2015

Disaster Management and Efforts to Mitigate the Destruction of the Human-Environment

Dorothy Henderson Bell
Walden University

Walden University

College of Social and Behavioral Sciences

This is to certify that the doctoral dissertation by

Dorothy Henderson Bell

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. George Larkin, Committee Chairperson,
Public Policy and Administration Faculty

Dr. Bruce Lindsay, Committee Member,
Public Policy and Administration Faculty

Dr. Tanya Settles, University Reviewer,
Public Policy and Administration Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2015

.

Disaster Management and Efforts to Mitigate the Destruction of the Human-Environment

Dorothy Henderson Bell

MA, NC Central University, 2006

BS, NC A&T State University, 1997

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Policy and Administration

Walden University

June 2015

Abstract

Natural disasters expose the fact that poverty, race, gender, and other indicators of social disadvantage are linked to the population of citizens who struggle the most to recover after a disaster, yet these factors are not accounted for in public policy that guides decision making related to federal assistance to residents affected by a disaster. This study used neural networks as a research strategy to determine whether the current policies under the Stafford Act related to assistance comply with Congressional intent and law that uses a formula for assistance distribution, and whether human factors such as culture, measured as residing in a non-white zip code according to Census tract data, are considered in decision making regarding assistance. Data from FEMA related to the recovery from Hurricane Irene in 2011 were used as the basis for the model. The neural network analysis of this study indicated that federal assistance decisions after the Hurricane Irene event tended to focus on the adjusted property value and actual dollar value of losses as the determining factor in decisions. Focusing on the actual dollar value of losses is consistent with the formulaic approach codified in public law, but this approach overshadows important human factors such as living in a primarily non-white zip code and the availability of temporary housing. This study underscores the notion that the public policy works the way it is intended, but it fails to accommodate human and social factors. As a consequence, the existing policy is legally equitable, but it is not necessarily morally fair to those impacted by disasters. The positive social change implications of this study include recommendations to federal policy makers to more equitably structure recovery efforts in alignment with the human environment of communities rather than a primary focus on cost and value of real property.

Disaster Management and Efforts to Mitigate the Destruction of the Human-Environment

by

Dorothy Henderson Bell

MA, [NC Central University], 2006

BS, [NC A&T State University], 1997

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Policy and Administration

Walden University

June 2015

Dedication

I dedicate this work to my family and to those whose lives have been negatively impacted by a natural disaster. I propose the efforts of this project to be a torch to inspire my daughter, Lavette, to never let go of her dreams, and my grandchildren, Demitre and Skylar, to reach for the stars. I thank my husband, Ulysses, for his patience and understanding for the many days and nights applied towards the completion of this project. I thank my parents, Eloise and Samuel, for their guidance as I matured into adulthood. It is my desire that this research be considered as a model for practitioners and social scientists as they seek to integrate measures to mitigate the destruction of the human-environment of so many citizens each year.

Acknowledgments

I would like to thank the members of my dissertaton committee who helped me achieve this milestone of achievement. Because of the expertise that each of you brought to the committee, I was able to execute and achieve my goal to obtain my degree in Public Policy and Aministration. My Committee Chair, Dr. George Larkin, was with me every step of the way. Dr. Larkin offered exceptional guidance thoughout this journey. I would like to thank Dr. Bruce Lindsay for becoming a part of my committee. Dr. Lindsay had the expertise in my subject matter, and he aggressively step in and offered me assistance once he joined my committee. I would like to thank Dr. Tanya Settles for her direct observations as she reviewed my dissertation. I, also, want to thank Dr. Kelly Chermak for editing my final document.

Additionally, I would like to thank the rest of the Walden University community including the Academic Advisors, the members of the Writing Center, and the Walden Library for your assistance. The customer service that your delivered was tremendous. It helped me to brave the storm of this academic inquisition as I worked towards my degree.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

The Federal Emergency Management Agency (FEMA) was established in 1979 when President Jimmy Carter wrote Executive Order 12127 to reorganize and merge 100 aid programs for the purpose of national security and emergency management (HSDL, 1979; Lindsay & McCarthy, 2012). There were times when the agency was criticized for issues of poor performance, lacking organizational structure with no clear mission, and the leadership consisting of inept political appointees lacking the skills to manage such an agency (Hollis, 2005).

In 1983, the Federal Emergency Management Agency (FEMA) and the National Association of Schools for Public Administration and Affairs (NASPAA) created an agreement to collaborate on integrating the practice of emergency management with academia and professionalize emergency management within the field of public administration (Cigler, Comfort, & Waugh, 2012). The NASPPA is a membership association for colleges and universities committed to promoting public administration programs (Henry, 1995). This collaboration resulted in the evolution of educational curriculums, publications of research articles and books, and numerous annual conferences enhancing an interest in the field of emergency management. Additionally, the collaboration led to greater credibility for FEMA and the passage of policies related to emergency management.

Equally important was the effort to integrate social research into the field of emergency management and advance the paradigm shift to proactively pursue sustainable measures to protect citizens from natural disasters through changes in how policy is

written. At one point in history, disasters were researched solely by natural scientists such as geographers and physical scientists (Wenger, 2006). Today, because of the repeated devastation to the overall social system, economists, political scientists, social scientists, and urban and regional planners factor into the quest for the transfer of knowledge to reduce destruction resulting from disasters (Wenger, 2006; Wolensky & Wolensky, 2002). Social scientists consider disasters "natural laboratories" or "crise révélatrice" (Oliver-Smith, 1996, p. 304) because with each disaster, the common elements of society are dissected and exposed to the extent that basic social and cultural needs are prioritized to restore communities to predisaster condition.

There is a clear difference in how social researchers and policy makers define disasters. For instance, Section 602(a)(2) of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as Amended April 2013 defines a disaster in terms of the destruction, caused either by a natural disaster, an accident, or human causes. Most social researchers, such as Lambros Comitas with the Comitas Institute for Anthropological Studies at Columbia University, took the definition a step further and define disasters as processes involving interaction of human populations (and the social system in which they are embedded) with potentially destructive natural or technological hazards (CIFAS, 2013). These differences may affect the outcome of the recovery efforts.

During the last decade, natural disasters have devastated areas across the United States such as Hurricanes Katrina (August 2005), Rita (September 2005), Gustav (September 2008), and Ike (September 2008). All of these events occurred in the south

central region of the United States (Goodman & Mann, 2008; Barras, Brock, Kraneburg & Palaseanu-Lovejoy, 2013). In 2011, tornadoes destroyed multiple properties and killed hundreds of people from Oklahoma to North Carolina (Simmons & Sutter 2012). Then, Hurricanes Irene (Grosman, 2011) and Sandy (Surowiecki, 2012) swept upwards along the Mid-Atlantic coast to New England, and caused substantial damage to civilian life and property. In fact, during the same time period, natural disasters around the world have highlighted the increased expense to protect life and property, and the need to find sustainable measures to protect our citizens. Figure 1 depicts the cost of global damages between 1990 and 2012 as a result of natural disasters (EM-DAT, 2012). Notice in purple that more than 80% of the United States damages was storm related and resulted in more than $700 Billion in recovery efforts.

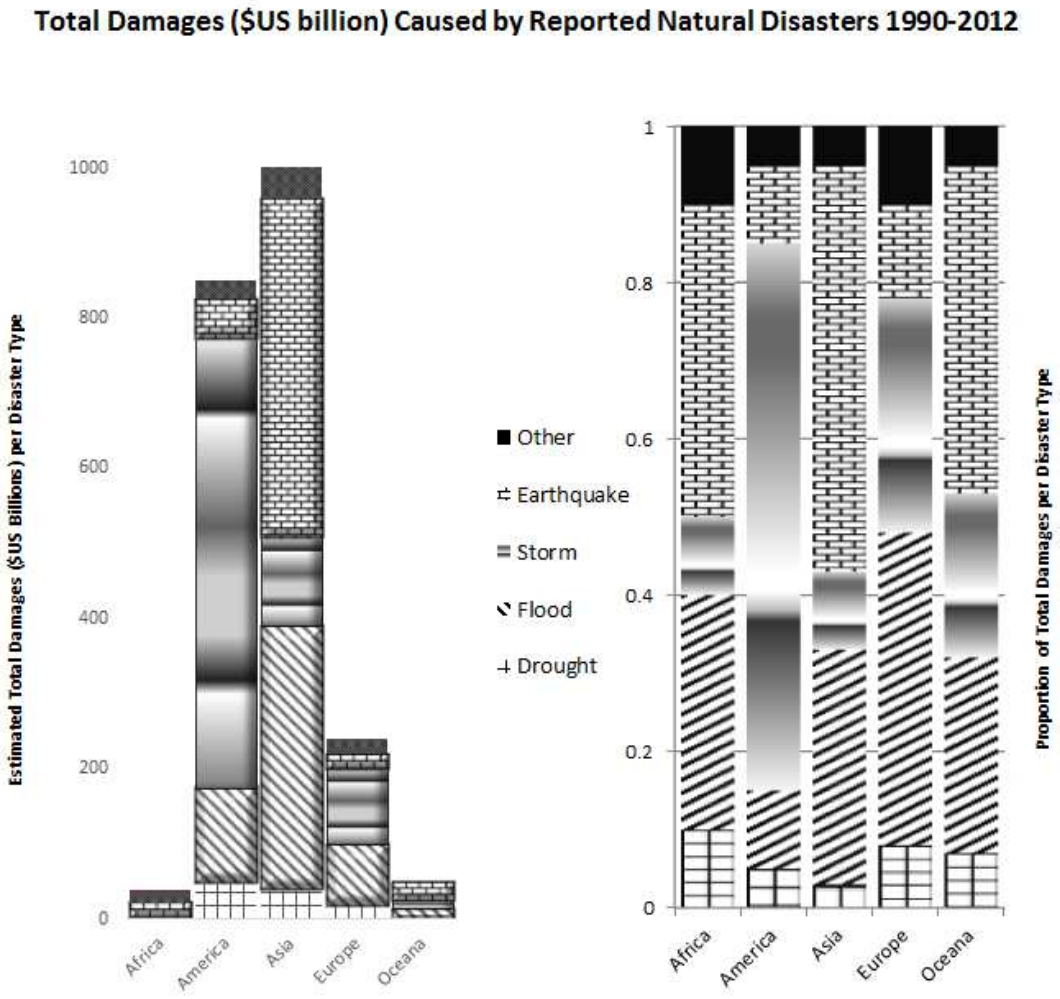

Figure 1. Global damages in $US Billions between 1990-2012. The source of information adapted from "EM-DAT. The OFDA/CRED International Disaster Database-www.emdat.be-universite´ Catholique de Louvain-Brussels-Belgum." Copyright by CRED 2009. Permission to reprint in Appendix A.

Background of the Problem

With each natural disaster, there is a population of civilians who are more negatively affected by the disaster than others (Orsak, 2010). Many are permanently displaced due to damages to their homes caused by flood and wind damage (Newman, 2010). Their homes may have been deteriorated property prior to the disaster. Many are under-educated, receive low wages, and lack proper insurance to protect their properties (Newman, 2010). There are socioeconomic issues that exist prior to the natural disaster, and the event exposes the fact that these people were experiencing an economic disaster before the natural disaster.

The human-environment is a phrase used to relate how humans interact or behave within their surrounding environments. Keys, Judkins, and Smith (2008) referred to the human-environment as the cultural and political ecology (CAPE), postulating that humans and the natural environment are inseparable because of the influence that each has on the other. Therefore, the study of social research implies that disaster management is a much broader scope of work than emergency management practitioners are trained to manage. Policy makers should consider the environments within cultural, ecological, political, and social systems when writing policies on managing disasters. These considerations will be the premise of my research in chapter two.

Problem Statement

As with Hurricane Katrina, many ethnic minorities are displaced from their homes after a natural disaster leading to interruption of education, income, or separation of family (Stevenson, 2013). Despite the assistance FEMA, African Americans and Hispanics who, in some cases, are socially and economically marginalized, have social issues that exist prior to a natural disaster. Some citizens face repetitive damage to their properties because the homes may be built on land susceptible to flooding or some other hazard or vulnerability (Dach-Gruschow & Hong, 2008).

Each natural disaster in the United States exposes the fact that poverty, race, gender, and other socially disadvantaged indicators are linked to the population of citizens who struggle the most to recover after a disaster. Stevenson (2013) suggested that the discourse of actions that society takes prior to a natural disaster determines the resiliency of recovery after a disaster. More clarity regarding the individuals affected by the disasters would help to create a more resilient recovery plan, thereby, providing more positive results in the long term. Perhaps a quantitative study using the Neural Networks (Aizawa, 2012) to investigate how a FEMA program providing assistance to citizens whose properties were damaged as a result of the Hurricane Irene event in 2011 will provide some helpful information on the topic.

The Purpose Statement

The purpose of this study was to analyze the importance of integrating social research, related to the human-environment, with policies involving disaster management. The research design was a quantitative approach, using neural networks to evaluate data collected by FEMA when Hurricane Irene destroyed properties, as it swept northward along the Mid-Atlantic coast of the United States in August 2011. Additionally, the research will allow me to make the case for how the selection process was made for citizens to obtain grant funding who experienced damages as a result of the disaster. Using neural networks (Aizawa, 2012; Lawrence, 1994), the results of this research should offer further insights on the relationship between citizens characterized as being socially and economically marginalized and the policies set forth by FEMA in an attempt to assist with recovery efforts after a natural disaster.

In this study, I explored the benefits of integrating the human-environment into public policy when creating policies to manage a natural disaster. Social research promotes the consideration of the human-environment interaction as an important indicator when determining the best approach to mitigating the destruction after a natural disaster. Considering all the systems (cultural, environmental, political, and social) of the human-environment when making policies on disaster management should help to reduce the percentage of citizens with unmet needs as a result of a natural disaster. Continuing to upgrade the cost of recovery efforts without identifying the underlining problems for such massive destruction is a reactive measure to disaster management rather than a proactive one. Mitigation of the human-environment is paramount to protecting our

citizens against natural disasters. Information gathered during this study could help design possible means for society to create new approaches to disaster management that protect its citizens from natural disasters.

Importance of the Study

The study is important because a) the study adds additional insight into the need to integrate the human-environment into policy making decisions, and b) it offers insight on the benefits of methodological testing of policies on disaster management. The federal government is spending a lot of time and money to improve disaster recovery. Between 1985 and 2004, damage to properties and crops caused by natural disasters averaged $16.5 billion per year (Healy & Malhotra, 2009). The federal government contributed an annual average of $3.05 billion in disaster relief during the same period. That is in contrast to the $195 million spent during the same time period on disaster preparedness (Healy & Malhotra, 2009). These statistics on disaster management suggest that efforts to reduce or mitigate the damages to life and property incurred as a result of a natural disaster require a new model on how policy is made for disaster management.

In 2011, President Barack Obama issued Presidential Policy Directive (PPD) 8 on national preparedness. The PPD 8 set guidelines for the Secretary of Homeland Security to collaborate with other federal agencies, local, state, and tribal governments, private and nonprofit sectors, and the public to develop a National Preparedness Goal and a National Preparedness System. The result is a goal to become a resilient nation with the capabilities for the nation's ability to protect, mitigate, prevent, respond, and recover from threats that pose the greatest risk against our nation (What is Mitigation, 2013).

The National Preparedness System is comprised of six parts:

- identifying and assessing risk
- estimating capability requirements
- building and sustaining capabilities
- planning to deliver capabilities
- validating capabilities
- reviewing and updating all capabilities, resources, and plans

Capabilities mentioned in the National Preparedness System refer to resources made available by a whole community of shareholders (individuals, the public sector, and the private sector). There are 31 specific core capabilities established to meet the National Preparedness Goal. One of which is housing, however, the consideration for housing relates to recovery which is a reactive measure as a result of a natural disaster rather than preventive or proactive measure during predisaster periods. There is no doubt that the government is working diligently towards improving disaster recovery. However, as Healy and Malhotra (2009) pointed out earlier, less than 10% of funding for disaster recovery is spent on preparedness efforts and there are no specific directives for the social issues that are presented as a result of a natural disaster.

Considering many people, affected by natural disasters, are simultaneously experiencing an economic disaster, a preventive or mitigation initiative would be in order to reduce or eliminate the damages before the natural disaster. The level of vulnerability to a natural disaster is directly related to the resilience of the community (Nix-Stevenson,

2013). More of the socially and economically marginalized citizens are left without a home, and they may have to relocate for work. Children may lose their schools and resort to being bused to other school districts.

