1-1-2012

Communication technology in disaster management

Denise Nicole Walker
Wayne State University,

COMMUNICATION TECHNOLOGY IN DISASTER MANAGEMENT

by

DENISE WALKER

THESIS

Submitted to the Graduate School

of Wayne State University,

Detroit, Michigan,

in partial fulfillment of the requirements

for the degree of

MASTER OF INTERDISCIPLINARY STUDIES

2012

MAJOR**:** INTERDISCIPLINARY STUDIES

APPROVED BY:

_____

Advisor Date

DEDICATION

This thesis is dedicated to my mother who has always believed in me and given me moral support. No matter how discouraged I became your strength, guidance and love have showed me that anything is possible.

Lastly, I would like to thank Dr. Julie Klein and the Interdisciplinary Studies faculty for your guidance and patience during this memorable time in my life. I could not have done this without you.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

In this thesis I will analyze different case studies involving catastrophic disasters and compare their rescue response with the government to FEMA's response to Katrina, using the latter example as a basis for comparison. Chapter 1 focuses on defining what interdisciplinary study is and how it is crucial for solving complex problems. I will discuss New Orleans' background and give an overview of Hurricane Katrina. The chapter establishes the basis for comparison by examining the technological, communication and government response failures that occurred during Hurricane Katrina. With the use of new technologies and alternative approaches being practiced, technology will help to avoid the horrific suffering and injustices that occurred during and after Katrina and other natural disasters. Information technology (IT) has the ability to make people understand the realties of a disaster more clearly and make first responders coordinate their services better. The use of IT is important to help address daily problems of life in communities. Therefore, more attention to how people use IT in disasters can help us to understand communities and help them sustain themselves through a crisis. We must make use of readily available technology that proves valuable during a disaster and create new technology.

Chapter two will explore California's landscape and why this region is constantly plagued by wildfires. Yet, despite this they have a good track record for successfully fighting fires due to technology, a sound disaster plan and excellent leadership. Chapter three covers the 2008 Midwest floods, the different states involved. Due to torrential rainfall the world feared they were witnessing another Hurricane. Thankfully our fears did not materialize due to the fast response from the government and FEMA. The purpose of this

chapter is to study the Midwest to determine why floods are so prominent in these areas. I will also compare Hurricane Katrina rescue efforts to the Midwest floods. Chapter four will show how the role of class, race and ethnicity played a role during Hurricane Katrina, California fires and the Midwest floods. I intend to show that low-income individuals, minorities, women and the elderly are disproportionately affected by disasters. Chapter five, the final chapter, will explore technological solutions that need to be in place in every state to avoid another disaster like Hurricane Katrina.

Chapter 1

Hurricane Katrina: an Overview

Interdisciplinary Studies

Julie Thompson Klein, Humanities Professor at Wayne State University and William Newell, former Professor of Interdisciplinary Studies at Miami University define Interdisciplinary Studies as a "process of answering a topic that is too broad or complex to be dealt with adequately by a single discipline or profession" (Klein, and Newell pg. 393). A Multidisciplinary approach uses more than one discipline and has multiple expertise and translation. It adds breadth and available information, methods and knowledge. The disciplines that are relevant to my thesis include engineering, ecology, geography, sociology, economics, technology and mathematics. All of these disciplines can be used to help rebuild New Orleans. The comparative approach I am taking with multiple case studies will demonstrate how an interdisciplinary approach can be used. Interdisciplinary differs from multidisciplinary approach. Multidisciplinary is a non-integrative mixture of disciplines that draw from multiple disciplines to redefine problems. I will do an analysis showing how the use of interdisciplinary studies can be used to help solve complex problems.

New Orleans

It is very important to understand the spirit of New Orleans. It is a place that is known for having a strong sense of community and for making people feel welcome. This is one of the reasons why Hurricane Katrina was so devastating. There was such a strong sense of loss. The people of New Orleans are of different ethnic groups and classes. Yet, they mix well like "gumbo" and they

all pull together as one. They take jazz and their food very seriously and people come from all over to go to Jazz fest and Mardi Gras. They are similar because people use culture as a way to adopt alternative identities. It is the spirit of New Orleans: "Jazz Fest music doesn't exist in a vacuum; it is carefully set into its cultural context at the fairgrounds and, by extension, in the city" (Piazza, 66). For a moment the residents and tourists of New Orleans are inside of their own world and nothing else matters. I think this is the reason that people visit New Orleans and decide to never leave. That is why hurricane Katrina was such a tragedy because anyone who ever visited or lived in New Orleans felt that a sense of heritage and cultural identity was permanently lost. Next, I will discuss how New Orleans was founded and why the land was desired even though it proved to be an inhospitable place to live. In order to understand the heritage in New Orleans one must go back to when New Orleans was first discovered.

