern you? ☐ Yes ☐ No

18. Which threat concerns you more?

- ☐ Coastal Flooding
- ☐ River overflowing its banks
- ☐ Ocean restricting water from leaving town

19. Do you think the frequency and magnitude of floods has increased over the years? ☐ Yes ☐ No.

20. Do you believe that your home/business place will get flooded in the near future? ☐ Yes ☐ No

21. If warned about a flood, how likely are you to take protective measures

- ☐ Not likely ☐ Somewhat likely ☐ Very likely

22. How confident are you in the flood warning systems?

- ☐ No confidence ☐ Little confidence ☐ Confident ☐ Very confident

23. Have you considered moving away from the community because of the flood hazard?

- ☐ Yes ☐ No

PART IV: FLOOD POLICY/FUTURE

24. To your knowledge, are the local authorities taking actions to reduce flood risk in the community? __Yes __No
25. Do you believe the relevant authorities are doing enough to reduce the risk of flooding to your community? __Yes __No
26. What is your perception of what can be done to mitigate the risk of flooding?_____
- _____
- _____
- _____
- _____

APPENDIX B: FREQUENCY TABLES

Number of Years living in Community	Frequency	Percent
3	1	1.2
4	2	2.3
5	1	1.2
6	4	4.7
8	4	4.7
12	4	4.7
13	7	8.1
14	1	1.2
15	3	3.5
17	3	3.5
20	2	2.3
21	1	1.2
22	2	2.3
23	1	1.2
25	3	3.5
26	3	3.5
27	2	2.3
28	1	1.2
29	1	1.2
30	6	7.0
32	2	2.3
33	5	5.8
35	5	5.8
36	4	4.7
38	1	1.2
40	1	1.2
42	1	1.2
43	1	1.2
45	2	2.3
46	1	1.2
47	1	1.2
49	1	1.2
50	2	2.3
58	2	2.3
60	2	2.3
65	2	2.3
70	1	1.2

APPENDIX C: CONTINGENCY TABLES

Demographic factors vs Perception

			Do you think the community is at risk to flooding?			Total
			Somewhat of a risk	High risk	Very high risk	
Gender	Male	Count	3	7	25	35
		Expected Count	2.0	11.4	21.6	35.0
		% w	8.6%	20.0%	71.4%	100.0%
		% of respondents who believe the community is at risk	60.0%	25.0%	47.2%	40.7%
		% of Total	3.5%	8.1%	29.1%	40.7%
	Female	Count	2	21	28	51
		Expected Count	3.0	16.6	31.4	51.0
		% within Gender	3.9%	41.2%	54.9%	100.0%
		% of respondents who believe the community is at risk	40.0%	75.0%	52.8%	59.3%
		% of Total	2.3%	24.4%	32.6%	59.3%
Total		Count	5	28	53	86
		Expected Count	5.0	28.0	53.0	86.0
		% within Gender	5.8%	32.6%	61.6%	100.0%
		% of respondents who believe the community is at risk	100.0%	100.0%	100.0%	100.0%
		% of Total	5.8%	32.6%	61.6%	100.0%

$$X^2=4.557$$

Significance = .103

		Do you think the community is at risk to flooding?		
		Somewhat of a risk	High risk	Very high risk
20,000-40,000	Count	2	4	10
	% who believe community is at risk to flooding	40.0%	14.3%	18.9%
	% of Total	2.3%	4.7%	11.6%
41,000-61,000	Count	0	0	3
	% who believe community is at risk to flooding	0.0%	0.0%	5.7%
	% of Total	0.0%	0.0%	3.5%
62,000-82,000	Count	2	6	19
	% who believe community is at risk to flooding	40.0%	21.4%	35.8%
	% of Total	2.3%	7.0%	22.1%
83,000-103,000	Count	0	15	14
	% who believe community is at risk to flooding	0.0%	53.6%	26.4%
	% of Total	0.0%	17.4%	16.3%
104,000-124,000	Count	1	2	6
	% who believe community is at risk to flooding	20.0%	7.1%	11.3%
	% of Total	1.2%	2.3%	7.0%
125,000-145,000	Count	0	0	1
	% who believe community is at risk to flooding	0.0%	0.0%	1.9%
	% of Total	0.0%	0.0%	1.2%
146,000-166,000	Count	0	1	0
	% who believe community is at risk to flooding	0.0%	3.6%	0.0%
	% of Total	0.0%	1.2%	0.0%