Research Question

Because of the increasing number of natural events each year, the escalating costs of each event, and the repetitive destruction in close proximity to each event, it would be incumbent upon society to assess sustainable measures for protecting citizens from the destruction caused by a disaster. Some public policies, although research based, have not been tested using hypotheses (Ringquist, 2011; Stout, 2009). In this research, I tested a hypothesis of a mitigation program which is outlined in the CFR 44 Part 80 of the Addendum to the Hazard Mitigation Assistance Guidance (FEMA, 2007a) to determine the effectiveness of the program for the citizens affected by the wrath of Hurricane Irene in 2011.

The null hypothesis was: There is no significant difference between the acceptance of applications for the mitigation program offered by FEMA for applicants characterized as socially and economically marginalized and those who are not.

The alternative hypothesis was: There is a significant difference between the acceptance of applications for the mitigation program offered by FEMA for applicants characterized as socially and economically marginalized and those who are not.

Neural Networks

Neural networks (Clary, et al., 2012) is an epistemological tool that is useful when there are missing components or elements within the data. Neural networks are a

simplified and elementary approach to recognize patterns and solve problems using the most complex or limited data. Just as the brain can perform, such seemingly, elementary tasks, as flexing a muscle or blinking an eye, neural networks, considered artificial intelligence, is a tool designed to predict actions or behaviors (Malone & Nagar, 2011). Some scientists suggest that the artificial agents within the neural networks typically yield better predictions that the human brain and are better at processing information. This is a result of the opportunity for humans to suffer from cognitive biases or fatigue that impairs their judgment. Human judgment may be swayed when in a group setting. Humans are better at acquiring and retrieving unorganized data, and exhibiting the common sense to recognize situations that require problem solving. Therefore, combining the human brain and the artificial brain leads to increased accuracy when making predictions rather than either acting alone (Malone & Nagar, 2013). This tool appears to be ideal for this research considering there are limited demographics and perfect for theory building.

Limitations

FEMA does not collect sensitive data on the demographics of applicants after a natural disaster, and access to U.S. Census data is restricted. Therefore, the lack of specific access to individual household demographics weakens the results. This literature contains benefit cost analysis data: characteristics of housing units, including lot size and structural characteristics; year of construction, location of property, and value of property. In addition, the sample size and the region of the research in question may

further weaken the results. Utilizing neural networks is an optimum tool considering the limitations of research. Social research on the significance of FEMA's mitigation programs is limited at this point. Additional studies on the relationship between the FEMA mitigation program and economically and socially marginalized citizens should produce more evidence of the need for more social science research in disaster management.

Gap in Literature

There are two very clear gaps in literature. The first being, of course, the need to bring more social science into the public administration arena as it relates to disaster management. Members of NASPAA (Cigler, Comfort, & Waugh, 2012) concede that integrating social research with public policy would be a major positive shift for public administration. Secondly, Ringquist (2011) reviewed a book entitled, *The Public Policy Theory Primer*, written by Larimer and Smith (2009). It was noted that original research was needed to test policy theories. Larimer and Smith wrote extensively about integrating theories, but they critiqued existing research which offered less of an impact to determine the effectiveness of integrating policies.

Theoretical Framework

The theoretical framework for this study is based upon theories related to public policy, the human-environment, and the neural networks. Several theories help to mold public policy. Most relate to how the policy process works. The general public does not understand the complexity of most laws. There are certain stakeholders or advocacy

coalitions that can represent the public's interest such as government agencies, special interest groups, researchers, and civil societies that influence policy and cause it to shift over time.

As noted earlier, there are two different schools of thought on disaster management. There is a field in academics that professionalize practitioners through the teachings of disaster management. Then, there is the field of social researchers that study the vulnerability of communities to natural disasters and the relationship of public policy to social issues related to the disasters. Some researchers suggest that consideration of the human-environment is key to addressing the inability for society to protect its citizens from the wraths of natural disasters that disrupt and destroy lives (Armstrong et al, 2010).

Summary and Transition

Society has reached the threshold where social research requires a greater role in policy making decisions because disasters are becoming more costly, more frequent, and more destructive each year. It is not enough to study how policy is made, it is necessary to understand the potential for a policy to be successful for the citizens for which it is intended prior to enactment. This requires a testing of hypotheses. .

Neural networks are used to support this study. Four models were derived from the data collected by FEMA. With the use of Excel software, the models will be tested to determine patterns in the application process and answer questions about how the FEMA Mitigation program works.

The remainder of this document will be organized as follows: I have divided Chapter 2 into four sections. After the introduction of the human-environment, each

section elaborates on the impact of the four environments; policy, social, cultural, and ecological. In Chapter 3, I elaborate on the research design. Using secondary research collected by FEMA in 2011, I will determine if mitigation projects address the needs of citizens who are characterized as socially and economically marginalized. FEMA used benefit cost analysis software to determine which properties were eligible for mitigation projects.

Chapter 2: Literature Review

Introduction

This literature review includes studies on how policy is made on disaster management and the need for the testing of hypotheses to consider the human-environment when making policies. Social, economic, and political implications are present with each new disaster. Effective and efficient disaster management requires a holistic interdisciplinary approach to social research and appropriate policy making decisions.

After my initial literary search, similar social issues were represented in each of the articles. By approaching the study with an emphasis on the socially and economically marginalized citizens, I could streamline the project to a specific focus. Drabek (2007) has penned a substantial amount of work in books particularly since he has worked in academia. His presentations have encountered some positive responses, and at times, not so positive. In-depth research identified *social ecological systems* (SES) as a relevant topic related to the *human-environment*. The two phrases appear to be interchangeable depending on the author. For several decades, researchers have written about the socially and economically marginalized members of our societies and their inability to recover as quickly after a natural disaster.

There is not an extreme amount of data that combines the two fields of practitioners and academics. Both focus on recovery efforts to improve disaster management, however, researchers focus on alternative measures that is not addressed directly in the practitioners' efforts. I obtained this research from the ABI/Inform

Complete Database, Business Source, Google Scholar, Homeland Security Digital Library (HSDL), ProQuest Central, Sage Publications, and the Science Digest Database. I used keywords such as*: Amendments, democratic, disaster management, ecological system, emergency management, federalism, FEMA, governance, Homeland Security, human-environment, hurricanes, Katrina, Mississippi Flood of 1927, New Orleans, 9/11, Public Administration, Public Policy, social systems, tornadoes, tsunami,* and *U.S. Constitution.*

The Human-Environment

Because natural disasters are occurring more frequently (Armstrong et al. 2010) and can have long-term devastating effects on a society, there is a sense of urgency to devise a plan that will mitigate the destruction to the human-environment, in part, because of the economic impact of government subsidies to assist with the restoration of life and property (Grugman, 2011), and more importantly, the inability to restore life and property completely to predisaster condition. In addition, social science research suggests that because of the frequency of natural disasters, with each new event, there should be a process for comparisons of the events to create routine generalizations to help anticipate the consequences and social needs as a result of a similar event (CIFAS, 2011; DeVries, 2011).

Over the past few decades, natural and social research has emerged on the human-environment or the SES. There continues to be a need for society to improve its efforts to create sustainable measures to protect its citizens from natural disasters. Relevant

theories related to natural disasters suggest that disasters do not disrupt and destroy lives; the inability for society to protect its citizens from the wraths of natural disasters disrupts and destroys lives. Disasters signal the failure of a society to adapt successfully to certain features of its natural and socially constructed environment in a sustainable fashion (Oliver-Smith, 1996, p.303). Smith (1996) categorized three trends that are still relevant, today, to the vulnerability to disasters:

1. Social change approach: Disasters destroy society's ability to replenish the needs of the people victimized by disasters. In some cases, there are cultural changes in landscape that change the historical base of the community. During reconstruction, original architecture changes can cause the community to lose its unique character (Donner & Rodriguez, 2008). Family relations are strained due to loss of jobs and homes. There are transportation needs. Education is interrupted and there is an occurrence of loss of identity.

2. Political economic environment approach: Disasters promote the opportunity for political empowerment. After 9/11, President G.W. Bush passed the Homeland Security Act that cost millions of dollars to merge multiple federal agencies. Disasters exacerbate the viral condition of social inequality. And,

3. Behavioral response approach: relates to the behavior of the individual before, during, and in the aftermath of the disaster. This presents an opportunity for altruism, trust, and community. Additionally, the behavior before the disaster may be directly related to the behavior during and after the disaster. An

> individual who is socially and economically challenged before a disaster will have those same needs amplified after a disaster. A greater understanding of the social environment and its capabilities to sustain after a disaster will minimize extended periods of loss.

Wenger (2006) related merging the mindsets of academics and practitioners for knowledge transfer on managing disasters. While practitioners are experiencing the need for more policy and procedures to manage a natural disaster, researchers are experiencing the need for greater research on sustainable measures to prevent the levels of destruction caused by the disasters. In fact, there is research supporting the notion that citizens are more organized during a disaster and are willing to offer assistance to mitigate the damages than they are perceived to be in the media (Voorhees, 2008). The statements under the behavior approach are important considerations in determining how to mitigate the destruction of the human-environment. Those behaviors before, during, and after a natural disaster are closely related to the economic status of the individuals and their social systems.

I designed a model to guide me through the social construction of the literature on disaster management. This will help to relate the major theories and frameworks to my research and further expand the stages heuristics of disaster management. These theories will focus on the human-environment which encompasses, in addition to the emergency management framework, the impact of the cultural, ecological, political, and social

systems as a result of a natural disaster. Social construction is a phrase adopted by society to describe artifacts produced by society (Motyl, 2010, p. 66). These artifacts range from language to culture to cars to fashion or anything that is not nature but the direct result of human construction (Motyl, 2010). A Venn diagram (Figure 2) was used to show the relationship between the components of the Emergency Management Framework, The design was overlapped with 2 rhombi designs to incorporate the four considerations of every disaster at the corners of each rhombus.

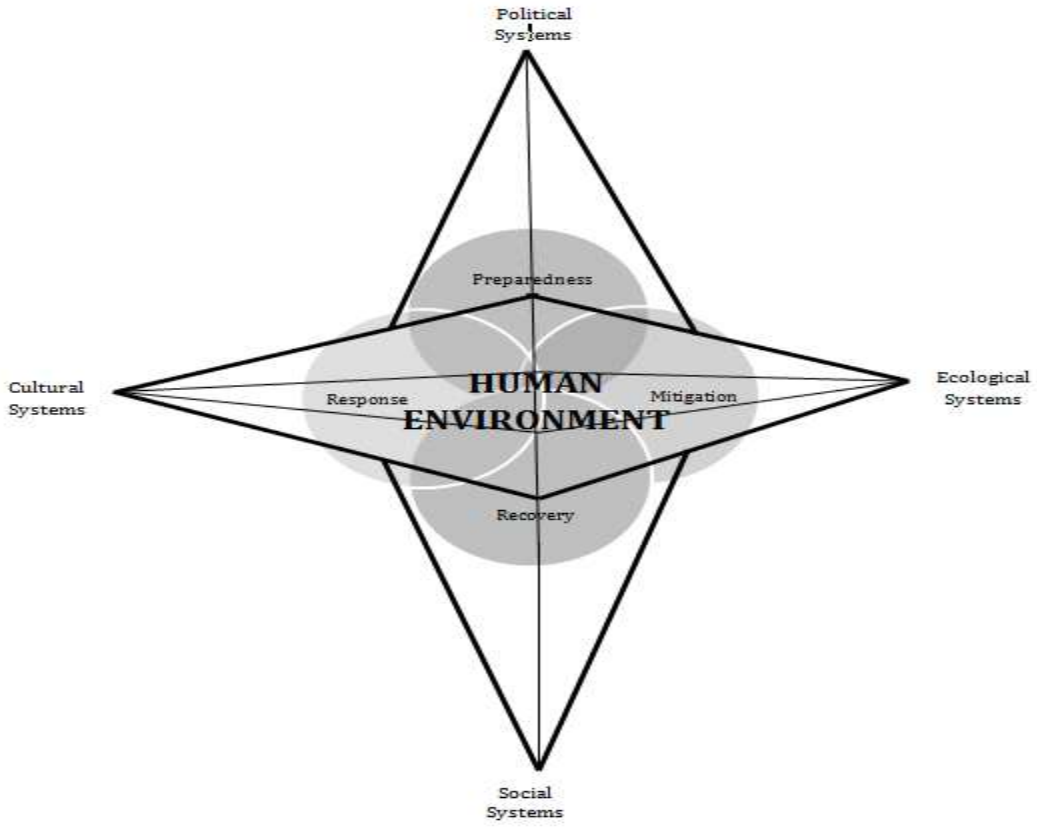

Figure 2. Coordination of the emergency management framework with the elements of the human-environment to create the "Social Construction of Disaster Management." D. Henderson (2015).

The lack of sound policies to protect all phases of the human-environment against natural disasters has created negative rhetoric from the public suggesting institutional discrimination of those victimized (Drabek, 2007; Kessner, 2007). This research is a continuation of decades of studies that have addressed the need to create sustainable measures to mitigate the destruction of the human-environment as a result of a major disaster**.** All findings indicate that the political system addresses disaster management through its policies; however, greater results are recognized when considering all the

components of the human-environment which include, in addition to the political system, social, cultural, and ecological systems.

Political Systems

It is important to understand how the events of September 11, 2001 created a paradigm shift in how the political system views federalism. In the wake of a terrorist threat on domestic soil, decidedly, the federation of government offered the expert capacity and resources to deal with political decisions that were limited by any one subgovernment (Cutler, 2010). Policies are established by the government as a measure for resolving specific social issues. These issues may be introduced by members or individuals of the Legislature or stakeholders representing community affiliates.

Understanding democratic governance and how policy is made is crucial to understanding the social issues associated with disaster management. Governance includes the statues, organizational structure for interorganizations, and rules and regulations for controlling the structure. A democratic form of government is defined as a form of government that distributes a measure of prosperity or well being to its people (Bevir, 2010). Governmental response to the population should do what the people want and nothing that they object to. By definition, the USSR was an example of governance prior to the end of the Cold War. There was a lack of democratic governance, but there was governance. More recently, Orissa, India was suffering from a lack of democratic governance. The government was allowing the Maoists to displace the poor tribes by taking their land for industrialization and leaving the tribes with inadequate resettlement resources (Minhas, 2010).

Policies

Policies are tenets or principles established by the government or organizations to manage the behavior of an organization or group of people. A policy network is a network of actors who are dependent upon each other for specific resources necessary for formulating policies and distinguished from other networks by those resources and interdependencies (Hee & Karl, 2014). According to the organizational theory, specific links and mechanisms are necessary in order to maintain the exchange of resources and dependencies. Actors with the greatest resources have the greatest influence on policy. Aggregately, these individuals or organizations that determine policy have traditionally been the politicians within the legislative branches of our state and federal governments and special committees, in addition to, interest groups and private organizations such as lobbyists and scholars.

Federalism and the multiple streams have been dominating decision making processes in determining policies on disaster management (Clovis, 2006). Federalism came back into focus since the September 11, 2001 event when polices were established to counter terrorism. The multiple streams of policy making categorize the issue, the advocates, and the policy decision. The multiple streams (MS) theory is quite common for understanding the legislative environment (Nowlin, 2011). MS described three components for policy making; problem stream, politics stream, and the policy stream (Nowlin, 2011). These three separate streams categorize the policy process by identification of the problem, the stakeholders, and the solution to the problem. Problem stream exist when the stakeholders have political issues to address (Nowlin, 2011).

The stakeholders are the politics stream, and they may be politicians or they may represent the general public. Policy stream, also termed policy surfing (Boscarino, 2009), is the process of advocacy groups creating proposals and monitoring the legislature for problems being addressed in an attempt to attach their proposal to that problem as an alternative solution that would help to get the issue on the governmental agenda. This would be an innovative approach to a decision making process for public policy because policy theories are not usually tested for hypotheses to determine the validity of a policy. Policy theories have been tested to determine what catalysts influence the innovation for new policies, or to change policies.

The punctuated equilibrium theory suggested that redefining policy problems can lead to changes in policy agendas (Boushey, 2012). For instance, policy diffusion was tested and the results suggested that there are three approaches to policy innovations or changes: (a) gradual policies through incremental changes, (b) emulate or mimic policies made by other states, and (c) policies driven by the federal government (Boushey, 2012). If the wording or focus of an agenda is changed to introduce new policy, it may generate more interest to change or establish new policy. This policy theory can impact social research theory to help re-design policies related to disaster management.