Joel K. Bourne Jr., journalist for *National Geographic*, received his Master's degree from Columbia University in journalism. Mr.Bourne has covered national and international environmental issues for over twenty years. In an article "New Orleans: A Perilous Future," Bourne states that New Orleans was founded in 1718 by a French man named Jean-Baptiste Le Monyne. He actually had to wait for the water to recede before he could plant the French flag. From day one, it was easy to see that New Orleans land was not suited for people to live on. It was surrounded by swamps, flooded easily and the land was low. "In its 289 year history, major hurricanes or river floods have put the city under 27 times, about once every 11 years" (Bourne, 42). With all of these major problems from day one, why would anyone want to live there? The reason why is the driving force that still motivates people today, money. Geography and economics are two disciplines that made New Orleans a prime location in which to live and do business. New Orleans' geographical location made it a great place to have a port for commercial trade and goods arriving from Europe. The port moves down the Mississippi river, yet it is a long way from the Gulf of Mexico. Hurricane Katrina helped

to prove the importance of wetlands and barrier islands. Next, I will explore why a healthy marsh is important and take a look at the science that was applied to hurricane Katrina. understanding the science and technology that was used during Katrina is relevant to minimizing disasters in the future.

The Corp of Engineers did not do an adequate job of rebuilding the levees and should reevaluate the integrity of their engineering work. Until April 2009, Dr. Ivor van Heerden was the former deputy director of the Louisiana State University Hurricane Center and current director of the Center for the Study of Public Health Impacts of Hurricanes. Heerden maintains the levees along Lake Pontchartrain, Industrial Canal, Intracoastal Waterway, the Mississippi River-Gulf-Outlet (MRGO), the Harvey Canal in the West Bank are not as high or intimidating (strong enough to deter or compel the water away) as those along the Mississippi River (Heerden, 79). "The levees along Lake Pontchartrain range in height from 13 feet to 18.5 feet. The other levees around the region range in height from a mere 5 feet to 17 feet" (Heerden, 79). During Katrina MR-GO levees were overwhelmed and in some cases destroyed due to poor construction and communication.

An interdisciplinary approach should be used to solve the problem involving MR-GO. The most plausible solution would be to shut it down, rebuild the marshes, tear down the levees causing the funnel effect and find an alternative route for shipping to go into the Gulf of Mexico. Interdisciplinary techniques such as engineering, technology, mathematics and ecology should be used to do this. MR-GO has ruined protective marsh structures, which has made its own levees more susceptible to failure and erosion. St. Bernard residents have been trying for years to get the Corps to close the channel they refer to as the "hurricane highway" due to the fact very few ships use MR-GO. "The channel destroyed tens of thousands of acres of wetland. It brought in salt water that killed marsh plants, while the wakes of the few ships eroded the banks of the channel, widening it from 500 feet to almost half a mile in places (Heerden, 80)." However, it has yet to be shutdown.

"The channel is a serious threat to public safety and an environmental threat to the region" (Heerden, 80). Another problem involving MR-GO is its levees. The levees create a "funnel effect" that could increase the local storm surge. This is a critical flaw in the design system for the levees at MR-GO. The levees did not take the funnel effect into consideration and the levees are not high or strong enough (Heerden, 80). The US Army Corps of Engineers must use technology to communicate effectively with each other and scientists to rebuild the levees to make them safe.

Van Heerden has since 2002 led a multidisciplinary team looking at what would happen if a major hurricane directly hit New Orleans. John Travis, a journalist with *Science News*, stated that the center has studied everything from how the city would flood to how many people might ignore evacuation orders or be unable to flee, almost one in four, they had estimated (Travis, 1). Katrina caused the largest natural disaster in the history of the United States. "Katrina slammed into the Gulf Coast on August 29, 2005 with its eye hitting about 55km east of the city. Although the storm initially brought more destruction to other areas along the Mississippi and Louisiana coast, several levees protecting New Orleans failed the following day, and the city, about 80% of which is below sea level, filled with water" (Travis, 1). Unfortunately, many lives were lost and this tragic event triggered a massive relief and evacuation effort. Scientists watched the hurricane in anger because they had warned us for years that this could happen yet, their warning fell upon deaf ears. "We've had plenty of knowledge to know this was a disaster waiting to happen" (Travis, 1). Katrina became one of the strongest storms ever recorded in the Gulf of Mexico-Caribbean region. Scientists agree that two factors fueled Katrina's growth, phenomenally warm waters in the Gulf and a lack of strong, high altitude winds that could have dispersed the storm's energy (Travis, 1).