$$X^2=13.922$$

Significance = .302

		Do you think the community is at risk to flooding?			Total
		Somewhat of a risk	High risk	Very high risk	
25-46	Count	4	12	23	39
	% Do you think the community is at risk to flooding	80.0%	42.9%	43.4%	45.3%
	% of Total	4.7%	14.0%	26.7%	45.3%
47-68	Count	1	14	26	41
	% Do you think the community is at risk to flooding	20.0%	50.0%	49.1%	47.7%
	% of Total	1.2%	16.3%	30.2%	47.7%
69-80+	Count	0	2	4	6
	% Do you think the community is at risk to flooding	0.0%	7.1%	7.5%	7.0%
	% of Total	0.0%	2.3%	4.7%	7.0%

$$X^2= 2.638$$

Significance = .620

Length of residence in years		Do you think the community is at risk to flooding?			Total
		Somewhat of a risk	High risk	Very high risk	
0-30	Count	1	13	26	40
	% Do you think the community is at risk to flooding	50.0%	76.5%	70.3%	71.4%
	% of Total	1.8%	23.2%	46.4%	71.4%
31-60	Count	0	3	10	13
	% Do you think the community is at risk to flooding	0.0%	17.6%	27.0%	23.2%
	% of Total	0.0%	5.4%	17.9%	23.2%
61-80	Count	1	1	1	3
	Do you think the community is at risk to flooding	50.0%	5.9%	2.7%	5.4%
	% of Total	1.8%	1.8%	1.8%	5.4%

$$X^2 = 9.055$$

Significance = .060

Demographic factors vs Perception of whether or not local authorities are taking actions to mitigate flood risk

			Are local authorities taking action to mitigate flood risk?		Total
			Yes	No	
Gender	Male	Count	16	19	35
		% Are local authorities taking action to mitigate flood risk	42.1%	39.6%	40.7%
		% of Total	18.6%	22.1%	40.7%
	Female	Count	22	29	51
		Are local authorities taking action to mitigate flood risk	57.9%	60.4%	59.3%
		% of Total	25.6%	33.7%	59.3%

$$X^2 = 1.802$$

Significance = .179

			Are local authorities taking action to mitigate flood risk?		Total
			Yes	No	
Estimated monthly gross income JMD	20,000-40,000	Count	7	9	16
		% Are local authorities taking action to mitigate flood risk	18.4%	18.8%	18.6%
		% of Total	8.1%	10.5%	18.6%
	41,000-61,000	Count	2	1	3
		% Are local authorities taking action to mitigate flood risk	5.3%	2.1%	3.5%
		% of Total	2.3%	1.2%	3.5%
	62,000-82,000	Count	12	15	27
		% Are local authorities taking action to mitigate flood risk	31.6%	31.3%	31.4%
		% of Total	14.0%	17.4%	31.4%
	83,000-103,000	Count	13	16	29
		% Are local authorities taking action to mitigate flood risk	34.2%	33.3%	33.7%
		% of Total	15.1%	18.6%	33.7%
	104,000-124,000	Count	3	6	9
		% Are local authorities taking action to mitigate flood risk	7.9%	12.5%	10.5%
		% of Total	3.5%	7.0%	10.5%
	125,000-145,000	Count	1	0	1
		% Are local authorities taking action to mitigate flood risk	2.6%	0.0%	1.2%
		% of Total	1.2%	0.0%	1.2%
	146,000-166,000	Count	0	1	1
		% within Are local authorities taking action to mitigate flood risk	0.0%	2.1%	1.2%

		% of Total	0.0%	1.2%	1.2%
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$$X^2 = 1.812$$