The Institutional Analysis and Development Framework (IAD) emphasizes the need to incorporate theories on social ecological system into the decision making process for disaster management. The (IAD) Framework suggested that familiarity in human behavior determines how rules, norms, and strategies are defined within institutions

(Nowlin, 2011). Institution is defined as shared concepts of human behavior in response to familiar issues. Three groups of people were evaluated on how rules, norms, and strategies were determined within an organization; a government group, a citizens' group, and a mixed group (both government and citizens). The government and mixed group made similar and more rigid suggestions characteristic of federal and state policies, whereas, the citizens' group made less formal and less rigid suggestions.

These findings would indicate a divide between what the citizens want and what they get from the government. The IAD Framework has been suggested as a possible answer to the sustainability of the social ecological system (SES) or the human-environment by utilizing the framework to improve the governing system's understanding of the issues; thereby, enabling the government to seek solutions to the issues (Ostrom, 2007). The IAD Framework idealizes regional compacts to mitigate localized issues that can be handled outside the justice or legislative branches.

Federalism

Federalism is defined within the Constitution as a system of two or more levels of government that have authority over the same people and same territory in a decentralized manner (Clovis, 2008). There are three characteristics of a federal system of government (a) provisions for multi-levels of government to have jurisdiction over the same region or citizens; (b) each level of government has its own legal authority, but may also overlap; and c) neither level of government can abolish the other (McCoy, 2001; Clovis, 2008). Three theories on federalism emerged from the depression years forward

to describe how the federal government reigned into a more centralized government; cooperative federalism, competitive federalism, and coercive federalism (Clovis, 2008).

According to Clovis (2008), cooperative federalism was used to describe how the federal and state governments would interact with the introduction of the grants-in-aid or social programs. Competitive federalism gave the state and local government opportunities to compete for their citizens through voter options. Citizens may vote for their preferences of education, highway projects, or other public goods and services. If the voting option is not suitable, there is the option to relocate to a region which offers more goods and services that the citizen prefers. Coercive federalism places more burdens on state and local government who accepted grants-in-aid because the programs were funded for limited periods of time or were underfunded. Taxes were increased by state and local governments to continue to provide public goods and services.

The 1914 adoption of personal income taxes in the Sixteenth Amendment has shown the greatest impact of the federal government. The New Deal, introduced by President F. D. Roosevelt during the Great Depression was another opportunity for the federal government to seize more power from the states with its massive public spending. In order for the federal government to establish preparedness policies that would be inclusive of all people and protect its citizens against such a cataclysmic event as on September 11, 2001, another movement towards centralization was needed. In 2002, the largest merger in federal government since the end of World War II took place.

Homeland Security Act of 2002

The Homeland Security Act of 2002 was the precursor of the establishment of the Department of Homeland Security which was the greatest merger since the Department of Defense in 1947 (Clovis, 2008). This endeavor consolidated 22 agencies, 5 Directorates, and 180,000 personnel (Clovis, 2008; McNeill, 2009). This merger was projected to eliminate waste, increase savings, and break down the barrier between agencies to improve intelligence (Clovis, 2008; McNeill, 2009). Although, a consolidation of this magnitude would not come without controversy (Berman & Light, 2008). The political behavior after the September 11, 2001 event mandated that these laws be established as a measure of protecting the American people. Politicians collectively, and without hesitation, voted on this major paradigm shift in government, all in the name of protecting our country and its citizens. As substantial and worthwhile as these laws are, they do not fully address the needs for disaster management of natural disasters without consideration of the human-environment.

Social Systems

Our social system is our community. A community is a land based ecological and social environment where a group of people share the same resources and services (Broderick, 2007; (Armstrong et al., 2010). It is a geographical area with districts and neighborhoods. There are public, private, and nonprofit agencies. Resilience does not guarantee that a community will look the same once it is restored after a natural disaster. It means that the community will be functional, even if there are changes in functionality. There may be adaptations to new conditions. Communities cannot depend upon governments to assume total responsibility of recovery efforts. There must to be a

grassroots approach based on the characteristics of the community because communities are affected differently by natural disasters. Some regions have earthquakes; others are more at risk for flood events, hurricanes, or tornadoes.

Communities do not share the same level of resilience because some communities are not as resourceful as others. Therefore, it may take some communities longer to recover from a disaster than others. Other communities may be more robust in resources and adaptive capacity (Armstrong et al., 2010). Adaptive capacity is the ability to self-organize and perform desired functions (Armstrong et. al, p.5). These communities have a high level of resilience and the ability to recover will be swift. Armstrong et al. (2010) designed a model that would allow communities to evaluate and create a plan to strengthen their resources and establish a robust community.

Adaptive capacity engages institutional memory, innovative learning, and connectedness (Armstrong, Hidek, Longstaff, Parker, & Perrin, 2010, p. 7). Institutional memory is shared knowledge over a period of time. This knowledge may be stored in the form of documents, repetitive rituals or ceremonies. Innovative learning is the ability of the group to use the transfer of knowledge to adapt to environmental changes. Connectedness is the formation of social and organizational networks that are subsystems of a community. These networks, or advocacy coalition frameworks (ACF) can complement changes in the environment by structuring shared beliefs of the coalitions to predict a change in belief leading to a change in policy over time (Henry, Jenkins-Smith, Nohrstedt, Sabatier, & Weible, 2011). Three sets of factors will shift beliefs towards a

change in policy (a) interactions of competing advocacy groups, (b) changes external to an advocacy group that leads to realignment with a larger group, and (c) constitutional rules and social structure constrain the actions of the coalition. Competing interests may include the need to change laws and regulations, the element of trust among the agencies, funding, and privacy concerns for the flow of information. Therefore, a community with adaptive capacity has more stakeholders involved in the recovery process after a natural disaster who have personal experiences and resources to share within the community. Advocacy coalition groups familiar with the issues within the communities can promote the need to change laws and regulations as issues develop involving the citizens of that community.

The Model for Community Resilience (see Figure 3) reinforces the need to examine the human-environment in an effort to reduce destruction related to natural disasters. The Model closely encompasses the works of academics and practitioners utilizing both theory and practice (Armstrong et al., 2010). Researchers have categorized the emergency management framework into two concepts; resistance (prevent and protect) and resilience (response and recovery).

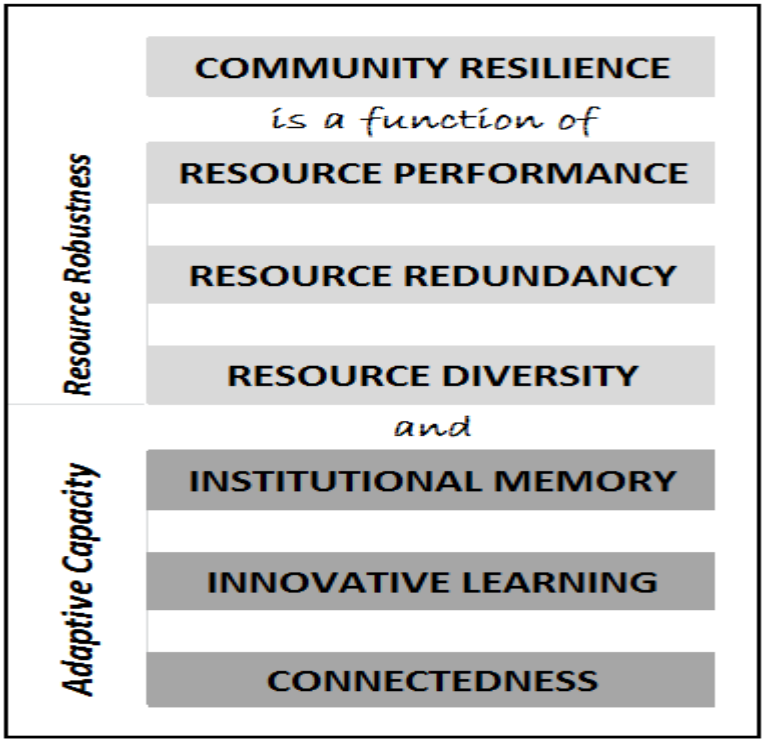

Figure 3. Community resilience model. Building resilient communities: a preliminary framework for assessment *by* N. Armstrong, M. Hidek, P. Longstaff, W.Parker, & K. Perrin (2010), *Homeland Security Affairs* 5(3), 1-23. Retrieved from www.hsaj.org

The resistance concept consists of investments in countermeasures to avoid disasters that may not develop. Resilience is a concept that has been difficult, throughout decades of research, for social researchers and practitioners to tackle in hopes of devising sustainable measures to protect citizens from natural disasters. This concept subscribes short term resources with hopes of creating long-term sustainability (Armstrong et al., 2010). Driving forces of long-term sustainability include strengthening and maturing governmental structures, high involvement in multijurisdictional partnerships, and creating clear agreements of responsibility across jurisdictional lines (Chenoweth and Clark (2010).

Resource Robustness is the community's strength or wealth of resources to be able to sustain in times of crisis or normalcy. The performance, diversity and redundancy of resources determine the system's overall robustness. Performance describes the level of capacity a system performs. Diversity defines the different types of available tangible and intangible resources. Tangible resources may be communications systems. Intangible resources may be information and ideas for managing a specific task. Redundancy is a failsafe resource or backup when a unit fails. Communities may not have adequate tangible or intangible resources due to social problems.

Cultural Systems

In a presentation accepting the Quarantelli Theory Award, Drabek (2007, p. 10) related how human harm and social disruption highlight the social problems related to disasters. Social problems infiltrate such social constructs as class, gender, race, power, and status. Drabek derived seven themes from a critical analysis of these social constructs that are consistently paramount issues for disaster management.

- There is currently a relationship between private troubles and public issues of individuals.
- Societal change is constant, and each change brings about democratic fallout.
- Society constructs social problems; therefore, they must also find solutions.
- Society's rich and famous determine social problems.
- Social problems are interrelated.
- Societal problems exist independent of its victims.
- Terrorism is accepted as a societal problem.

There is, seemingly, the opportunity to demonstrate further social inequalities towards the socially and economically marginalized members of our society (Dach-Gruschow & Hong, 2008**;** Fouche, 2006; Ruether, 2006). Throughout history, there are cases of misalignment of resources to disaster stricken victims; The Great Mississippi Flood of 1927 left more than 400,000 citizens displaced and living in tents for an extended period of time (Slivka, 2005; Levering, 2005).

In the aftermath of Hurricane Andrew in 1992, more than 250,000 citizens were left homeless (Kessner, 2007), most were the socially and economically challenged. The Katrina Hurricane of 2005 left more than 600,000 people displaced and most will never return to life prior to Katrina (Brezina & Kaufman, 2008). Disasters destroy social systems when there are changes in population patterns. Thousands of people were uprooted from their homes after the flood waters inundated their communities destroying all of their properties according to a 2006 US Census report from a survey conducted on the South Central Region (Alabama, Louisiana, Mississippi, and Texas) of the US after the 2005 Katrina event (Koerber, 2006). People were housed in shelters around the country and some lost contact with their family members for weeks.

Table 1

2006 U. S. Census American Community Survey September –December 2005

	Jan-Aug 2005	Nonmovers	Movers within New Orleans MSA	Movers remainder of FEMA area	Movers to other areas in U.S.
Population 1 year and older (actuals)	1,170,160	567,350	131,240	152,210	178,170
Median Age	38.5	44.3	32.2	30.8	28.8
Owner Occupied	68.2	82.5	60.2	22.6	24.5
Renter Occupied	31.8	17.5	39.8	77.4	75.4
Whites	54.6	68.8	58.6	27.8	35.7
African Americans	35.7	19.8	29.1	62.3	56.7
Education					
Less than High School	16.8	14.2	16.4	19	20.8
High School and some college	58.3	58.2	63	61.9	54.7
Bachelor's Degree or more	24.8	27.6	20	19	24.6
Employment					
Employed	59	51.7	54.8	36.3	36
Unemployed	5.5	7.4	7.9	19.2	16.3
Not in the Labor Force	35.5	41	41	44.5	47.6
Not in Poverty	83.4	86.6	89.2	69.2	66.5
In Poverty	17	13.4	10.8	30.8	33.5
	1-Jul-04	1-Jul-05	1-Jan-06		
New Orleans Population	1,201,389	1,292,774	914,745		
Houston, Texas Area Population	4,919,279	5,021,470	5,151,290		

Note. Adapted from *Migration Patterns and Mover Characteristics from the 2005 ACS Gulf Coast Area Special Products* by K. Koerber 2006.

The survey (Table 1) compared the status of residents 8 months prior to Hurricane Katrina and 4 months after the disaster. The 2nd column includes data prior to the Hurricane. The 3rd column has data regarding those how did not leave after the hurricane. The 4th column includes data regarding those who moved to surrounding areas within the New Orleans MSA.

The 5th column includes data of residents who moved to a FEMA designated location such as a mobile home. The last column involves data of people who moved to other areas of the United States. The number of African Americans in New Orleans decreased 16% after Hurricane Katrina. The further the citizens were displaced from the Gulf Coast region, the less education, employment, and stable living conditions existed (Koerber, 2012). As citizens were further displaced, owner occupied dwellings decreased from 68.2% to 24.5%. Overall unemployment increased 11%. The poverty rate increased 17%. Those citizens with less than a high school education increased 4%.

To further substantiate changes in landscape after disasters, in 2008, a study was conducted to investigate demographic changes in U.S. regions hit by major hurricanes (more than $1B in property damage) during the early 1990s (Elliott & Pais, 2008). Quantitative data was collected using the 2000 Census data and a HAZUS-MH file which is a GlS-applicable software that contains meteorological and engineering models used to estimate wind speed damage from past hurricanes. The sample population included blacks, whites, Latinos, and foreign born citizens.

The researchers studied four regions; the Alabama and Florida panhandle, South Florida, Southern New England, and Southern Louisiana. Additionally, they studied Hurricanes; Andrew, Bob, and Opal (Elliott & Pais, 2008, p.18). For these regions, they merged census tract demographic data from the Neighborhood Change Database with biophysical data from HAZUS-MH file. This combination of census data and HAZUS wind speed estimates allowed the researchers to model spatial variations in hurricane damage and recovery within affected regions. With this information, the researchers would be able to test and refine propositions about how regions and constituent neighborhoods change five to ten years after a major hurricane strikes.

The results of the research found that regions grow substantially after major hurricanes. In the four regions studied, this growth brought roughly 1.4 million additional people and 600,000 additional housing units to areas that experienced $Billion storms during the early 1990s. Second, findings affirm that this growth tends to be spatially uneven. Demographically, coastal neighborhoods that experienced the brunt of these major hurricanes tended to become smaller, whiter and older during the recovery phase. By contrast, surrounding neighborhoods in the inner ring of recovery tended to grow dramatically, fueled by expanding black and Latino/immigrant populations and by households with declining incomes relative to the rest of the affected region.
Results also help to refine the framework by showing that this growth in black and Latino populations tends to cluster in areas where group members already concentrated before the disaster, thereby expanding and solidifying preexisting patterns of residential

segregation rather than challenging. Elliott and Pais found that the sample demographics increased 16% for blacks, 27% for foreign born and 39% for Hispanics. Additionally, this further perpetuates the lower income citizens moving into more vulnerable areas of the community. The researchers admit that because their results are based on the research of 3 hurricanes and 4 regions, more research is needed on other environmental hazards (such as earthquakes and floods) and other parts of the country to obtain more conclusive results.

Ecological System

The natural environment is our ecological system of organic and inorganic matter that structures our environment. These organic matter may consist of plants and animals, whereas, inorganic matter may consist of precious metals, oil, and minerals. There are aspects of the natural environment that society cannot control. Society cannot control the occurrence and recurrence of natural disasters such as hurricanes, tornadoes, earthquakes, or severe winter weather. Scientists have been successful identifying and classifying certain phenomena. The Fujita Scale can determine whether a tornado is an F1 or an F5. The Saffir Simpson scale can determine whether a hurricane is a Cat. 1 or Cat. 5. The Richter scale can determine whether an earthquake is <3.4 or >8.0.

The fourth deadliest year for tornadoes was 2011 (NOAA, gov). In the spring of 2011, tornadoes caused more deaths and destruction than any tornadoes since 1950 when the National Oceanic and atmospheric Administration (NOAA.gov) began keeping records. April was the most active month in history with 753 tornadoes. A total of 549

people were killed during the year with an estimated 157 people killed in Joplin, Missouri, and more than 130 people killed in Alabama.