Computer Modeling

The wetlands are necessary for protecting Louisiana from hurricanes' storm surges. Wetlands along with Barrier Islands are the best, least expensive natural buffer against a storm surge. "Louisiana is losing roughly 12 square miles of storm-buffering wetlands each year as levees black sediment, canals are dredged, and ground subsides" (Bourne, 57). Flooding has historically led an interdisciplinary research involving engineers and scientists. One interdisciplinary technique that can be used to help aid the restoration process is computer modeling. A good computer model would be able to show the benefits of barrier islands and a healthy marsh. Chester Jelesnianski developed SPLASH (Special Program to List Amplitudes of Surge of Hurricanes). SPLASH helped to predict the storm surge for Hurricane Camille in 1969. Jelesnianski then developed SLOSH (Sea, Lake, and Overland Surges from Hurricanes). Dr. Heerden stated "Our idea was to use the computer to compare what the tides did to these marshes with and without the barrier islands offshore. If the models showed what we thought they would, we could really create on-the-ground value for restoration. And the models did show this value" (Van Heerden, 35-36).

The ADCIRC (Advanced Circulation) model was developed by Dutch-born Joannes Westerink, a civil engineer professor and Rick Luettich. The ADCIRC is the best surge model for both planning and operational support. "ADCIRC is much more adept at simulating convoluted shorelines and incorporating features like highways and canals that can block-or accelerate-storm surge. ADCIRC can include tides; SLOSH cannot" (Heerden, 37). ADCIRC uses complex mathematical equations using data pertaining to the storm itself such as, wind speed and barometric pressure. A version of the ADCIRC model is also used by the Corps for designing the levee system. Computer modeling becomes an important tool in advance communication about storm patterns. There was a serious lack of

coordination in communication about the levee breaks. According to professor of Management Technology Fletcher Griffis, the levees and gates were built by the U.S. Army Corps of Engineers to protect the city. "Levees generally consist of earthen embankments, varying in height, with gently sloping sides. A properly constructed levee is constructed on firmly compacted ground with an impervious soil center and erosion protection on the slopes" (Griffis, 190). Most of the levees were built of sand and shell dredged from the canal itself. Clay is used to cap the levees.

Technology has improved storm prediction significantly. Just before landfall, Katrina moved to the east, sparing New Orleans from the full force of the storm. Meteorologist Hugh Willoughby of Florida International University in Miami stated that because of the way spinning storms interact with land, hurricanes often wobble to the right as they come ashore. By landfall, Katrina had shrunk to a category four storm. Scientist believe Katrina weakened because it had just undergone a phenomenon called eyewall replacement. "The eyewall is the band of intense wind and clouds that forms around the hurricane's eye. Large storms sometimes develop an outer eyewall that starves the inner one of energy until it degrades" (Travis, 1). The two photos below show how the levees were breached and water poured into the city causing major flooding.

Fig.1 The Levees are Breached: Water pours into New Orleans

Source: Hurricanekatrina.com

Fig.2 The Flood: Hurricane Katrina's most devastating damage was caused by flooding

Source: Hurricanekatrina.com

The people of New Orleans are of different ethnic groups and classes. I feel that I have a keen insight to why New Orleans means so much to people and that it is so much more than just a place to live. New Orleans has so much history and culture to share I hope that it can continue to do so. Many lessons have been learned from Hurricane Katrina, unfortunately at the expense of the people in New Orleans. Katrina has taught us that communication among official leaders and rescue organizations, such as FEMA, is crucial. Interoperability and updated technology are also extremely important but technology is useless if people do not communicate with each other to effectively use technology. Since the land was found New Orleans was known to have a flooding problem. In comparison I will discuss California and why it is prone to fires and why the Midwest experiences massive floods. Chapter 2 will discuss in more detail the organizational and technological problems Hurricane Katrina, California Fires, and the Midwest floods faced.