Significance = .929

		Are local authorities taking action to mitigate flood risk?		Total
		Yes	No	
25-46	Count	11	28	39
	Are local authorities taking action to mitigate flood risk	28.9%	58.3%	45.3%
	% of Total	12.8%	32.6%	45.3%
47-68	Count	22	19	41
	% Are local authorities taking action to mitigate flood risk	57.9%	39.6%	47.7%
	% of Total	25.6%	22.1%	47.7%
69-80	Count	5	1	6
	% Are local authorities taking action to mitigate flood risk	13.2%	2.1%	7.0%
	% of Total	5.8%	1.2%	7.0%

$$X^2 = 2.815$$

Significance = .245

		Are local authorities taking action to mitigate flood risk?		Total
		Yes	No	
0-30	Count	21	19	40
	% Are local authorities taking action to mitigate flood risk	72.4%	70.4%	71.4%
	% of Total	37.5%	33.9%	71.4%
31-60	Count	6	7	13
	% Are local authorities taking action to mitigate flood risk	20.7%	25.9%	23.2%
	% of Total	10.7%	12.5%	23.2%
61-80	Count	2	1	3
	% Are local authorities taking action to mitigate flood risk	6.9%	3.7%	5.4%
	% of Total	3.6%	1.8%	5.4%

$$X^2 = .244$$

Significance = .855

Demographic Factors vs Perception of whether or not authorities are doing enough to mitigate flood risk

			Are relevant authorities doing enough to reduce flood risk?		Total
			Yes	No	
Gender	Male	Count	4	31	35
		% Are relevant authorities doing enough to reduce flood risk	66.7%	38.8%	40.7%
		% of Total	4.7%	36.0%	40.7%
	Female	Count	2	49	51
		% Are relevant authorities doing enough to reduce flood risk	33.3%	61.3%	59.3%
		% of Total	2.3%	57.0%	59.3%

$$X^2 = 1.802$$

Significance = .179

			Are relevant authorities doing enough to reduce flood risk?		Total
			Yes	No	
Estimated monthly gross income in JMD	20,000-40,000	Count	1	15	16
		% Are relevant authorities doing enough to reduce flood risk	16.7%	18.8%	18.6%
		% of Total	1.2%	17.4%	18.6%
	41,000-61,000	Count	0	3	3
		% Are relevant authorities doing enough to reduce flood risk	0.0%	3.8%	3.5%
		% of Total	0.0%	3.5%	3.5%
	62,000-82,000	Count	3	24	27
		% Are relevant authorities doing enough to reduce flood risk	50.0%	30.0%	31.4%
		% of Total	3.5%	27.9%	31.4%
	83,000-103,000	Count	1	28	29
		% Are relevant authorities doing enough to reduce flood risk	16.7%	35.0%	33.7%
		% of Total	1.2%	32.6%	33.7%
	104,000-124,000	Count	1	8	9
		% Are relevant authorities doing enough to reduce flood risk	16.7%	10.0%	10.5%
		% of Total	1.2%	9.3%	10.5%
	125,000-145,000	Count	0	1	1
		% Are relevant authorities doing enough to reduce flood risk	0.0%	1.3%	1.2%
		% of Total	0.0%	1.2%	1.2%
	146,000-166,000	Count	0	1	1
		% Are relevant authorities doing enough to reduce flood risk	0.0%	1.3%	1.2%
		% of Total	0.0%	1.2%	1.2%

$$X^2 = 1.812$$

Significance = .929

Age Categories		Are relevant authorities doing enough to reduce flood risk?		Total
		Yes	No	
25-46	Count	4	35	39
	% Are relevant authorities doing enough to reduce flood risk	66.7%	43.8%	45.3%
	% of Total	4.7%	40.7%	45.3%
47-68	Count	1	40	41
	% Are relevant authorities doing enough to reduce flood risk	16.7%	50.0%	47.7%
	% of Total	1.2%	46.5%	47.7%
69-80	Count	1	5	6
	% Are relevant authorities doing enough to reduce flood risk	16.7%	6.3%	7.0%
	% of Total	1.2%	5.8%	7.0%

$$X^2 = 2.815$$

Significance = .245

Length of residence in years	Breakdown	Are relevant authorities doing enough to reduce flood risk?		Total
		Yes	No	
0-30	Count	3	37	40
	% Are relevant authorities doing enough to reduce flood risk	75.0%	71.2%	71.4%
	% of Total	5.4%	66.1%	71.4%
31-60	Count	1	12	13
	Are relevant authorities doing enough to reduce flood risk	25.0%	23.1%	23.2%
	% of Total	1.8%	21.4%	23.2%
61-80	Count	0	3	3
	% Are relevant authorities doing enough to reduce flood risk	0.0%	5.8%	5.4%
	% of Total	0.0%	5.4%	5.4%