Global warming is a concern and the human-environment is credited with the cause and effect (US Senate Environment and Public Works Committee, 2008). Excessive greenhouse gases such as fossil fuels have polluted the atmosphere causing an abnormal increase in our earth's temperature. Some researchers believe the increase in temperature is creating a climate change. As difficult as 2011 was for the United States due to unusual patterns of weather, Southeast Asia has been documenting its issues with climate changing (Adraneda, 2009). The Economy and Environmental Program for Southeast Asia (EEPSEA, 2009) has been assessing the vulnerability of its region based on such variables as infrastructures, poverty levels, income, literacy, and life expectancy.

Although, this hypothesis is yet to be certified, there are enough question marks within the recent weather patterns that would lead one to believe in the relationship between climate change and the greenhouse effect (Rapoza, 2011). These uncertainties about the climate change and the certainties about natural disasters leave our society in a near helpless state for creating sustainable measures to protect the citizens against the destruction that is inevitable with natural disasters.

With the advancements of technology to include such research tools as geographical information science, and dendrochronology, it is now possible to conduct historical research on how humans interact within their environment in wider spatial and longer time frames (Vayda &Walters, 2009). Disasters are created by further

urbanization. As our urban areas increase so do the vulnerabilities of our communities (the Heinz Center, 2002; Quarantelli, 1996).

For example, an amphitheatre within a community that features summer concerts would impact an individual based on his or her interest in outdoor concerts or the type of performances that were booked (Goodall, 2002: as cited in Broderick, 2007). The conditions of an environment impacts one's identity, livelihood, and social well-being. An individual's perception of his or her environment, through social interactions, is critical to understanding environment management. A social ecological system (SES) study was conducted in Australia to compare three communities' perception of the natural environment in relation to the social systems and natural resource management (NRM). This study was significant because it integrated anthropology with environment to explain how environmental perceptions determine how individuals will behave within that environment (Broderick, 2007). Individuals perceive their environment based on their social, cultural, and personal experiences.

The region of SW Australia was noted for its public drinking water supply since the 1930s (Broderick, 2007). By the late 1980s, the water had become salinized from upper catchments and no longer useful for drinking water (Loh, 1989; as cited by Brokerick, 2007). The goal of the Salinity Recovery Program that began in 1996 is to produce potable water by 2015 (Dames & Moore, 2000; as cited by Broderick, 2007). This is a government directed program that transitioned into a community oriented partnership or a natural response management program that the community will manage.

Southwest (SW) Australia was divided into three regions with three focus groups to conduct a case study through observations and interviews to determine environmental and social issues. The regions were divided based on social and biophysical characteristics. Focus group #1was coastal plains (lower catchment), focus group #2 was river valley (middle catchment), and focus group #3 (upper catchment) was more inland. The participants in the focus groups included town residents, rural residents, business and industry representatives and local and state officials. Participants were asked to evaluate the health of their ecosystem and communities. The findings proved that the three regions had different geological aspects that created differences in opinions of the environment.

Focus group #1 had no issues with the Collie River that flowed through their communities, but the focus group from the other two catchments had major concerns with the river. A buildup of weeds in the river basin was a major problem for the focus group #2. Focus group #3 had issues with water quality and recreational use. Salinity and local governments' involvement in environmental management was a concern for all. Because of the differences in population in each region, defining the governmental organization was challenging.

There were also varying differences in environmental management activities. Focus group #1 had activities from land care to Wildflower society. Focus group #2 encouraged volunteerism. Focus group #3 had a Catchment Council and Salinity Recovery and corporate volunteerism. It was easy to detect the differences in social engagement based on personal experiences within their environment. There were also

differences within the focus groups on the environment and effective management. Farmers within each group had different opinions about water management to prevent erosion and water logging. There were differences in skills and education.

Overall, the social interaction was good for environmental management. Sharing perceptions and experiences within their environment was good for the participants. It was a contributing factor for defining communities to share spaces in nature that were great places for recreational activities.

Study Area

This research is concentrated along the Mid-Atlantic coast of the United States. It had been several years since a major natural disaster had affected this region of the country. DeVries (2011) used the phrase "temporal vulnerability" to describe the vulnerability of a population to natural disasters when there is a time lapse between disasters. The population becomes less resilient because of their complacency to disaster planning and readiness. Using FEMA's mitigation project to assist property owners with their recovery efforts, I will blend policy with theory to test the effectiveness of the program and determine whether one program is suitable for all victims affected by a natural disaster.

Natural disasters such as Hurricanes Fran in 1996 and Floyd in 1999 demonstrated the vulnerability of landowners along the Mid-Atlantic coast with rain fall amounts up to 20 inches and significant flood levels. More recently, Hurricane Irene was a category 1 storm that passed through on August 27, 2011 (Figure 4), again, wreaking

havoc along the Mid-Atlantic coast, with up to 16 inches of rain in some of the most vulnerable areas (NOAA, 2011).

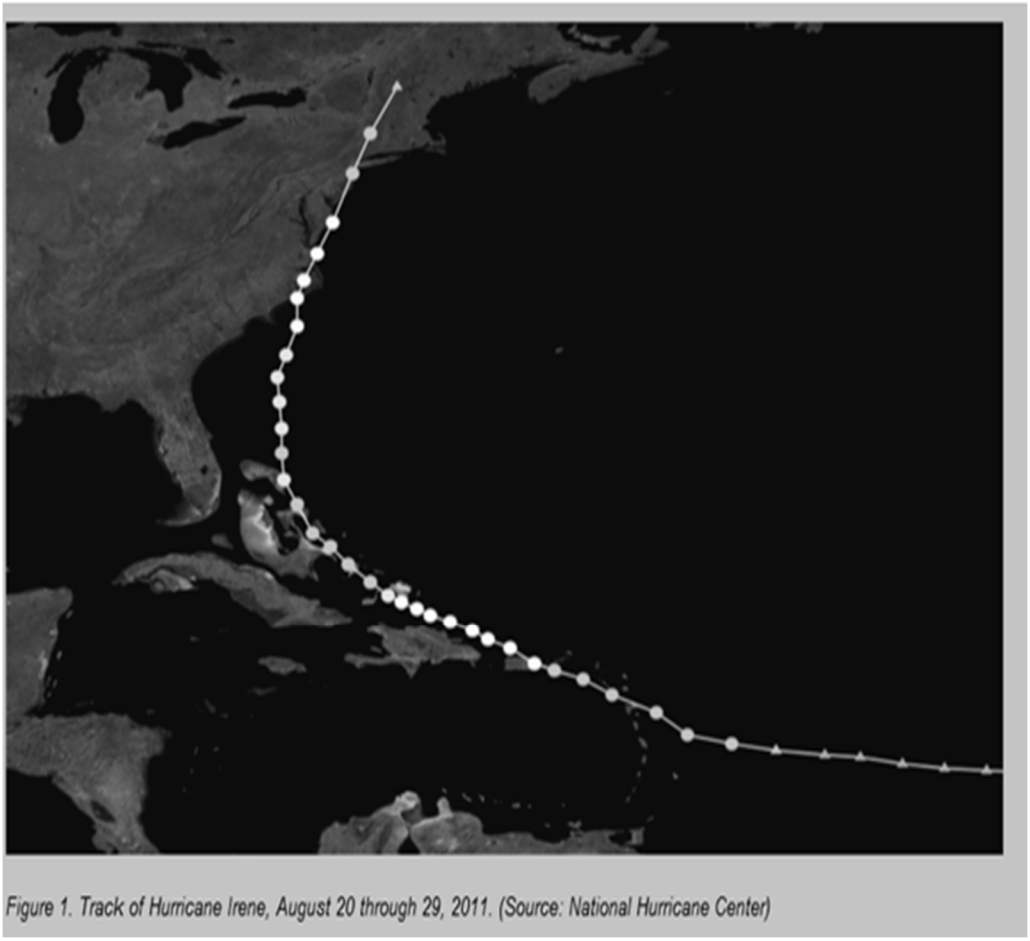

Figure 4. The path of Hurricane Irene. The source of information provided by the MHX Case Study Team of the National Oceanic Atmospheric Administration (NOAA) Newport/ Morehead City, NC Event Summaries.

As a result of the devastation of Hurricane Irene, on August 27, 2011, there was extensive property damage along the Mid-Atlantic coast. A federal declaration was signed by President Obama which activated FEMA to the region to help with recovery efforts. Hurricane Irene was a multi-million dollar disaster. In accordance with Section

406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (2007), fifteen percent of the total damages caused by Hurricane Irene equated to enough funding for the State Mitigation team to corroborate with FEMA and consider mitigation projects to acquire or elevate properties that experienced damages from Hurricane Irene and were subject to the risk by damages in the future.

Through in-depth interviews, FEMA personnel gathered data from property owners in the region who had extensive damage to their properties. The property owners initially had to report to a disaster relief center to gain information about the process. Three hundred fifty residential property owners, initially, completed a form expressing interest in an acquisition or elevation. Some owners were not sure whether they wanted an acquisition or elevation or they did not understand what was being asked so they checked both. Some answered "acquisition then elevation." Once clarified, some changed to acquisition or elevation, others backed out of the process because they were not comfortable with either choice.

The FEMA personnel made contact with each applicant and explained the next steps. The latitude and longitude was needed to verify the exact location of their properties, pictures would need to be taken, a tax assessment would be needed to determine the value of the property, and other pertinent information such as the base elevation of the building on the property. An environmental and preservation specialist had to research the property to ensure that there would be no disturbance to a cemetery or

a home fifty years or older that was registered as a historic site. After all the data was collected, three hundred fifty property owners had signed up for a mitigation project.

This picture (Figure 5) epitomizes the resilience of the citizens through the eyes of the middle school students who were also negatively affected by the Hurricane Irene event in 2011. The students designed this picture to describe their determination to move beyond the devastation of Hurricane Irene. The school encountered more than $500,000 in damages as a result of Hurricane Irene. FEMA was able to provide about 13% in recovery funds based on policies regarding flood insurance. The school did not have flood insurance, and it was in a flood plain. School administrators stated that they had to make a decsion between hiring much needed teachers and flood insturance which would cost about $60,000 per year. As a result of the hurricane, the middle school students had to share facilities with the primary school for school year 2011-2013.

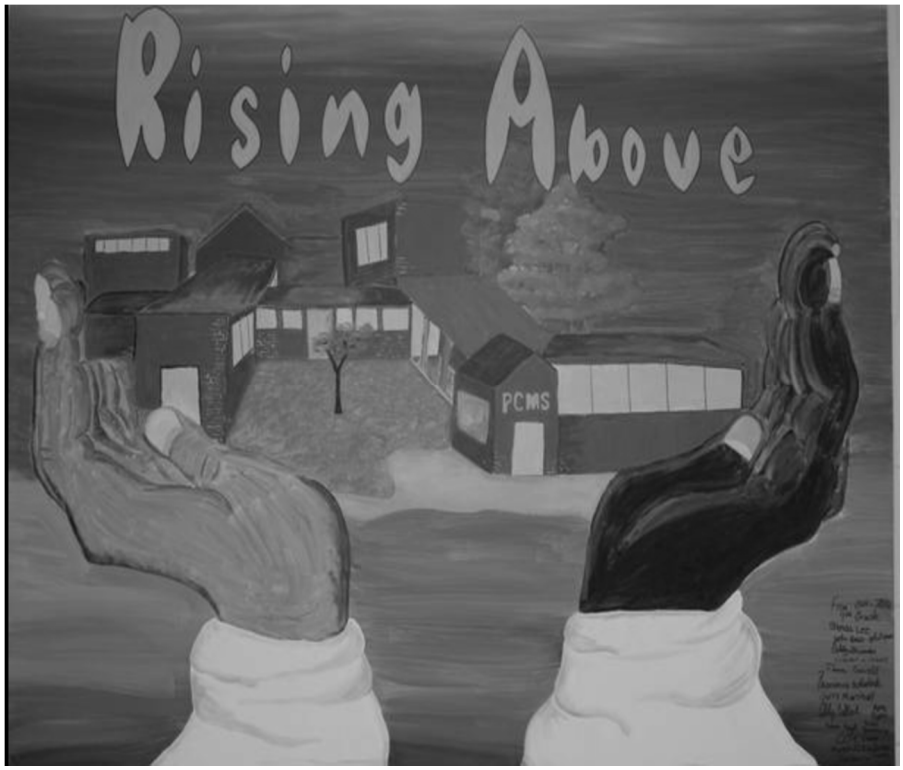

Figure 5. "Rising Above." The creators of this picture were primary school children in the region who were give the assignment to depict their emotions regarding the Hurricane Katrina event that damaged their school and caused them to be displaced for one year and be rerouted to another school.

Neural Networks

In 1943, Warren McCulloch (Neurophysiologist) and Walter Pitts (Mathematician) collaborated on the evolution of neural networks (Aizawa, 2012; Malone & Nagar, 2011; Piore, 2013). McCulloch derived that the smallest cells in the brain called neurons form networks and perform the simplest activities sending and receiving signals causing humans to think, move, feel, learn, analyze, and even form computations. Pitts used algorithms to configure the mathematical proof of activity of the neurons within the brain. Billions of neurons interact to capacitate learning, and these

neurons make predictions and recognize patterns resulting in conclusions and making recommendations.

Neural networks (also considered artificial intelligence or artificial neural network –ANN) are a simplified and elementary approach to recognize patterns and solve problems using the most complex or limited data (Jain, A. & Mao, J., 1996; Lawrence, 1994). Computers perform analyses and operations based on a set of rules that determine the outcome of the data. Neural networks perform operations based on a set of cases. The cases are input into neural networks or neural tools software, and the results are based on a relationship recognized among the neurons that represent a pattern to conclude a prediction or possible outcomes of the data.

Funding for research on neural networks decreased during the 1960s due to problems with the reliability as a valid research tool. Then, into the 1980s, a Soviet mathematician, Kolmogorov, proved a theorem that, once again, gave neural networks credence as a valid research tool. In 2011, engineer, Dharmendra Modha and colleagues (Piore, 2013), discovered how neural networks could be a reliable problem solving tool utilizing less time and energy. Today, banks use neural networks to determine credit risks or recognize behaviors, detect fraud, problem solve diagnosis for diseases, analyze and organize the overload of digital information created worldwide between 2005 and 2012 (Snyder, 1996; Piore, 2013).

Summary

Academics are divided on the approach to managing disasters. There is the approach to professionalize the field of emergency management in the public administration curriculum. The human-environment, also, needs consideration when establishing policies on natural disasters. This environment embodies a community of stakeholders, not only the political system, but the social system, the cultural system, and the ecological system.

Though, public policy theory has been tested to determine the effectiveness of the policy process, policy research is rarely tested by hypotheses before mplementation to determine validity or how effectively the policy will perform. Certain policy theories may complement one another in order to obtain knowledge and discern that knowledge for the greater good. For instance, the multiple streams theory categorizes the policy process by identifying the problem, the stakeholders, and a solution to the problem. The punctuated equilibrium theory takes the policy process a step further by redefining policy problems can lead to changes in policy agendas.

The advocacy coalition framework (ACF), adaptive capacity, and the institutional analysis and development framework complement each other and exemplify the need to integrate the human-environment into disaster management policies. These concepts focus on community and advocacy groups with competing interests within the community. Competing interests may include the need to change laws and regulations, the element of trust among the agencies, funding, and privacy concerns for the flow of information. There are shared values and beliefs among diverse cultures. Some

communities have fewer resources than others. The socially and economically marginalized citizens are most affected in each disaster and unresolved environmental issues may have made the difference in the outcome of the disaster. Combining these frameworks support the idea that the government needs more understanding of the issues related to the human-environment in order to provide the services that the citizens want, and subsequently, need after a natural disaster.

Chapter 3: Research Method

Introduction

The behavior of the researchers suggested that current approaches to the management of natural disasters do not meet the holistic needs of communities. Since 1984, social science has taken a giant leap into the public policy arena regarding disaster management. FEMA recognized the need to employ academia into its recovery efforts because of the social ramifications in the aftermath of natural disasters (Waugh, 2006). As described in Chapter 1, natural disasters are inevitable, we cannot control them. Society has to seek ways to mitigate the amount of damage incurred as a result of a natural disaster. This research involved a region along the Mid-Atlantic coast that was affected by Hurricane Irene on August 27, 2011.

Hurricane Irene left an inordinate amount of property damage. The State of North Carolina applied for funding through the Hazard Mitigation Grant Program (HMGP) under the authority of Section 404 of the Robert T. Stafford Disaster and Relief Act (2007) to mitigate properties damaged of more than $100 million when Hurricane Irene ravaged the region in 2011. In an effort to assist property owners with recovery efforts, a FEMA Mitigation team gathered data to identify homeowners who may have been interested in a mitigation project to ameliorate damages caused by Hurricane Irene.