Chapter 2

California

Michael Brown from FEMA wrote about California, “They live on earthquake fault lines, on cliff tops, in the middle of dying forests, and far from any source of water…you might call it the California way of life” (Brown, 9). Among the many hazards Californians face is a complex fire environment with a wide array of climates, fuels, and topographies each presenting many unique challenges. Wildfires in California’s communities are nothing new. According to Robert Kirstein’s, Chair of the California Board of Forestry, in 1991, the Oakland Hills fires in northern California claimed 25 lives and destroyed nearly 3,200 homes at an insured cost of about $1.7 billion. In 1993, two major fires in Laguna and Malibu destroyed 1,000 homes costing over $550 million in damages (Kerstiens, 38). Even when fires are not necessarily larger, they are burning more intensely. They are more costly to control and create greater risk of losses to the resources, improvements and people in the wild land areas. For example, in the 10 days between October 25 and November 3, 1993, wind driven wildfires consumed over 189,000 acres of valuable Southern California watershed and wildlife habitat (Kerstiens, 38). “It also destroyed 1,260 structures, claimed three lives and injured hundreds of people. The damages cost around $1 billion” (Kerstiens, 38). The 2003 wildfires had an estimated cost of $3.5 billion making it the costliest fire incident in California’s history (Brown, 9). The following four photos show the intensity and devastation of the California fires, the captions are quoted verbatim.

Fig. 3

Northern California 2008 Photo of Butte Lightning Complex Fire Source: Photo is from the California Department of Forestry & Fire Protection

Fig. 4

Hotspots burn into the night as seen from Durham-Pentz Rd. above Clark Rd, in Butte Valley California. Firefighters work to contain the Humboldt fire that broke out on June 11, 2008 and had burned more than 19,000 acres by June 12, 2008 in Butte Valley, CA.

Source: Photo is from http://www.boston.com/bigpicture/2008/06/california_fires.html

Fig. 5

A firefighter points to a fire burning in the more than 4,200 acre Indians Fire burning on Fort Hunter Liggett, 21 miles west of King City, Calif. Wednesday, June 11, 2008. Fires fed by raging winds raced across parts of Northern California destroying dozens of homes, threatening hundreds of others and leaving a firefighter severely burned.

Source: Photo is from http://www.boston.com/bigpicture/2008/06/california_fires.html

Fig. 6

Cindi Sterling takes a look at the ashes of her home as people begin to return home to see the remains on day four of the Humboldt Fire on Saturday, June 14, 2008 in Paradise, CA.

Source: Photo is from http://www.boston.com/bigpicture/2008/06/california_fires.html

On June 20, 2008 lightning strikes, which at their peak ignited over 2,000 fires and scorched more than 887,000 acres. "Over 6,000 lightning strikes in more than 26 counties moved through northern and central California. Fifteen people died and many have been injured" (Brown, 1). Some of the counties involved included Butte, Mendocino, Inyo, Kern, Mariposa, Monterey, Plumas, Santa Barbara, Santa Clara, Santa Cruz, Shasta and Trinity. Governor Schwarzenegger asked President Bush for additional equipment and personnel on July 9, 2008. " Numerous federal resources were provided including 301 fire trucks, 12 fixed-wing aircraft, 50 helicopters, more than 3,500 personnel and NASA drone" (Brown, 1). In addition FEMA is reimbursing the state $31 million in public assistance funding to CAL FIRE for some of the costs incurred to fight ongoing California fires. FEMA will reimburse 75 percent of the firefighting cost with the remaining 25 percent coming from the state (Brown, 1).

Causes for Fires in California

Fire risk in southern California is determined by a number of factors, including drought, lightening storms, the availability and type of fuels, the Santa Ana Winds, and development in the wild land urban interface. The area is characterized by a Mediterranean style climate of hot, dry summers and mild wet winters. The region has seen significantly below average rainfalls in recent years, leaving parched brush and trees extremely dry and fire prone. Through the years scientists have discovered that the drought conditions have also made the weakened trees vulnerable to bark beetles, which bore into the surface of the wood, rapidly killing an otherwise healthy tree (Brown, 10).

Fig.7 Bark Beetle

Source: Bark Beetle Images website: http://www,ag.arizona.edu/extension/fh/bark_bettle.html

Many brush plants in southern California's chaparral seed quickly, leaving dead vegetation that is rich in nutrients, which are released into the soil by burning. "Some chaparral plants have leaves that are coated with flammable resins. Others, such as Chamise (greasewood) not only produce volatile gases when they burn, but also leave a water-resistant residue in the soil that prevents water absorption, which accelerates erosion on denuded slopes" (Brown, 10). This increases post-fires risks of flash flooding and mudslides in area communities.

Vegetation that can fuel wild land fires in California grows in the moist winters only to be dried by the Santa Ana winds after the generally arid summer months. The Santa Ana winds blow from the inland deserts in northeast towards the Pacific Ocean. They often blow with exceptional speed below the passes and through canyons of southern California and in the Los Angeles basin (Brown, 10). "Several blazes of the 2003 California Wildfires transformed from a small brushfire into a raging firestorm because of the Santa Ana Winds" (Brown,10).