$$X^2 = .244$$

Significance = .885

Flood Experience vs Perception

Number of Floods	Breakdown	Do you think the community is at risk to flooding?			
		Somewhat of a risk	High Risk	Very High Risk	Total
1	Count	1	5	4	10
	% Do you think the community is at risk to flooding	20.0%	17.9%	7.5%	11.6%
	% of Total	1.2%	5.8%	4.7%	11.6%
2	Count	3	6	10	19
	% Do you think the community is at risk to flooding	60.0%	21.4%	18.9%	22.1%
	% of Total	3.5%	7.0%	11.6%	22.1%
3	Count	0	9	15	24
	% Do you think the community is at risk to flooding	0.0%	32.1%	28.3%	27.9%
	% of Total	0.0%	10.5%	17.4%	27.9%
4	Count	0	4	15	19
	Do you think the community is at risk to flooding	0.0%	14.3%	28.3%	22.1%
	% of Total	0.0%	4.7%	17.4%	22.1%
5	Count	0	1	4	5
	% Do you think the community is at risk to flooding	0.0%	3.6%	7.5%	5.8%
	% of Total	0.0%	1.2%	4.7%	5.8%
6	Count	1	2	4	7
	% Do you think the community is at risk to flooding	20.0%	7.1%	7.5%	8.1%

	% of Total	1.2%	2.3%	4.7%	8.1%
7	Count	0	0	1	1
	% Do you think the community is at risk to flooding	0.0%	0.0%	1.9%	1.2%
	% of Total	0.0%	0.0%	1.2%	1.2%
8	Count	0	1	0	1
	% Do you think the community is at risk to flooding	0.0%	3.6%	0.0%	1.2%
	% of Total	0.0%	1.2%	0.0%	1.2%

$$X^2 = 14.304$$

Significance = .427

Number of Floods	Breakdown	Do you believe your home of business will get flooded in the future?		Total
		Yes	No	
1	Count	9	1	10
	% Do you believe your home of business will get flooded in the future	10.7%	50.0%	11.6%
	% of Total	10.5%	1.2%	11.6%
2	Count	19	0	19
	% Do you believe your home of business will get flooded in the future	22.6%	0.0%	22.1%
	% of Total	22.1%	0.0%	22.1%
3	Count	24	0	24
	% Do you believe your home of business will get flooded in the future	28.6%	0.0%	27.9%
	% of Total	27.9%	0.0%	27.9%
4	Count	18	1	19
	% Do you believe your home of business will get flooded in the future	21.4%	50.0%	22.1%
	% of Total	20.9%	1.2%	22.1%
5	Count	5	0	5
	% Do you believe your home of business will get flooded in the future	6.0%	0.0%	5.8%
	% of Total	5.8%	0.0%	5.8%
6	Count	7	0	7
	% Do you believe your home of business will get flooded in the future	8.3%	0.0%	8.1%
	% of Total	8.1%	0.0%	8.1%
7	Count	1	0	1
	% Do you believe your home of business will get flooded in the future	1.2%	0.0%	1.2%
	% of Total	1.2%	0.0%	1.2%

8	Count	1	0	1
	% Do you believe your home of business will get flooded in the future	1.2%	0.0%	1.2%
	% of Total	1.2%	0.0%	1.2%

$$X^2 = 4.672$$

Significance = .700

Number of Floods	Breakdown	Would you take protective measures if warned?			
		Not Likely	Somewhat Likely	Very Likely	Total
1	Count	0	3	7	10
	% would you take protective measures if warned?	0.0%	20.0%	10.1%	11.6%
	% of Total	0.0%	3.5%	8.1%	11.6%
2	Count	2	4	13	19
	% would you take protective measures if warned?	100.0%	26.7%	18.8%	22.1%
	% of Total	2.3%	4.7%	15.1%	22.1%
3	Count	0	4	20	24
	% would you take protective measures if warned?	0.0%	26.7%	29.0%	27.9%
	% of Total	0.0%	4.7%	23.3%	27.9%
4	Count	0	2	17	19
	% would you take protective measures if warned?	0.0%	13.3%	24.6%	22.1%
	% of Total	0.0%	2.3%	19.8%	22.1%
5	Count	0	1	4	5
	% would you take protective measures if warned?	0.0%	6.7%	5.8%	5.8%
	% of Total	0.0%	1.2%	4.7%	5.8%
6	Count	0	1	6	7
	% would you take protective measures if warned?	0.0%	6.7%	8.7%	8.1%
	% of Total	0.0%	1.2%	7.0%	8.1%
7	Count	0	0	1	1