Once the home owners were identified, FEMA used the *Benefit Cost Analysis* (BCA) software package, Version 4.8, to quantify the applicants for the project. The BCA V4.8 (2009) software package had been updated to create an easier process of

entering data and generating a more structured and categorized output. A BCA tool is an effective and more accurate measure to determine the future benefit of (a) mitigating a property or project versus (b) the cost to do the project. Converting (a/b) to a Benefit Cost Ratio, the number one (1) or greater supports the position that the project is cost effective. A number less than 1 is not considered cost effective.

The FEMA agents input the following variables into the BCA tool: name, address, parcel, base floor elevation, value of property and building on property (generated from tax records), the year the structure was built, stick built or factory built, prior damages, and the existence of flood insurance. Another variable considered was the projected expense for rental housing because some home owners would be displaced until their homes were either purchased or elevated by FEMA. Each home owner had completed a questionnaire earlier in the process regarding their preference for a mitigation project. The principle questions asked of the homeowner were:

1. did they prefer an acquisition of their properties? or,
2. did they prefer an elevation of the building on their properties?

This information was also included in the BCA tool. A multiplier of 1.5 (used for all counties in the region) was applied to the value of the property plus the building to maintain consistency with any change in tax rates. A discount rate of .07 was set as default.

Table 2 is a recap of the data generated when the home owners were asked about their choice of an acquisition or an elevation. Percentages in frequency tables are

important because they can be compared to other surveys to determine a correlation. These were the initial responses when asked whether to acquire or elevate the owners' properties. Eighteen percent of the home owners were interested in acquisitions. Sixty Eight percent were interested in elevations. Nine percent of the home owners were undecided. It appears that five percent of the home owners did not understand how the process worked when they responded to each option (both- mitigate- acquire then mitigate- elevate then acquire), and one entry had no response to the request.

Table 2

Frequency Table of Property Owners Interested in Mitigation

Interest in mitigation	Frequency	Percent	Valid percent	Cumulative
0 acquisition	64	18%	21%	21%
1 elevation	239	68%	79%	100%
			100%	
2 Undecided	30	9%		
3 Both	7	2%		
4 Mitigate	1	0%		
5 Acquire then Elevate	3	1%		
6 Elevate then Acquire	5	1%		
7 No response	1	1%		
	350	100%		

Note. The information listed here was adapted from the data that the FEMA agents collected in 2011 after the Hurricane Irene Federal Declaration.

Problem Statement

As with Hurricane Katrina, many ethnic minorities are displaced from their homes after a natural disaster leading to interruption of education, income, or separation of family (Stevenson, 2013). Despite the assistance from FEMA, African Americans and Hispanics who, in some cases, are socially and economically marginalized, have social issues that exist prior to a natural disaster. Some citizens face repetitive damage to their properties because the homes may be built on land susceptible to flooding or some other hazard or vulnerability (Stevenson, 2013).

Each natural disaster in the United States exposes the fact that poverty, race, gender, and other socially disadvantaged indicators are linked to the population of citizens who struggle the most to recover after a disaster. Stevenson (2013) suggested that the discourse of actions that society takes prior to a natural disaster determines the resiliency of recovery after a disaster. Access to sensitive demographics of individual household data related to race, household income, or education was not available. More clarity regarding the individuals affected by the disasters would help to create a more resilient recovery plan, thereby, providing more positive results in the long range. Because of limited data, perhaps a quantitative study using neural networks (Aizawa, 2012) to predict the behavior of the HMGP process, used to determine eligibility of the of the citizens who experienced property damage after the Hurricane Irene event in 2011, will provide some helpful information on the topic.

Purpose Statement

The purpose of this study was to analyze the significance of integrating social research, related to the human-environment, with policies involving disaster management. The research design is a quantitative approach using neural networks to evaluate data collected by the Federal Emergency Management Agency (FEMA) when Hurricane Irene destroyed properties, as it swept northward along the Mid-Atlantic coast of the United States in August 2011. In addition, the research was useful in suggesting how the selection process was made for citizens to obtain grant funding who experienced damages as a result of the disaster. Using neural networks (Lawrence, 1994), the results of this research should offer further insights on the relationship between citizens characterized as being socially and economically marginalized and the policies set forth by FEMA in an attempt to assist with recovery efforts after a natural disaster.

I explored the benefits of integrating the human-environment into public policy when creating policies to manage a natural disaster. Social research promotes the consideration of the human-environment interaction as an important indicator when determining the best approach to mitigating the destruction after a natural disaster. Considering all the systems (cultural, environmental, political, and social) of the human-environment when making policies on disaster management should help to reduce the percentage of citizens with unmet needs as a result of a natural disaster. Continuing to upgrade the cost of recovery efforts without identifying the underlining problems for such massive destruction is a reactive measure to disaster management rather than a proactive one. Mitigation of the human-environment is paramount to protecting our citizens

against natural disasters. Information gathered during this study could help design possible means for society to create new approaches to disaster management that protect its citizens from natural disasters.

Importance of the Study

The study is important because a) it offers insight on the benefit of methodological testing of policies on disaster management, and b) the study adds additional insight into the need to integrate the human-environment into policy making decisions. The federal government is spending a lot of time and money to improve disaster recovery. Between 1985 and 2004, damage to properties and crops caused by natural disasters averaged $16.5 billion per year (Healy & Malhotra, 2009). The federal government contributed an annual average of $3.05 billion in disaster relief. That is in contrast to the $195 million spent during the same time period on disaster preparedness (Healy & Malhotra, 2009). These alarming statistics on disaster management suggest that efforts to reduce or mitigate the damages to life and property incurred as a result of a natural disaster require a new model on how policy is made for disaster management.

Research Question

Because of the increasing number of natural disasters each year, the escalating costs of each event, and the repetitive destruction in close proximity to each event, it would be incumbent upon society to assess sustainable measures for protecting citizens from the destruction caused by a disaster. Some public policy, although research based, have not been tested using hypotheses (Ringquist, 2011; Larimer & Smith, 2009). I

tested a hypothesis of a mitigation program (which was outlined in the Robert T. Stafford Act) to determine the effectiveness of the program for the citizens affected by the wrath of Hurricane Irene in 2011. The data were limited because FEMA does not collect demographics at the time of the application process to obtain a mitigation grants. Neural networks is an ideal tool to use since it is designed to detect relationships between limited amounts of data to derive at a prediction.

The null hypothesis was: There is no significant difference between the process for acceptance into the mitigation program offered by FEMA for applicants characterized as socially and economically marginalized and those who are not.

The alternative hypothesis is: There is a significant difference between the acceptance of applications for the mitigation program offered by FEMA for applicants characterized as socially and economically marginalized and those who are not.

The Research Design

I employed a quantitative approach to a case study to examine the behavior of a public policy for a mitigation program using neural network software. For decades, the social and economically marginalized sector of our society, specifically minorities, have experienced more difficulty recovering after a major natural disaster. There is a need for more testing by hypotheses of public policies. This results in greater reliability and positive outcomes of programs. Secondary data is used for the study, and there are demographics (deemed sensitive) missing from the data that would be useful to deriving the targeted results.

Methodology

Hurricane Katrina occurred 78 years after the 1927 Mississippi Flood; and yet, there were parallels where society failed to protect its citizens from such a horrific disaster. The socially and economically marginalized citizens are the ones most affected in each natural disaster and unresolved environmental issues may have made the difference in the outcome of the disaster (Bullard, 2008). The purpose of this study is to conduct some statistical analyses to evaluate the pattern of behavior of a FEMA mitigation policy, further, suggesting how the selection process was determined. Neural networks will be used to model the allocation of funding of FEMA's mitigation program. Determining how the funding is allocated will give insight into whether the program considers the social and economically marginalized members of the community when there is a natural disaster. The primary objectives of this study was to:

- Provide supporting evidence related to the importance of integrating the human-environment into policy making decisions.
- Provide new insights on the benefits of methodological testing of policies on disaster management.
- Provide insights on the importance of utilizing neural networks in research with limited data, particularly, sensitive data.

FEMA's data was collected in a geo-referenced file spreadsheet. The geo-referenced file spreadsheet was integrated into the Environmental Systems Research Institute (ESRI) global information systems (GIS) software (Hoover's Company Records, 2014). ESRI, founded in 1969 by Jack and Laura Dangermond, produces GIS software

that was originally designed for land use planning managers with decisions on the environment. The system produces and publishes digital maps on the Internet, and conducts business with public and private industries from the government to the oil industry to aid planners and land resource managers with decisions on the environment.

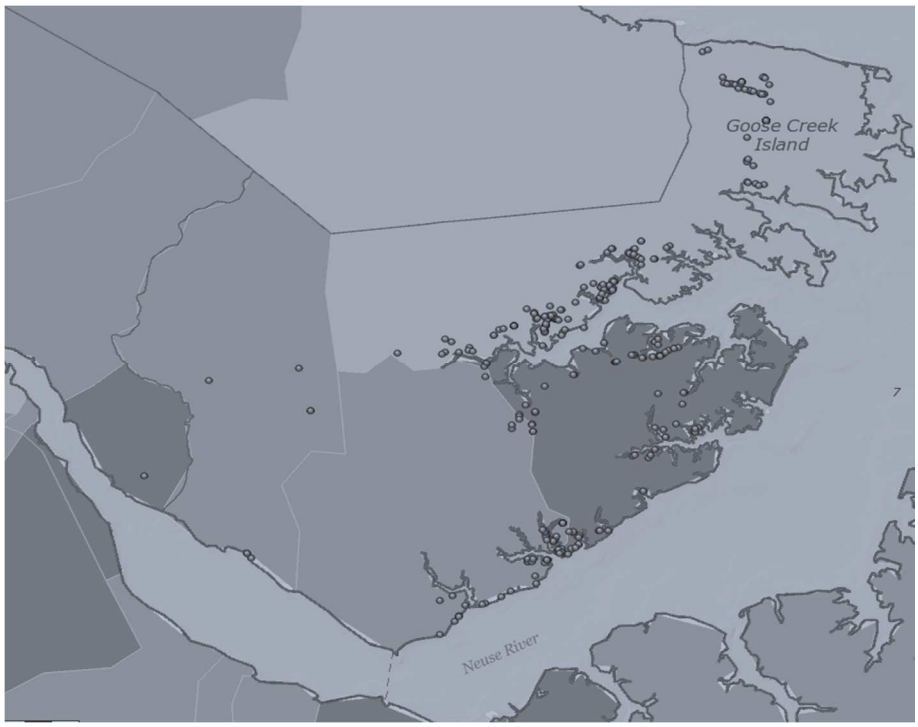

Figure 6. MAP of geo-referenced data file area maps located by zip code. Adapted from ESRI software indicating the physical location of each of the properties involved in the research. http://www.esri.com/data/esri_data/ziptapestry

As mentioned earlier, neural networks are a simplified and elementary approach to recognize patterns and solve problems using the most complex or limited data. Some scientists suggest that the artificial agents within the neural networks typically yield

better predictions that the human brain and are better at processing information. One could combine the best features of each in solving a problem. One of the simplest and most common neural network models is the fully connected three layer model that consists of the input layer, the hidden layer, and the output layer. Instead of programming a neural network, the neural network is trained by presenting a history of inputs and outputs to the network. Training can be difficult and time-consuming, but after training, the neural network can quickly recognize patterns. One of the easiest places in which to integrate neural networks into the curriculum is a follow-up to the study of regression. The goal of regression is to determine a functional relationship between an outcome variable and one or more predictor variables.

Unlike typical computer processing, neural networks are trained rather than programmed. The Feedforward neural network model (Figure 7) consists of three layers, the input layer, the hidden layer, and the output layer. This model is most commonly used for problem solving and predictions, plus, it is used widely in computer science, engineering, and medical curriculums (Razavi & Tolson, 2011). Neural networks can be trained to identify the relationships between the input and output layers. Through this process, neural networks can make assumptions or predictions about certain outcomes

(Daya, & Karouni, 2014).

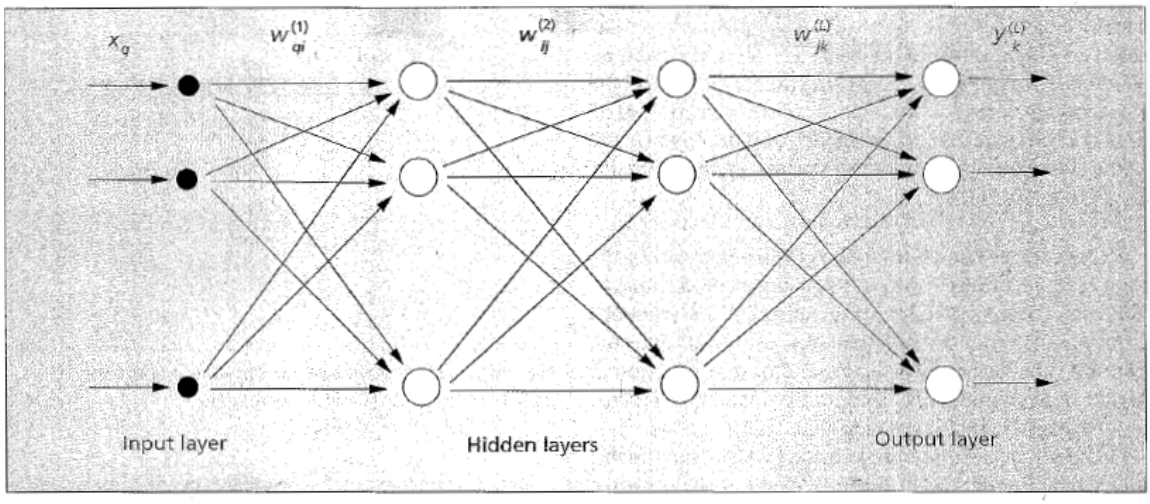

Figure 7. Model Feedforward Neural Network (FFNN) by A. Jann and J. Mao (1996). Artificial Neural Networks: a Tutorial, *Institute of Electrical and Electronics Engineers,* 194-212.

A neural network is trained to map a set of input data by iterative adjustment of the weights. Information from inputs is fed forward through the network to optimize the weights between neurons. The neural network reads the input and output values in the training data set and changes the value of the weighted links to reduce the difference between the predicted and target (observed) values. The error in prediction is minimized across many training cycles until the network reaches specified level of accuracy. The inputs were multiplied by the connection weights and summed or combined, then pass through a transfer function to produce the output for the neuron. There are two main connection formula types; feed forward and feedback (recurrent) connections. Feed forward neural network (FFNN; Figure 7) does not have a connection back from the output to the input neurons (Hussein & Tawfiq, 2013, p.2). Feedback neural network

(FBNN; Figure 8) is one type of connection where the output of one layer routes back to the input of a previous layer, or to the same layer.

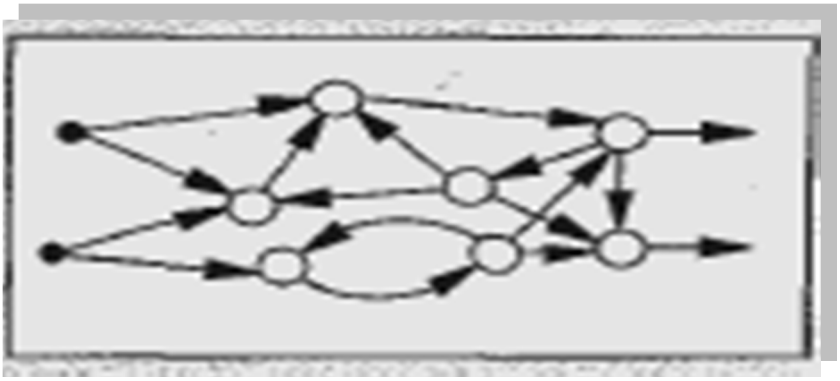

Figure 8. Model Feedback Neural Network (FBNN) by A. Jann and J. Mao (1996). Artificial Neural Networks: a Tutorial, *Institute of Electrical and Electronics Engineers,* 194-212.

Sampling Design

The sampling approach can best be described as a nonrandom or a convenience approach. After the region was declared by President Obama for federal assistance, FEMA set up a disaster relief center for interested property owners to come and apply for a potential mitigation project. Three Hundred fifty residents applied for assistance which is about three percent of the 2011 estimated population of 13,197 residents in the region of 337 square miles.

The Instrument

FEMA used a questionnaire to gather the data. Then, a BCA software V 4.8 (2009) was used to determine cost effectiveness of FEMA's Mitigation program. The BCA software organized, categorized, and performed calculations that would generate eligible applicants for the mitigation program.