Finally, the development of communities in the urban wild land interface poses challenges for developing an effective and comprehensive fire management program. While local building codes have developed over time to encourage more fire-resistant construction,

older buildings pose a challenge to local communities (Brown, 10). Vegetation control is another issue, as well as the palm trees, eucalyptus, and other oily landscaping plants common in southern California, which can add fuel to a rapidly moving fire. All of these elements, plus human errors, led to the numerous fires in California. Not only is California known for fires but they also have massive earthquakes and mudslides. However, like New Orleans people in California love their community and find it hard to leave even though the area is prone to natural disasters.

California's Fire Environment

California has a complex fire environment, with multiple climates, diverse topography and many complex vegetation communities. The following information is a direct quote from the California's Fire Plan headed by Robert Kerstiens. The history of California wildfires indicates that the following trends will continue.

- Risk from wildfire to life, property, natural resources, and firefighter safety is increasing.
- Population will grow and more people will live and use wild land areas, especially in the Central Sierra and in the Southern California counties.
- Topography and climate support ecosystems where large wildfires can be expected.
- Drought and fuel moisture conditions will be unpredictable but almost always dangerous in fire season.
- More structures will be constructed in areas that are very susceptible to wildfire.

- Historical legacy of narrow roads, difficult entrance, insufficient water supplies, flammable building construction and location that make many communities and homes wildfire-prone-still exists.
- Public demand for wild land fire protection and other services will increase.
- Deteriorating forest health, increasing fuel loads and other factors have led to more intense, destructive wildfires.
- Large wildfires do not respect political or property boundaries. The ability to rapidly mobilize, effectively deploy and support large numbers of specialized firefighting resources is essential to cope with large multiple fires. California Department of Forestry, along with other agencies, must maintain infrastructure, including communications and capital improvements necessary to facilitate such a response.
- Fire protection forces in California must have sufficient depth to respond to large, multiple wildfires and still prevent other small fires from becoming large damaging fires. California Department of Forestry plays a key role in supplying and coordinating such forces, it should maintain and enhance this ability. (Kerstiens, 6)