	% would you take protective measures if warned?	0.0%	0.0%	1.4%	1.2%
	% of Total	0.0%	0.0%	1.2%	1.2%
8	Count	0	0	1	1
	% would you take protective measures if warned?	0.0%	0.0%	1.4%	1.2%
	% of Total	0.0%	0.0%	1.2%	1.2%

$$X^2 = 9.851$$

Significance = .773

Number of floods	Breakdown	Have you thought of moving from this community due to flooding		
		Yes	No	Total
1	Count	4	6	10
	% have you thought of moving from this community due to flooding	7.7%	17.6%	11.6%
	% of Total	4.7%	7.0%	11.6%
2	Count	9	10	19
	% have you thought of moving from this community due to flooding	17.3%	29.4%	22.1%
	% of Total	10.5%	11.6%	22.1%
3	Count	18	6	24
	within have you thought of moving from this community due to flooding	34.6%	17.6%	27.9%
	% of Total	20.9%	7.0%	27.9%
4	Count	11	8	19
	% have you thought of moving from this community due to flooding	21.2%	23.5%	22.1%
	% of Total	12.8%	9.3%	22.1%
5	Count	4	1	5
	% have you thought of moving from this community due to flooding	7.7%	2.9%	5.8%
	% of Total	4.7%	1.2%	5.8%
6	Count	4	3	7
	% have you thought of moving from this community due to flooding	7.7%	8.8%	8.1%
	% of Total	4.7%	3.5%	8.1%
7	Count	1	0	1

	% have you thought of moving from this community due to flooding	1.9%	0.0%	1.2%
	% of Total	1.2%	0.0%	1.2%
8	Count	1	0	1
	%have you thought of moving from this community due to flooding	1.9%	0.0%	1.2%
	% of Total	1.2%	0.0%	1.2%

$$X^2= 7.477$$

Significance = .386

Damages Experienced vs Perception

Level of Damage	Breakdown	Do you think the community is at risk to flooding?			Total
		Somewhat of a risk	High risk	Very high risk	
Moderate Damage	Count	2	3	6	11
	% Do you think the community is at risk to flooding	40.0%	10.7%	11.3%	12.8%
	% of Total	2.3%	3.5%	7.0%	12.8%
Badly Damaged	Count	2	15	21	38
	% Do you think the community is at risk to flooding	40.0%	53.6%	39.6%	44.2%
	% of Total	2.3%	17.4%	24.4%	44.2%
Devastating Damage	Count	1	10	26	37
	% Do you think the community is at risk to flooding	20.0%	35.7%	49.1%	43.0%
	% of Total	1.2%	11.6%	30.2%	43.0%

$$X^2 = 5.318$$

Significance = .256

Level of Damage	Breakdown	Do you believe your home of business will get flooded in the future?		Total
		Yes	No	
Moderate Damage	Count	10	1	11
	% Do you believe your home of business will get flooded in the future	11.9%	50.0%	12.8%
	% of Total	11.6%	1.2%	12.8%
Badly Damaged	Count	37	1	38
	% Do you believe your home of business will get flooded in the future	44.0%	50.0%	44.2%
	% of Total	43.0%	1.2%	44.2%
Devastating Damage	Count	37	0	37
	% Do you believe your home of business will get flooded in the future	44.0%	0.0%	43.0%
	% of Total	43.0%	0.0%	43.0%