Data Collection

The FEMA Mitigation agents used questionnaires to gather information from the property owners in a small region along the Mid-Atlantic coast. Then, they used a Benefit Cost Analysis software to input the data and produce the eligible applicants for a mitigation project.

The Modeling Techniques

I used the Palisades Risk and Decision Analysis software in this research. Established in 1984, Palisades is a provider of software that, when integrated with Excel, solutions are derived from uncertain situations. Neural network Models 1, 2, & 3 were constructed, trained, tested, and used to conduct sensitivity analysis in order to answer the research questions. Then, Models 4, 5, & 6 were trained and tested again eliminating one of the predictor variables during each test. This was an additional opportunity to determine which predictor variables were not as significant and may require substitution of another variable. A description of each model design in listed below.

The variables for the study in Table 3 *were extracted* from the data collected by the FEMA agents after the Hurricane Irene event in 2011. The variables selected were based on the hypotheses of some correlation to the opportunity to receive funding assistance. There was a question regarding the extent of the damage to the structures. There was a question regarding temporary housing for those owners who were displaced from their homes due to damages. The percentage of non-whites by the zip codes was obtained by from the US Census Fact Finder (2010). The adjusted property value was

already calculated within the dataset by multiplying the tax value of the building and land by the tax multiplier 1.5.

Table 3

Variables and Variable Types

Variables	Variable type
Is the structure substantially damaged? (X_1)	Predictor categorical
Is the owner living in FEMA temporary unit? (X_2)	Predictor categorical
Non-White by zip code (X_3)	Predictor numerical
Adjusted property value (X_4)	Predictor numerical
Received some sort of assistance (Y_1)	Outcome categorical
Elevation assistance (Y_2)	Outcome categorical
Acquisition assistance (Y_3)	Outcome categorical

Model 1

Model 1 predicted how the mitigation project impacts all residents receiving some form of assistance. The input facts for this model were the predictor variables X_1 through X_4 from Table 3. The output pattern was the outcome variable received some sort of assistance (Y_1) from Table 3. The equation for this model was:

$$Y_1 = f(X_1, X_2, X_3, X_4) \quad (1)$$

Model 2

Model 2 predicted how the mitigation project impacts those residents receiving elevation assistance. The input facts for this model were the predictor variables X_1 through X_4 from Table 3. The output pattern was the outcome variable elevation assistance (Y_2) from Table 3. The equation for this model was:

$$Y_2 = f(X_1, X_2, X_3, X_4) \quad (2)$$

Model 3

Model 3 was used to predict how the mitigation project impacts those residents receiving acquisition assistance. The input facts for this model were the predictor variables X_1 through X_4 from Table 3. The output pattern was the outcome variable acquisition assistance (Y_3) from Table 3. The equation for this model was:

$$Y_3 = f(X_1, X_2, X_3, X_4) \quad (3)$$

Model 4

Model 4 was used to predict how the mitigation project impacts those residents receiving some sort of assistance eliminating one predictor variable each time from Table 3. This model was trained and tested 4 times. The output pattern was the outcome variable some sort of assistance (Y_1) from Table 3. The equations for this model were:

$$Y_1 = f(X_1, X_2, X_3) \quad (4)$$

$$Y_1 = f(X_2, X_3, X_4) \quad (5)$$

$$Y_1 = f(X_1, X_2, X_4) \quad (6)$$

$$Y_1 = f(X_1, X_3, X_4) \quad (7)$$

Model 5

Model 5 was used to predict how the mitigation project impacts those residents receiving elevation assistance eliminating one predictor variable each time from Table 3. This model was trained and tested 4 times. The output pattern was the outcome variable elevation assistance (Y_2) from Table 3. The equations for this model were:

$$Y_2 = f(X_1, X_2, X_3) \quad (8)$$

$$Y_2 = f(X_2, X_3, X_4) \quad (9)$$

$$Y_2 = f(X_1, X_2, X_4) \quad (10)$$

$$Y_2 = f(X_1, X_3, X_4) \quad (11)$$

Model 6

Model 6 was used to predict how the mitigation project impacts those residents receiving acquisition assistance eliminating one predictor variable each time from Table 3. The data for this model was entered 4 times for training and testing. The output pattern was the outcome variable acquisition assistance (Y_3) from Table 3. The equations for this model were:

$$Y_3 = f(X_1, X_2, X_3) \quad (12)$$

$$Y_3 = f(X_2, X_3, X_4) \quad (13)$$

$$Y_3 = f(X_1, X_2, X_4) \quad (14)$$

$$Y_3 = f(X_1, X_3, X_4) \quad (15)$$

The models were trained and tested to an adequate level of 75% or greater on a test data set. The analysis helped to answer the research question and provide more detailed information about which predictor variable took priority when considering the outcome variables. Considering the limited data available to conduct this research, it was critical to realize the ability of neural networks as a viable tool when studying public policy particularly as it relates to disaster management.

Methodologically, as more research is conducted on social research in disaster management, models that fail to train after several attempts can still provide insights into issues addressed by the research such as a) did the model fail to train because of failed data, or b) lack of a pattern. In either case, it may be necessary to identify variables that may suggest changes in policy behavior.

Chapter 4: Results

Of the 350 home owners who applied for FEMA mitigation assistance, 312 had complete data entries for the purpose of this research. The Palisades Neural Tools software conducted up to 102 trials on 250 cases during training, randomly selected 62 cases for testing not used in training, and then conducted a sensibility analysis on 30% the test cases. Testing is conducted to determine how well a neural network can predict the outcome of known data. Sensibility analyses determine which variables have the greatest impact on the outcome.

Initially, three neural network models were designed, trained, and tested, in addition to sensitivity analysis for this study. The input for each model was predictor variables ($X_1 \ldots X_4$) as summarized in Table 3. The output or outcome variable for Model 1 was based on those people who received some sort of assistance which would be the sum total of applicants who received either acquisition or elevation assistance. This model was used to help delineate which predictor variable had a greater impact in determining the behavior of the Mitigation Grant Program when awarding grant funding for people who have experienced extensive damage to their homes as a result of Hurricane Irene. Figure 8 represents summaries of the findings of Models 1, 2, & 3 along with an abbreviated version of the results of the training and testing for each model. The actual results are in the Appendices.

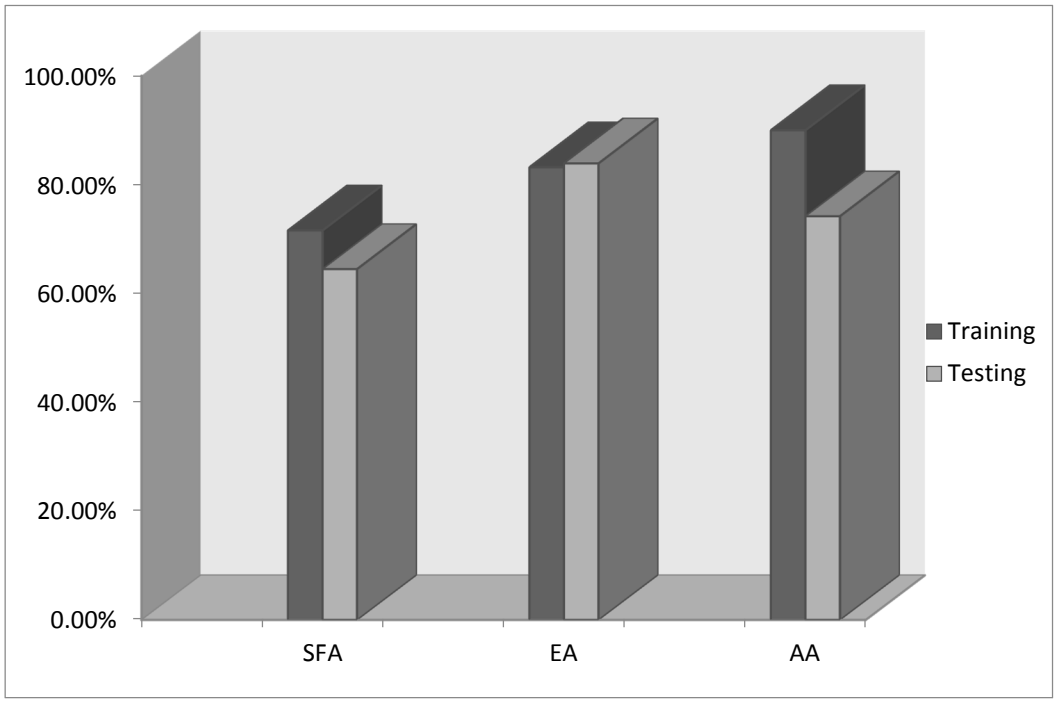

Figure 9. Training, testing, and sensitivity analysis for models 1, 2, & 3.

Using the following outcome variables: received some form of assistance (SFA), elevation assistance (EA), and acquisition assistance (AA) and predictor variables: structural damage, living in temporary housing, non-white by zip code, and adjusted property value, the models were able to predict with a confidence level of SFA (71.6000%), EA (83.2000%), and AA (90.0000%) on training cases where the outcome was known. Additionally, using the same outcome and predictor variables, the models were able to predict with a confidence level of SFA (64.5161%), EA (83.8710%), and AA (74.1935%) on testing cases where the outcome was known. The confidence level was about equal for the prediction of the training and testing of the outcome variable, Elevation Assistance, where the outcome was known. Upon review of the sensibility

analysis, adjusted property value (48.4836%) had the greatest impact on Model 1, the need for temporary housing unit (80.2724%) had the greatest impact on Model 2, and non-white by zip code (44.2828%) had the greatest impact on Model 3.

Table 4

Results of Training, Testing, and Sensitivity Analysis for Models 1, 2, & 3

	Model 1 Some Form of Assistance	Model 2 Elevations Assistance	Model 3 Acquisition Assistance
Training			
# Cases	250	250	250
# Trials	102	75	100
Prediction %	71.6000%	83.2000%	90.0000%
Testing			
# Cases	62	62	62
Prediction %	64.5161%	83.8710%	74.1935%
Data Set			
# Rows	314	314	312
Variable Impact Analysis			
Adjusted Property Value	48.4836%	0.2724%	1.5349%
Non White by Zip Code	41.2484%	4.7627%	44.2828%
Substantial Damage	10.2196%	14.6464%	21.4625%
Temporary Housing	0.0483%	80.3185%	32.7198%

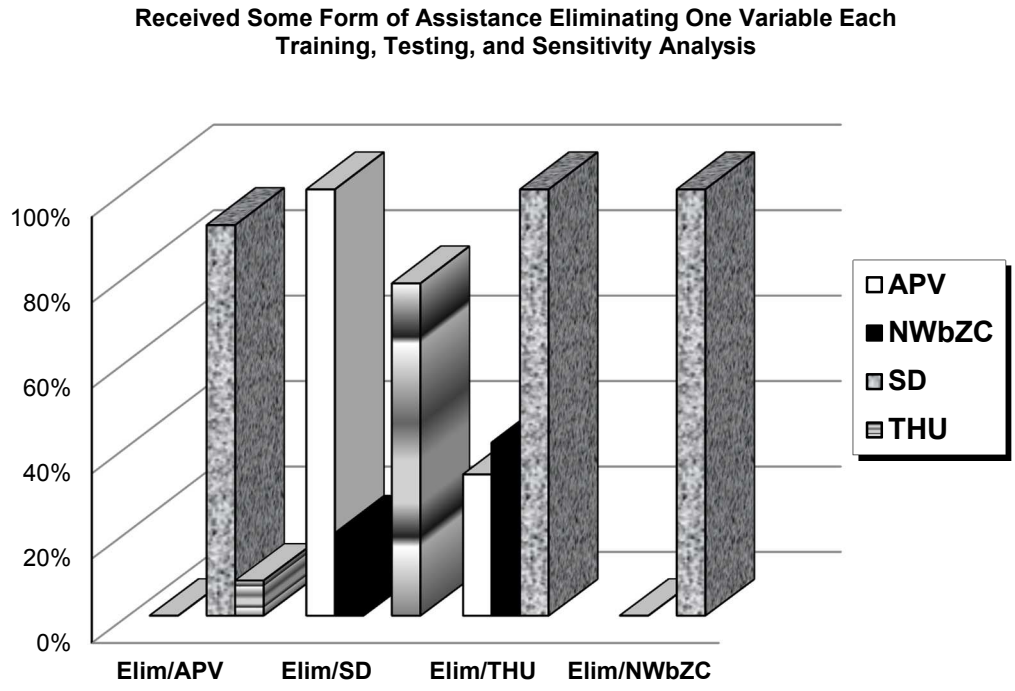

Figure 10. Training, testing, and sensitivity analysis for Model 4

Using the outcome variable, received some form of assistance (SFA), and predictor variables: structural damage, living in temporary housing, non-white by zip code, and adjusted property value, Model 4 was retrained and retested for more conclusive evidence to determine the accuracy of the predictor variable with the most impact on the decision making process to receive some form of assistance in Figure 10. One predictor variable was eliminated during each training, testing, and sensibility analysis. During this series of training, testing, and analysis, the predictor variable with the most impact was structural damage with 100% confidence level when nonwhite by zip code was eliminated, 91% when adjusted property value was eliminated, but 26% when temporary housing was eliminated. This indicated that the behavior of the mitigation policy was more focused on the extent of structural damage to the owners'

property as a basic consideration for providing some form of assistance to the home owners.

Table 5

Results of Training, Testing, and Sensitivity Analysis for Model 4

	Model 4			
	Some Form of Assistance Eliminating 1 Variable each Training, Testing, and Analysis			
Training				
# Cases	250	250	251	250
# Trials	86	67	70	62
Prediction %	68.0000%	66.8000%	65.737100%	68.4000%
Testing				
# Cases	62	62	63	62
Prediction %	64.5161%	69.3548%	71.428600%	64.5161%
Data Set				
# Rows	312	312	314	312
Variable Impact Analysis				
Adjusted Property Value	0%		2.5537%	33.2902%
Non White by Zip Code		0%	19.6424%	40.7604%
Substantial Damage	100.00%	91.6517%		25.9494%
Temporary Housing	0%	8.3483%	77.8039%	

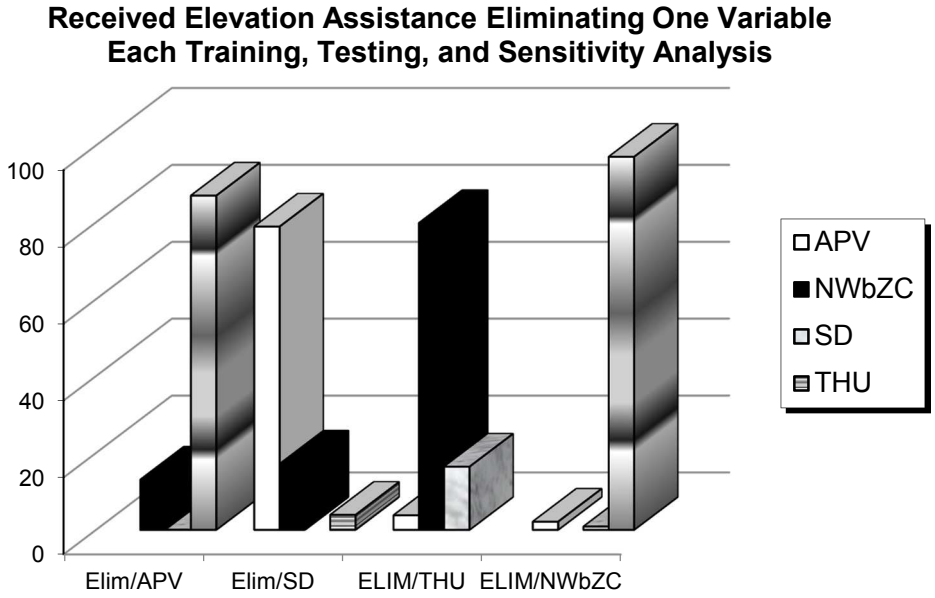

Figure 11. Training, testing, and sensitivity analysis for Model 5

Using the outcome variable, elevation assistance (EA), and predictor variables: structural damage, living in temporary housing, non-white by zip code, and adjusted property value, Model 5 was retrained and retested for more conclusive evidence to determine the accuracy of the predictor variable with the most impact on the decision making process for elevation assistance in Figure 11. One variable was eliminated during each training, testing, and sensibility analysis. During this series of training, testing, and analyses, the predictor variable with the most impact was temporary housing unit with 87% confidence level when adjusted property value eliminated and 97% when non-white by zip code was eliminated. This indicated that the behavior of the mitigation policy was more focused on those property owners who needed temporary housing units as a consideration for providing elevation assistance to the home owners.