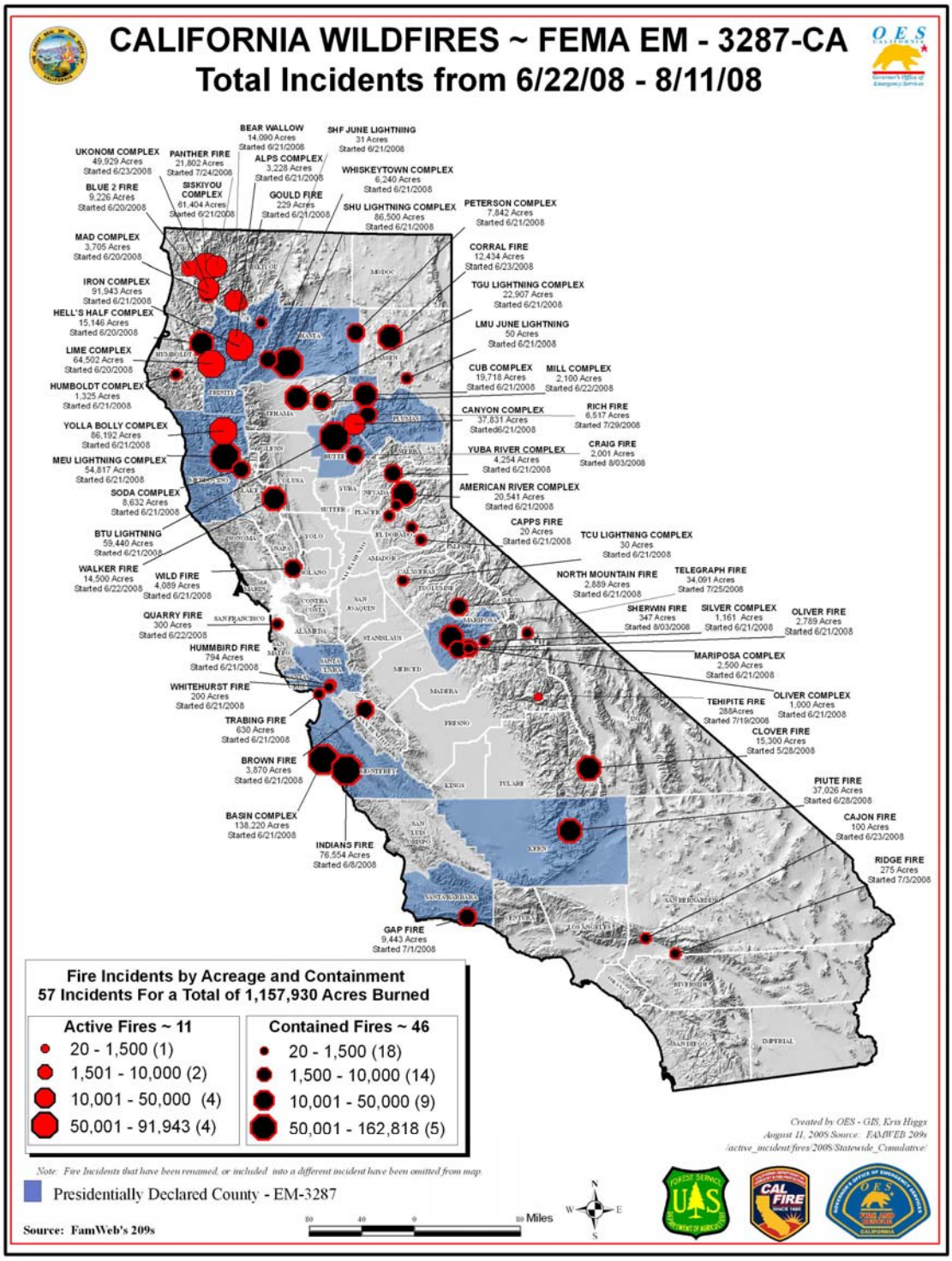

Fig.8

Source: Map is from the California Department of Forestry & Fire Protection

Figure eight above shows a map of California and all of the communities at risk from wildfire from June 22 thru August 11, 2008. The red dots represent communities with active fires and the black dots with the red circles represent the contained fires.

Vegetation in California's Mediterranean climate was dominated by a complex succession ecology of more, smaller and less damaging wildfires before European settlement began (Kerstiens, 37). The evolution of fire suppression since then has produced these results: (Information below is direct quote from Kersteins 37-38)

- Increasing life, property, resources and ecological losses.
- Difficulty of fire suppression, increasing safety problems for firefighters and reducing productivity by fire crews on perimeter lines.
- Increasing volumes of fuel per acre/Increasing fire intensities
- Increasing taxpayer costs and asset losses

Other factors also contribute to a complex fire environment prone to large disastrous wildfires in California listed from the California Fire Plan:

- More people are living and recreating in wild land intermix areas. That adds to the demand for finite natural resources in the wild land, and increases ignition sources, resulting in more fires.
- California's extended drought increased the dead and dying vegetation, the volumes of drier fuel per acre, and the number of days annually of lower humidity and fuel moisture.
- Continued set-asides of federal lands, without an aggressive prefire management program, limit fuel management and contributes to the annual fuel loading increases (Kerstiens, 38).