$$X^2 = 3.113$$

Significance = .211

Level of Damage	Breakdown	Would you take protective measures if warned?			Total
		Not Likely	Likely	Very Likely	
Moderate Damage	Count	1	2	8	11
	% within would you take protective measures if warned?	50.0%	13.3%	11.6%	12.8%
	% of Total	1.2%	2.3%	9.3%	12.8%
Badly Damaged	Count	0	8	30	38
	% within would you take protective measures if warned?	0.0%	53.3%	43.5%	44.2%
	% of Total	0.0%	9.3%	34.9%	44.2%
Devastating Damage	Count	1	5	31	37
	% within would you take protective measures if warned?	50.0%	33.3%	44.9%	43.0%
	% of Total	1.2%	5.8%	36.0%	43.0%

$$X^2 = 3.829$$

Significance = .430

Level of Damage	Breakdown	Have you thought of moving from this community due to flooding?		Total
		Yes	No	
3 Moderate Damage	Count	8	3	11
	% have you thought of moving from this community due to flooding	15.4%	8.8%	12.8%
	% of Total	9.3%	3.5%	12.8%
4 Badly Damaged	Count	22	16	38
	% have you thought of moving from this community due to flooding	42.3%	47.1%	44.2%
	% of Total	25.6%	18.6%	44.2%
5 Devastating Damage	Count	22	15	37
	% have you thought of moving from this community due to flooding	42.3%	44.1%	43.0%
	% of Total	25.6%	17.4%	43.0%

$$X^2 = .813$$

Significance = .666

Protective Action vs Perception

Protective action	Breakdown	Do you believe your home of business will get flooded in the future		
		Yes	No	Total
Yes	Count	68	1	69
	% Do you believe your home of business will get flooded in the future	81.0%	50.0%	80.2%
	% of Total	79.1%	1.2%	80.2%
No	Count	16	1	17
	% Do you believe your home of business will get flooded in the future	19.0%	50.0%	19.8%
	% of Total	18.6%	1.2%	19.8%

$$X^2 = 1.180$$

Significance = .277

		Would you take protective measures if warned?			Total
		Not Likely	Somewhat Likely	Very Likely	
Yes	Count	1	11	57	69
	% within would you take protective measures if warned?	50.0%	73.3%	82.6%	80.2%
	% of Total	1.2%	12.8%	66.3%	80.2%
No	Count	1	4	12	17
	% would you take protective measures if warned?	50.0%	26.7%	17.4%	19.8%
	% of Total	1.2%	4.7%	14.0%	19.8%

$$X^2=1.848$$

Significance = .397

Protective Action	Breakdown	Have you thought of moving from this community due to flooding		Total
		Yes	No	
Yes	Count	45	24	69
	% within Did you take any protective measure?	65.2%	34.8%	100.0%
	% within have you thought of moving from this community due to flooding	86.5%	70.6%	80.2%
	% of Total	52.3%	27.9%	80.2%
No	Count	7	10	17
	% within Did you take any protective measure?	41.2%	58.8%	100.0%
	% within have you thought of moving from this community due to flooding	13.5%	29.4%	19.8%
	% of Total	8.1%	11.6%	19.8%

$$X^2 = 3.298$$

Significance = .069

APPENDIX D: IRB Approval



EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
4N-70 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office **252-744-2914** · Fax **252-744-2284** · www.ecu.edu/irb

Notification of Initial Approval: Expedited

From: Social/Behavioral IRB
To: Shadane Williams
CC: Burrell Montz Covey
Date: 9/22/2016
Re: UMCIRB 16-000892
Flood Risk Perception and The Role of Experience

I am pleased to inform you that your Expedited Application was approved. Approval of the study and any consent form(s) is for the period of 9/21/2016 to 9/20/2017. The research study is eligible for review under expedited category # 6, 7. The Chairperson (or designee) deemed this study no more than minimal risk.

Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The Investigator must adhere to all reporting requirements for this study.

Approved consent documents with the IRB approval date stamped on the document should be used to consent participants (consent documents with the IRB approval date stamp are found under the Documents tab in the study workspace).

The approval includes the following items:

Name	Description
Flood Risk Perception	Surveys and Questionnaires
Informed Consent Document Template No More Than Minimal Risk 07.29.15.doc	Consent Forms
Thesis Proposal 2016.docx	Study Protocol or Grant Application
Thesis Survey Draft 4.docx	Interview/Focus Group Scripts/Questions