Table 6

Results of Training, Testing, & Sensitivity Analysis of Model 5

	Model 5			
	Elevation Assistance Eliminating One Variable each Training, Testing, and Analysis			
Training				
# Cases	250	251	250	250
# Trials	64	75	75	60
Prediction %	82.8000%	84.4622%	83.2000%	80.4000%
Testing				
# Cases	62	63	62	62
Prediction %	82.2581%	74.6032%	85.4839%	91.9355%
Data Set				
# Rows	312	314	312	312
Variable Impact Analysis				
Adjusted Property Value		78.8847%	3.7870%	2.1243%
Non White by Zip Code	13.0452%	17.2294%	79.7870%	
Substantial Damage	0.0174%		16.43%	0.8413%
Temporary Housing	86.9374%	3.8859%		97.0343%

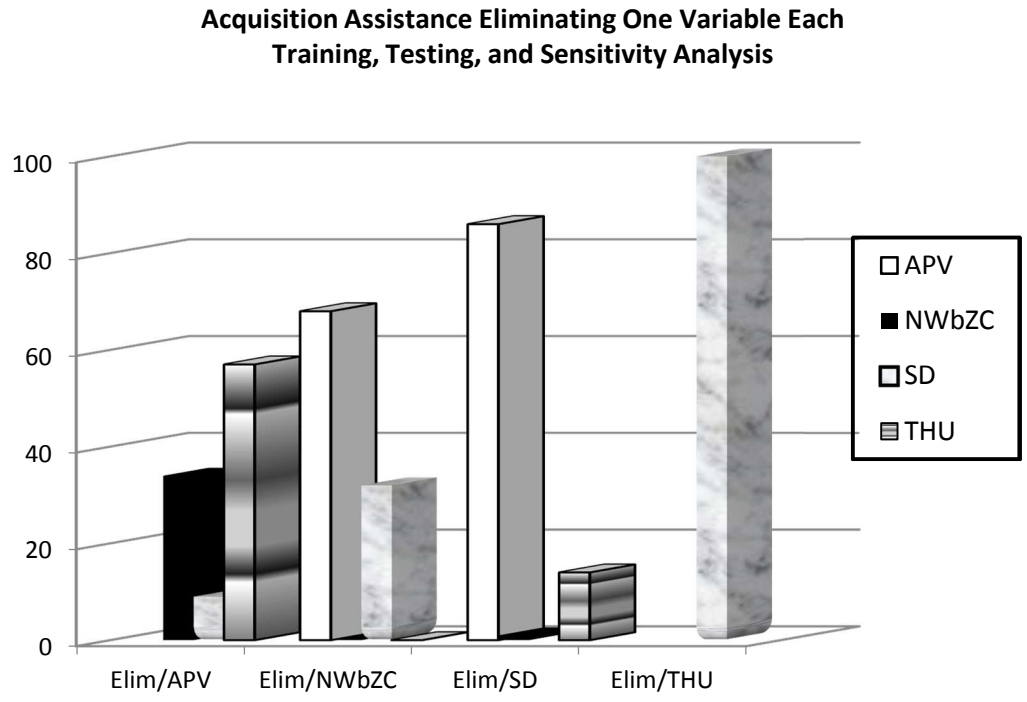

Figure 12. Training, testing, and Sensitivity Analysis for Model 6.

Using the outcome variable, acquisition assistance (AA), and predictor variables: structural damage, living in temporary housing, non-white by zip code, and adjusted property value, Model 6 was retrained and retested for more conclusive evidence to determine the accuracy of the predictor variable with the most impact on the decision making process for acquisition assistance in Figure 12. One variable was eliminated during each training, testing, and sensibility analysis. During this series of training, testing, and analyses, the outcome variable with the most impact was adjusted property value with a confidence level of 86% when substantial damage is eliminated and 68% when non-white by zip code is eliminated. This indicated that the behavior of the

mitigation policy was more focused the adjusted property value as a consideration for providing acquisition assistance to the home owners.

Table 6

Results of Training, Testing, and Sensibility Analysis of Model 6

	Model 6			
	Acquisition Assistance Eliminating One Variable each Training, Testing, and Sensitivity Analysis			
Training				
# Cases	250	251	250	250
# Trials	68	79	71	52
Prediction %	84.0000%	85.2590%	84.4000%	87.2000%
Testing				
# Cases	62	63	62	62
Prediction %	77.4194%	82.5397%	85.4839%	74.1935%
Data Set				
# Rows	312	314	312	312
Variable Impact Analysis				
Adjusted Property Value		86.0111%	0%	68.3017%
Non White by Zip Code	33.9491%	0.1785%	0%	
Substantial Damage	9.1363%		100.00%	31.6983%
Temporary Housing	56.9147%	13.8104%		0%

Summary and Transition

The neural network tool was effective because it is designed to predict or evaluate policy behavior despite the existence of limited data. The data was not conclusive, however, analyses indicated that the behavior of the hazard mitigation policy is working as designed. The program's focus is to assist the victims of disasters based on "need." The applicants that registered for assistance qualified based on the criteria set forth by the policy guidelines. The results did suggest that the predictor numerical variable, adjusted property value, had a greater impact for receiving assistance. Therefore, the test results would coincide with the null hypothesis that "there is no significant difference between the acceptance of applications for the mitigation program offered by FEMA for applicants characterized as socially and economically marginalized and those who are not." Further comments and recommendations will follow in Chapter 5.

Chapter 5: Discussion, Conclusion, & Recommendations

The purpose of this study was to analyze the importance of integrating social research related to the human-environment, with policies involving disaster management. The research design was a quantitative approach using neural networks to evaluate the behavior of the Mitigation Policy that provided assistance to property owners who experienced damages to their properties when Hurricane Irene swept northward along the Mid-Atlantic coast of the United States in August 2011. The sample population was a compilation of data collected by FEMA representatives in a process for providing financial assistance to those targeted with property damage as a result of the disaster caused by Hurricane Irene. The statistics on the sample population were limited due to the fact that FEMA does not evaluate the demographics of the applicants. The three primary objectives were to enlist the need for further studies on the human-environment, assess the effectiveness of neural networks to make predictions about the data received, and assess the benefits of using methodological testing of policies on disaster management.

The study began by integrating the emerging field of emergency management with academia and the need to integrate the study of social science into that curriculum. There was existing research on the need to involve the entire human-environment (cultural, ecological, political, and social systems) when designing policies on disaster management. Additionally, there was the introduction of neural networks as a tool for modeling and analyzing policy behavior despite the existence of limited data specifically

demographics. Policies are not typically tested by hypotheses prior to implementation. The use of neural networks would predict with a level of accuracy, the outcome of what is already known about the data that exists, whether there is a behavior within the policy that would prevent certain applicants from receiving financial assistance for their properties. The study addressed the following hypotheses:

- The null hypothesis was: There is no significant difference between the acceptance of applications for the mitigation program offered by FEMA for applicants characterized as socially and economically marginalized and those who are not.
- The alternative hypothesis was: There is a significant difference between the acceptance of applications for the mitigation program offered by FEMA for applicants characterized as socially and economically marginalized and those who are not.

Implications of the Hazard Mitigation Grant Program

As mentioned earlier, for decades, researchers have written about the socially and economically marginalized members of our societies and their inability to recover as quickly after a natural disaster. There is not an extreme amount of research that integrates social science into studies on disaster management. Both focus on recovery efforts to improve disaster management, however, social researchers focus on alternative measures that is not addressed directly in the practitioners' efforts. Without practices that evaluate polices before implementation, it becomes difficult to understand how adequately the policies serve the aggregate of people which includes those who may be

socially and economically marginalized. Understanding how these policies serve this sector of people is compounded by the fact that there are no demographics collected to support the issue. The Hazard mitigation policy provides grant funding for elevation of homes above flood plain levels or acquisitions of properties to allow property owners to move to higher ground and avoid future problems resulting from floods.

Overall, receiving some form of assistance appeared to identify applicants in need of assistance based on the adjusted property value resulting from Hurricane Irene and least impacted by the need for temporary housing units. Elevation assistance appeared to be more impacted by the need for temporary housing units and least impacted by adjusted property values. Acquisition assistance appeared to be more impacted by non-white by zip code and least impacted by adjusted property value.

Additional training, testing, and analyses determined more details regarding the sensitivity analyses to determine which of the four predictor variables offered a greater impact on the decision making process of providing financial assistance to owners who experienced property damage as a result of Hurricane Irene. When considering receiving some form of assistance, the behavior of the policy was impacted more by substantial damage and least by adjusted property value. When considering Elevation assistance, again, the behavior of the policy was impacted more by the need for temporary housing units and least by substantial damage. When considering acquisition assistance, the behavior of the policy was impacted more by adjusted property value and least by non-White by zip code.

Non-White by zip-code was a significant variable on a broader scale for this research, but it could have offered a wealth of data if the specific incomes, levels of education, age groups, and other demographics were available. This information would offer an insight into the cultures and social systems of the region.

Theoretical Implications of Policies on Disaster Management

The findings of this study are specific to the Hurricane Irene event of 2011. Further studies are necessary to support the need to integrate issues related to the human-environment into disaster management. Social science researchers suggest that because of the frequency of natural disasters, with each new event, there should be a process for comparisons of the events to create routine generalizations to help anticipate the consequences and social needs as a result of a similar event (CIFAS, 2011; DeVries, 2011).

Researchers need to continue to support earlier literature identifies four considerations of the human-environment (cultural, ecological, social, and political systems) that are commonly addressed in social research (Key, Judkins, & Smith, 2008). Cultural systems; each major natural disaster involves an astounding number of socially and economically marginalized citizens who are most negatively affected by the disaster (Donner & Rodriguez, 2008).

1. Social systems; because of the devastation caused by natural disasters, social systems may be destroyed due to displacement of citizens, decrease in employment, decrease in education (Newman, 2010).

2. Ecological systems; it is now possible to conduct historical research on how humans interact within their environment in wider spatial and longer time frames (Vayda &Walters, 2009). Disasters are created by further urbanization. As our urban areas increase so do the vulnerabilities of our communities (the Heinz Center, 2002; Quarantelli, 1996).
3. Policy theories have been tested to determine what catalysts influence the innovation for new policies, or to change policies. Some public policies, although research based, have not been tested using hypotheses (Ringquist, 2011; Larimer & Smith, 2009). The punctuated equilibrium theory can help re-design policies related to disaster management by redefining policy problems could lead to changes in policy agendas (Boushey, 2012). The Institutional Analysis and Development Framework (IAD) emphasized the need to incorporate theories on social ecological system into the decision making process for disaster management Nowlin, 2011).

Each of these systems is interdependent upon the others. The government is investing an inordinate amount of time, human capital, and funding into disaster recovery. It is paramount that a course of action is taken that incorporates research on the human-environment into policy making decisions. It is quite obvious that the policy system cannot manage this issue without considering the other systems.

Additional Research Opportunities

Due to the lack of demographics in the data collected by FEMA, it was difficult to identify the social and economically marginalized specifically. However, using the zip codes in the data, the cultures of people could be determined. Factually, during previous disasters, many of the socially and economically marginalized citizens that were affected by a natural disaster were African Americans. The benefit of obtaining the percentage of African Americans within each zip code added one predictor variable that implicated a demographic. Upon conclusion of the research, it was determined that the predictor variable with the least impact on the behavior of the mitigation policy was the non-white by zip code predictor variable.

The research supported the need for continued efforts to address the socially and economically marginalized citizens who are negatively affected by a natural disaster. The results of the research further emphasized the importance of integrating the human-environment into policy making decisions. Additionally, the research provided more insights on the benefits of methodological testing of policies on disaster management, and the importance of utilizing neural networks in research with limited data, particularly, sensitive data. The ability to make predictions on limited data could help to provide a framework for predicting future devastations of natural disasters and thereby, prevent the destruction the human-environment.

References

Addendum to the hazard mitigation assistance unified guidance 508 (2013). Retrieved from https://www.fema.gov/media-library/assets/documents/33634

Adraneda, K. (2009, September). Manila ranked #7 in Southeast Asia as most vulnerable to climate change. Feud Art. Retrieved from http://feudart.com/2009/09/06/manila-ranked-7-in-southeast-asia-as-most-vulnerable-to-climate-change/

Aizawa, K. (2012). Warren McCullouch's turn to cybernetics: what Walter Pitts contributed. *Interdisciplinary Science Reviews*, *37*(3), 206-217. Retrieved from http://www.isr-journal.org/

Anderies, J., Jansen, M., & Ostrom, E. (2007). Robustness of social ecological systems to spatial and temporal variability. *Society & Natural Resources*, 20(4), 307-322.

Armstrong, N., Hidek, M., Longstaff, P., Parker, W., & Perrin, K. (2010). Building resilient communities: a preliminary framework for assessment. *Homeland Security Affairs*, 5(3), 1-23. Retrieved from www.hsaj.org

Berman, D., & Light, P. (2008). How to fix Homeland Security. Retrieved from http://www.salon.com/news/opinion/feature/2008/10/16/homeland_security/index.html

Bevir, M. (2010). Democratic governance. Retrieved from http://press.princeton.edu/titles/9357.html#evendors

Boardman, A., Greenberg, D., Vining, A., & Weimer, D. (2012). *Cost- benefit analysis concepts and practice* (3rd ed.). New Jersey: Pearson, Prentice Hall.

Bousey, G. (2012). Punctuated equilibrium theory and the diffusion of innovations. *Policy Studies Journal*, *40*(1), 127-146.

Brezina, T. & Kaufman, J. (2008). What really happened in New Orleans? Estimating the threat of violence during the Hurricane *Katrina Disaster.* Justice Quarterly, 25(4), 701-722. Retrieved from http://www.tandfonline.com/toc/rjqy20/current

Broderick, K. (2007). Getting a handle on social ecological systems in catchments: the nature and importance of environmental perception. *Australian Geographer*, *38*(3), 297-308. Retrieved from http://www.tandfonline.com/toc/cage20/current

Bullard, R. (2008). Differential vulnerabilities: environmental and economic inequality and government response to unnatural disasters. *Social Research*, *75*(3), 753-784. Retrieved from http://www.newschool.edu/cps/social-research/.

Cairney, P. (2013). Standing on the shoulders of giants: how do we combine the insights of multiple theories in public policy studies? *Policy Studies Journal, 41*(1) 1-21. Retrieved from http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291541-0072

Chauvet, P., Daya, B., & Karouni, A. (2014). Applying decision tree algorithm ad neural networks to predict forest fires in Lebanon. *Journal of Theoretical and Applied Information Technology, 63*(2), 282-291.

Chenoweth, E., & Clarke, S. (2010). All terrorism is local: resources, nested institutions, and governance for urban Homeland Security in the American federal system. *Political Research Quarterly, 63*(3) 495-507. doi: 10.1177/1065912909334426

Chorowski, J. & Zurada, J. (2011). Extracting rules from neural networks as decision diagrams. *Institute of Electrical and Electronics Engineers*, *22*(12), 2435-2446.

Clary, L., Coffee, M., Kelly, E., Kyle, S., Lauter, J., Ninness, C., Ninness, S., Rumph, M., Raumph, R. (2012). Behavioral and physiological neural network analyses: a common Pathway toward pattern recognition and prediction. The Psychological Record, 62, 579-598.

Comitas Institute for Anthropological Study, (2013, July 9). Anthropological perspectives on disaster. Retrieved from http://www.cifas.us/page/crisis

Clovis, S. (2006). Federalism, Homeland Security and national preparedness: a case in the development of public policy. *Homeland Security Affairs, 2*(3).

Cigler, B., Comfort, L., & Waugh, W. (2012). Emergency management research and practice in public administration: emergence, evolution, expansion, and future directions. *Public Administration Review, 72*(4), 539-547.

Creswell, J. (2003). *Research Design: qualitative, quantitative, and mixed methods approaches* (2nd ed.). Thousand Oaks, California: Sage Publications.

CRS Report for Congress. Homeland Security Act of 2002: Legislative History and Pagination Key (2011, January 25). Retrieved from http://assets.opencrs.com/rpts/RL31645_20030411.pdf

Dach-Gruschow, K. & Hong, Y. (2008). The Racial divide in response to the aftermath of Katrina: a boundary condition for common in group identity model. *Analyses of Social Issues & Public Policy*, *6*(1), 125-141. Academic Search Premier Database.