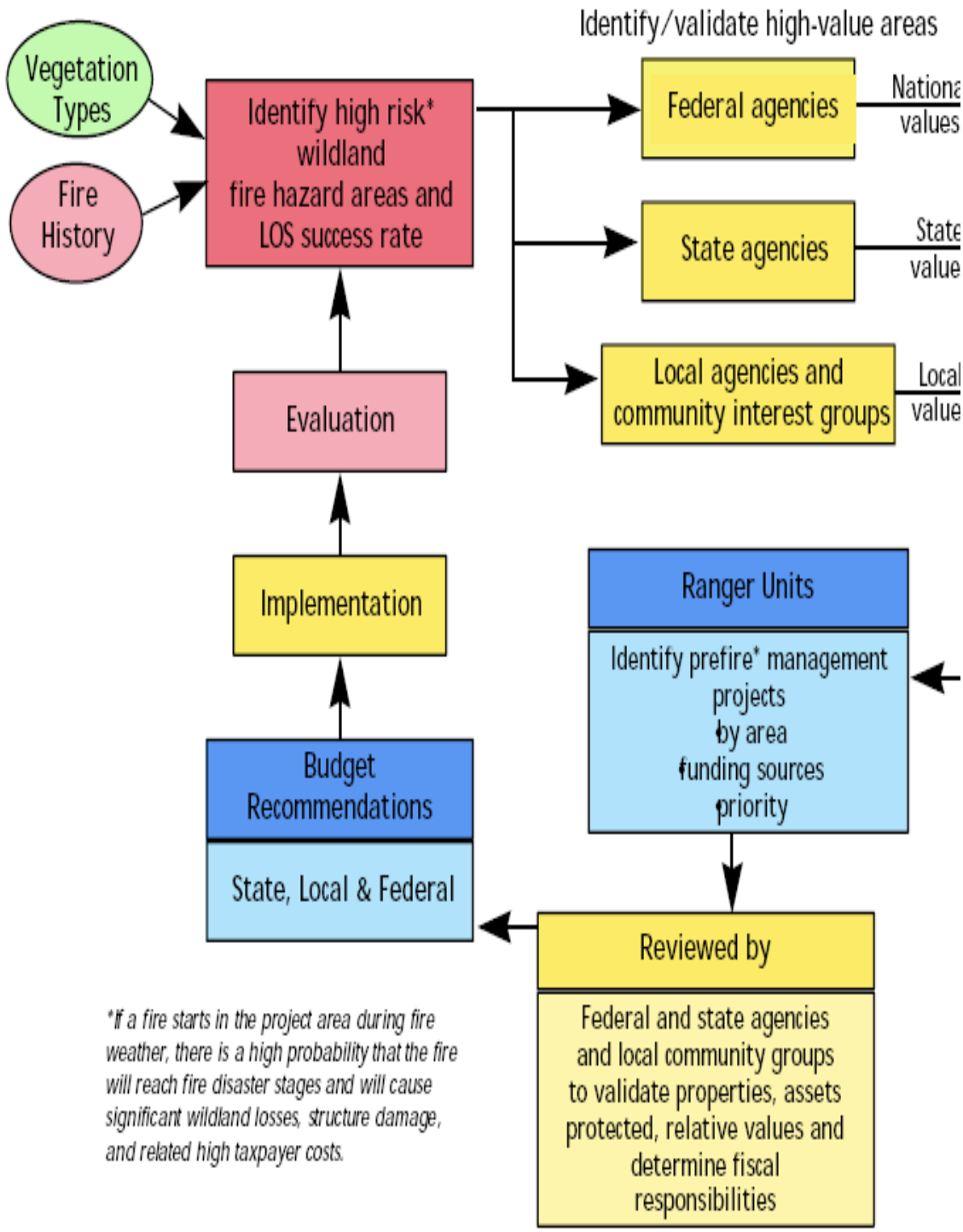

Fig.9 *Source*:Map is from the California Fire Plan

Figure nine illustrates the Wildland Fire Protection System; the goal of this is to identify for state, federal and local public officals and the public, those areas within the state responsibility areas that are high-priority areas in terms of assets at risk, and with a high probability of large wildfires with assoicated costs and loses. This will allow the public and government decision makers to focus on what can be done to develop wildfire protection zones and reduce future costs and losses in these areas (Kerstiens, 25).

Why California is Successful in Fighting Fires

One of the main reasons California has success with fighting their fires is because of organization and direct leadership. Former Governor Schwarzenegger has done a really good job at preparing early. "In May 2008 Governor Schwarzenegger issued Executive Order S-03-08, which boosts the state's preparedness for wildfire season and directs the California Department of Forestry and Fire Protection (CAL FIRE) to immediately mobilize critical firefighting resources and personnel" (Bowen 1). This Executive Order gives CAL FIRE the ability to increase staffing and pre-deploy equipment in anticipation of extreme and threatening fire weather. The Governor also directed state agencies, including the Governor's Office of Emergency Services, the National Guard, California Conservation Corps and the California Department of Corrections and Rehabilitation to coordinate their actions with federal and local agencies, maximizing California's fire prevention and fighting capabilities (Bowen, 1). The Governor also requested from President Bush that federal Modular Airborne Fire Fighting System be made available during wildfire season. Schwarzenegger also declared May 4-10, 2008 "Wildfire Awareness Week." All of these techniques to prepare for a disaster early helped to greatly lessen the tragedy that occurred

on June 2008. Even though 15 people lost their lives if it wasn't for California's early preparation it could have been a lot worse.

Chapter 3

Midwest Floods

June 2008 I can vividly remember watching television in complete shock and horror like so many other Americans during the Midwest floods. I prayed that this would not turn out to be another Hurricane Katrina. Even though the Midwest flood was a great tragedy, injuries and fatalities thankfully did not compare to Hurricane Katrina. This is because the rescue efforts were better planed by FEMA, ever since Hurricane Katrina FEMA realized that the world was watching. The purpose of this chapter is to study the Midwest to determine why floods are so prominent in these areas. I will also compare Hurricane Katrina rescue efforts to the Midwest floods.