DeVries, D. (2011). Temporal vulnerability to hazardscapes: flood memory network and referentiality along North Carolina Neuse River. *Global Environmental Change*, 21(1), 154-164. Science Digest Database

Donner, W. & Rodriguez, H. (2008). Population composition, migration anti inequality: the influence of demographic changes *on* disaster risk and vulnerability. *Social Forces*; 87(2) 1089-1114. EBSCOhost Database.

Drabek, T. (2007, August). Social problems perspectives, disaster research and emergency management: intellectual contexts, theoretical extensions, and policy implications. E.L. Quarantelli Theory Award Lecture presented at the annual meeting of the American Sociological Association, New York City, New York. Google Scholar Database

Drabek, T. (2007, April). Emergency management and homeland security curricula: contexts, cultures, and constraints. Paper presented at the annual meeting of Western Social Science Association, Calgary, Alberta, Canada. Google Scholar Database

Elliott, J. & Pais, J. (2008). Places as recovery machines: vulnerability and neighborhood change after major hurricanes. *Social Forces*; 86(4) 1415-1453. Retrieved from http://web.ebscohost.com.ezp.waldenulibrary.org/ehost/pdf?vid=8&hid=103&sid=4c94742d-6c2f-4668-a964-1a7d0fd78091%40sessionmgr109

EEPSEA (2009). Retrieved from http://www.eepsea.org/en/ev-7890-201-1-DO_TOPIC.html

Federal Emergency Management Agency. (2011, January 16). *Homeland Security Exercise and Evaluation Program HSEEP Newsletter.* Washington, DC: 7, 10 pgs. Retrieved from https://hseep.dhs.gov/support/Newsletter-Winter-2008.pdf

Federal Emergency Management Agency, (2007a). Retrieved from http://www.fema.gov/media-library-data/20130726-1721-25045-3264/web_page_3_acq_guidance_06_20_08.pdf

Federal Emergency Management Agency. (n.d.). Benefit cost analysis. Retrieved from http://www.fema.gov/benefit-cost-analysis#0

Fiorino, D. (1997). Strategies for regulatory reform: forward compared to backwards mapping. *Policies Studies Journal*, 25(2), 249-265.

Fouche, R. (2011, January 13). The wretched of the Gulf: racism, technological dramas, and Black politics of technology. *The Black Scholar*, 36(4), p7-12. Retrieved from http://ezp.waldenulibrary.org/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=24533771&site=ehost-live&scope=site.

Fujita Scale (2011, March 10). Retrieved from http://www.tornadoproject.com/fscale/fscale.htm

Gibson, C. (2006, July- August). Our 10 greatest natural disasters. *American Heritage*; 57(4), 26-37.

Goodman, D. & Mann, S. (2008). Managing public human resources following catastrophic events. Review of Public Personnel Administration, 3(1), 3-19. Sage Publications

Grosman, Lisa (2011). Irene fades out. New Scientist, 211(2828), 7.

Haider-Markelm D. & Sharp, E. (2008). An invitation of the court: eminent domain reform in the State legislatures in the wake of the Kelo decision. *The Journal of Federalism*, 38(93), 556-575. Political Science Complete Database

Hall, A. (2011). Opportunity: technical assistance for community resilience planning. Retrieved from http://www.carolinas.noaa.gov/PressRelease/CRP_Advertisement.html

Hee, P. & Karl, R. (2014). The politics of connections: assessing the determinants of social structure in policy networks**.** Journal of Public Administration Research & Theory, 24(2), 349-379.

The John Heinz III Center (2002). Human links to coastal disasters. The H. John Heinz III Center for Science, Economics and the Environment. Retrieved from http://www.heinzctr.org/publications/PDF/Full_report_human_links.pdf

Henry, A.; Jenkins-Smith, H.; Nohrstedt, D.; Sabatier, P.; Weible, C. (2011). A quarter century of the advocacy coalition framework: an introduction to the special issue**.** *Policy Studies Journal,* 39(3) 349-360. ABI/Inform Complete

Hollis, A. (2005). A tale of two federal emergency management agencies, *The Forum*, 3(3), 1-17.

Homeland Security Act of 2002 (2010, January 25). H.R. 5005- Homeland Security Act of 2002. Retrieved from http://www.govtrack.us/congress/bill.xpd?bill=h107-5005&tab=summary/

HSDL, (1979). Executive Order 12127: Federal Emergency Management Agency. Retrieved from https://www-hsdl-org.ezp.waldenulibrary.org/?abstract&did=464521

Hoover's Company Records (2014). Environmental systems research institute, inc Retrieved from http://www.esri.com/data/esri_data/ziptapestry

Hussein, A. & Tawfiq , L., 2013) Design feed forward neural network to solve singular boundary value problems. *ISRN Applied Mathematics*, 2013 (650467), 1-7

Jain, A. &Mao, J. (). Artificial neural networks: a tutorial. *Institute of Electrical and Electronics Engineers,* 194-212

Kelman, I. (2007). Hurricane_Katrina_disaster_diplomacy. *Disasters*, 31(3), p288-309, 22p. Academic Search Premier Database.

Kessner, J. (2007). Racial and ethnic conflict in south Florida: Hurricane Andrew and the housing crisis. Wesleyan University: a Thesis.

Koerber, K. (2012, March 7). Migration patterns and mover characteristics from the 2005 ACS Gulf Coast Area special products. Retrieved from http://www.census.gov/newsroom/emergencies/additional/gulf_migration.html

Krugman, P. (2011, September 1). Eric and Irene. Retrieved from http://www.nytimes.com/2011/09/02/opinion/krugman-eric-and-irene.html?_r=1&scp=1&sq=eric%20cantor&st=Search

Kuhn, J. (nd). Retrieved 2/1/2011 from H:\Social Science Sum. 09\Kuhnsnap.htm

Kapucu, N. (2007). Building the capacity to respond. Public Manager, 36(3), 21-25.

Kapucu, N. & Van Wart, M. (2008). Making matters worse: an anatomy of leadership failures in catastrophe events. *Administration & Society*, 40(7), 711-740.

Landy, M. (2008). Megadisasters and federalism. *Public Administration Review*, 68, 5186-5198. Political Science Complete Database

Laurin, L. (1995). Retrieved from http://www.naspaa.org/about_naspaa/about/history.asp

Levering, D. (2005). Unchanged melody, the Negro and the flood. *Crisis*: 112(6).

Light, P. (2011, January 15). Katrina's lessons in readiness. Washington, DC: Brookings Institution .Retrieved from http://www.brookings.edu/opinions/2005/0901defense_light.aspx

Lindsay, B. & McCarthy, F. (2012). Stafford Act declarations 1953-2011: trends and analyses, and implications for Congress. Congressional Research Service. Retrieved from http://fas.org/sgp/crs/homesec/R42702.pdf

Ludkins, G., Smith, M., Keys, E. (2008). Determinism within human-environment research and the rediscovery of the environmental causation. *Geographic Journal*, 174(1), 17-29.

Malone, T & Nagar, Y. (2011). Combining human and machine intelligence for making predictions. *MIT Center for Collective Intelligence: Massachusetts Institute of Technology*. Retrieved from http://cci.mit.edu

McNeil. J. (2009). Restructuring FEMA: stand-alone FEMA would not make cents. Retrieved from http://www.heritage.org/Research/HomelandSecurity/wm2316.cfm

Maurstad, D. (2006). The NFIP's response to Katrina and Rita. *Watermark*, 1, 1-3.

Minhas, S. (2010). Lack of good governance breeding Maoism: Orissa NGO. Retrieved from http://governancenow.com/news/regular-story/lack-good-governance-breeding-maoism-orissa-ngo

Motyl, A. (2010). The social construction of social construction: implications for theories of nationalism and identity formation. *Nationalities Papers*, 38(1), 59-71

Mufson, S. (2010). Gulf of Mexico oil spill creates environmental and political dilemmas. *Washington Post*. Retrieved from http://www.washingtonpost.com/wp-dyn/content/article/2010/04/26/AR2010042604308.html

National preparedness goal (2011). Retrieved from http://www.fema.gov/pdf/prepared/npg.pdf

NC State Hazard Mitigation Plan (2010, April 12). Retrieved from http://www.nccrimecontrol.org/Index2.cfm?a=000003,000010,001623,000177,001563.

Newman, S. (October 2010). The human face of governance: the public service in times of crisis. *PA Times, p16*

NRF (2010, March 1). Retrieved from http://www.fema.gov/emergency/nrf/aboutNRF.htm

NOAA.gov. (2011, May). Retrieved from http://www.noaanews.noaa.gov/2011_tornado_information.html

NOAA.gov (2011, August). Retrieved from http://www.erh.noaa.gov/mhx/SignificantEvents.php

Nowlin, M. (2011). Theories of the policy process: state of the research and emerging trends. *Policy Studies Journal, 39(S1), 41-60.*

Oliver-Smith, A. (1996). Anthropological research on hazards and disasters. *Annual Review of Anthropology*, 25, 303-328.

Orsak, G. (2010). We failed Haiti once. *Design News.* Retrieved from http://www.designnews.com/document.asp?doc_id=228953

Pearce, L., (2000). An integrated approach for community hazard, impact, risk, and vulnerability analysis, HIRV. (Doctoral dissertation) University of British Columbia. Canada

Piore, Adam (2013). Mind in the machine. *Discover*, 34(5), 52-59

President Barack Obama (2011). Presidential policy directive 8: national preparedness. Retrieved from http://www.dhs.gov/presidential-policy-directive-8-national-preparedness

Quarantelli, E. (1996). The future is not the past repeated: projecting disasters in the 21st century from current trends. *Blackwell Publishers,* 4(4), 228-240

Rapoza, K. (2011). Climate change unlikely factor in US tornado spree. Retrieved from (http://blogs.forbes.com/kenrapoza/2011/05/23/climate-change-unlikely-factor-in-us-tornado-spree/

Ringquist, E. (2011). The public policy theory primer. *Perspectives on Politic,* 9(3), 726-727.

Robert T. Stafford Act (2007). Retrieved from https://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3564

Ruether, R. (2006). After Katrina: poverty, race and environmental degradation. *Dialog: A Journal of Theology;* 45(2), 176-183 Retrieved from http://ezp.waldenulibrary.org/login?url=http://search.ebscohost.com/login.aspx?direct=tr ue&db=a9h&AN=20785770&site=ehost-live&scope=site

Saffir-Simpson Hurricane Wind. Retrieved from Schttp://www.pbs.org/newshour/updates/social_issues/jan-june06/census_06-07.html

Scales for measuring earthquakes. Retrieved from http://www.matter.org.uk/schools/content/seismology/richtersale. Retrieved from http://www.nhc.noaa.gov/sshws.shtml

Seigel, G. (2006). National incident management system: we're not there yet. *Fire Engineering*, 159, 17-19

Sharples, T. (2008). A Brief History Of: FEMA. *Time Magazine*, 172. Retrieved from http://www.time.com/time/magazine/article/0,9171,1837231,00.html

Simmons, K. &Sutter, D. (2012). The 2011 tornadoes and the future of tornado research. *Bulletin of the American Meteorological Society,* 93(7), 959-961.

Slivka, J. (2005). Another flood that stunned America. *US News and World Report*, 139(9). Academic Search Database

Smith, A. (1996). Anthropological research on hazards and disasters. Annual Review of Anthropology, 25, 303-328.

Stevenson, D. (July-September 2013). Human response to natural disasters. *Sage Open, 3(3)* 2158244013489684*,* Retrieved from http://sgo.sagepub.com/content/3/3/2158244013489684

Stout, M. (2009). In search of a holistic public policy theory primer. *Public Administration Review*, 71(2), 322-326.

Surowiecki, J. (2012). Disaster economics. *The New Yorker*, 88(38), 1.

The Stafford Act. Amended (April 2013). Retrieved from https://s3-us-gov-west-1.amazonaws.com/dam-production/uploads/20130726-1646-20490-1658/stafford_act_booklet_042213_508d.pdf

Sylves, R. (2008). Public Managers, Volunteer Organizations, and Disasters. *Public Manager*, 37(4), 76-80.

Synder, R. (1996). Neural networks for the beginner. *Association of Small Computer Users in Education Summer Conference Proceedings*.

Thatcher, M. (1998). The development of policy network analyses: From modest origins to overarching frameworks. *Journal of Theoretical Politics*, *10*(4), 389–416

US Census Fact Finder. Retrieved from http://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml

US Senate Environment and Public Works Committee (2008). US Senate Minority Report: more than 650 international scientists dissent over man-made global warming claims, 2-231. Homeland Security Digital Library.

Vayda, A. & Walters, B. (2009). Event ecology, causal historical analysis, and human-environment research. Annals of the Association of Geographers, 99(3), p.534-553.

Virgona, T. (2008). September 11, 2001: a historical study of the human aspects of disaster recovery. Northeast Business and Economic Association, 630-632. Business Source Complete Database

Voorhees, (2008). New Yorkers respond to the World Trade Center attack: an anatomy of an emergent volunteer organization. *Journal of Contingencies & Crisis Management*, 16(1), 3-13

Waugh, W. (2007). Katrina and the governors. Public Organization Review, 9, 343-361

Waugh, W. (2006, spring). Public administration, emergency management, and disaster policy. Disciplines, Disasters, and Emergency Management. Retrieved from http://www.training.fema.gov/emiweb/edu/ddemtextbook.asp

Wenger, D. (2006). Hazards and disaster research, how would the past 40 years rate? *Natural Hazards Observer*, 31(1), 1-28.

Wilman, A. (2006). Reliability, validity, and true values in surveys. *Social Indicators Research*, 78(1), 85-110. AB/INFORM Global Database.

Wolensky, K. & Wolensky, R. (1990). Local government problems with disaster management. A literature review and structural analysis. *Policy Studies Review*, 9(4), 703-72

Appendix : Letter of Understanding

Letter of Understanding

Between:

Centre for Research on the Epidemiology of Disasters (CRED)
School of Public Health
Université Catholique de Louvain (UCL)
30.94 Clos Chapelle-aux-Champs
1200 Brussels
Belgium

Hereafter referred to as CRED

And

Dorothy M. Henderson, PH.D. Candidate
Walden University
115 East Wind Lane
Cary, NC 27518

Hereafter referred to as the Public Policy PH.D. Candidate:

The CRED and the Public Policy PH.D. Candidate are cooperating in the analysis of EM-DAT data for the dissertation entitled "Disaster Management and Efforts to Mitigate the Destruction of the Human Environment in a Natural Disaster." My dissertation involves the need to integrate social science with disaster management. The data used from EM-DAT will display a pattern of escalating issues including displacement and number killed as a result of a natural disaster during the designated time period. This analysis will be based on data from 1992 to 2012 from EM-DAT database.

Through the present letter of understanding, CRED and the agree that:

- This letter of understanding concerns the access to the EM-DAT raw data on natural disasters (including: earthquakes, floods, storms, hurricanes, tornadoes, typhoons, tsunamis) that occurred in the North America and Asia from 1992 until 2012.
- CRED will provide Public Policy PH.D. Candidate with EM-DAT raw data in table format including the following information: Disaster Type, Disaster Sub-Type, Disaster Sub-sub-type, Event Name, Localization, Start and End date, People Killed, Total Affected, Estimated Damage, Homeless, and Injured.[1]
- CRED will provide the Public Policy PH.D. Candidate with the knowledge on the interpretation of the EM-DAT data used for the analysis.
- The Public Policy PH.D. Candidate commits to clearly mention, for every reproduction or communication based on provided figures, the source of the information as follows:

[1] The variables included in the EM-DAT database are described on the website (http://www.emdat.be/ExplanatoryNotes/explanotes.html).

"EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.be – Université Catholique de Louvain – Brussels – Belgium.".

- The Public Policy PH.D. Candidate will not distribute the raw data to others, and will not commercially make use of the data. Data will be securely stored in an encrypted format. As a matter of courtesy The Public Policy PH.D. Candidate will inform CRED of its intentions to publish findings and send copies of the findings to CRED.
- The letter of understanding between CRED and The Public Policy PH.D. Candidate is signed for a period of one year and shall take effect from the time of its signature. It can be renewed after each year upon agreement between the parties. The agreement may also be terminated at any time by either party upon three months prior written notice to the other party.
- The letter of understanding is signed in two copies, from which one is for CRED and the second one for the Public Policy PH.D. Candidate.

To this end the following focal points have been appointed: for the Public Policy PH.D. Candidate, Ms. Dorothy M. Henderson and for CRED, Ms. Regina Below

Date:

September 16, 2013

Signed by:

Dorothy M. Henderson

Ms. Dorothy M. Henderson
Public Policy PH.D. Candidate
Walden University

Date:

Approved by:

Debarati Guha Sapir
Director, CRED
Professor, UCL