2008 Midwest Floods Background

During the first part of June 2008 a large portion of the Midwest received large amounts of rain due to several storms. States affected by the flooding included Iowa, Illinois, Michigan, Wisconsin, Indiana, Minnesota and Missouri. Many of these states received over a foot of rainfall. Dams and levees were breached across parts of Wisconsin, Iowa, Indiana and along the Mississippi Rivers ("2008 Midwestern U.S. Floods", 1). The map below (Figure 5) shows the United States including all of the states affected by the Midwest floods listed above. Major levees in Des Moines and Cedar Rapids (marked by a red star in figure 5 below), in Iowa were breached forcing evacuation causing major damage. "Prior to the Midwest floods much of the upper Mississippi and Ohio River

Basins had experienced wet conditions during the 2007-2008 winters and into the spring. Precipitation received across the Upper Mississippi Basin from December

Fig. 10 United States Map

Source: Google Images: http://cache.eb.com/eb/image?id=4839&rendTypeId=4

2007 through May 2008 was the second wettest in the 1895 to present record" ("2008 Midwestern U.S. Floods", 2). This fact shows how saturated the region was before the Midwest floods hit. A majority of the rainfall that happened in June across the Midwest was sent directly into the lakes, streams, and rivers. This is an important factor in the severity of flooding.

The last time the Midwest had a major flood was in 1993, when many of the same states experienced what scientists term a 500 year flood. That term means that a flood has a one in 500 chance of happening in a given year. Such probabilities are based on records of historical water levels, which go back decades or even a century ("Midwest Deluge: Another 500 Year Flood", 1). Scientists use these records to calculate the odds that the waters will reach a given level in a given year at a given location. For example, for one town the 500 year mark might be five meters above the normal water level for another it might be 12. Robert Holmes, the U.S. Geological Survey's National Flood Specialist, stated that new data is constantly added to the records and scientists frequently revise their calculations. Mr. Holmes says that two large floods in the span of fifteen years will likely drive the 500 year flood mark up.

However, many scientists including Timothy Kusky, an earth scientist at St. Louis University, stated that there is a big problem with the calculation of what is a 100 and 500 year flood plain because it is based on the original shape of the Mississippi Basin. Science and technology journalist, Emily Gertz said that Kusky believed that many factors contributed to this years flooding. Among these are, increased rainfall due to global warming. The other two reasons are based on relatively recent physical changes in the region (Gertz, 1). Kusky stated that bottomlands that used to absorb floodwaters have been overdeveloped.

"What's worse, the miles of new levees that were built to protect the malls, industrial parks and homes in those areas have hurt more than they've helped by constricting rivers into narrower channels. Once we reduce capacity, things that use to be beyond the flood plains are at risk, because floods become higher and more frequent" (Gertz, 1). Mr. Kusky and other scientists are currently working on digital models that can determine the outcome of a flood which might help developers from building in the most dangerous and vulnerable areas.

Flooding could be an Act of Humans

Many scientists are beginning to believe that maybe the Midwest floods were caused by something else besides excessive rainfall. Scientists believe that the Midwest floods were caused by global warming and other factors in the earth's atmosphere. Kamyar Enshayan, director of an environmental center at the University of Northern Iowa, suspects that this natural disaster was not really all that natural. He points out that the heavy rains fell on a landscape radically reengineered by humans. Plowed fields have replaced tall grass prairies. Fields have been meticulously drained with underground pipes. Streams and creeks have been straightened. *Washington Post* journalist Joel Achenbach stated that most of the wetlands are gone. Flood plains have been filled and developed. "We've done numerous things to the landscape that took away these water absorbing functions, agriculture must respect the limits of nature" (Achenbach, 1). Jerry DeWitt, director of the Leopold Center for Sustainable Agriculture at Iowa State University, says that the flooding is not the result of a 500 year event. The flooding is due to the fact that we are farming

closer to creeks and farming closer to rivers. Without adequate buffer strips the water moves rapidly from the field directly to the surface of the water (Achenbach, 1).

James Wang, a climate scientist at Environmental Defense, says that global warming intensifies the hydrological cycle which is the process in which water evaporates into the air, forms clouds, and then rain back down to earth (Wang, 1). Higher temperatures cause evaporation to occur more quickly. "This can cause very dry conditions on land, even drought. But, the greater amount of water vapor that a warm atmosphere can hold causes wetter clouds to form, so the rain, when it comes, can be unusually heavy-heavy enough to cause flooding" (Wang, 1). This intensification of the hydrological cycle causes some seasons to be very wet while others are very dry. Not everyone agrees with the scientists. Some feel that the only cause of the Midwest floods was bad luck because it rained so hard and fast the land just could not absorb all of the rain. Scientists know they have a hard case to prove, but they hope to get people thinking about how to reduce the chances of another major flood from hitting.

Midwest Flood Statistics

Table 1 below is a direct quoted summary of the Midwest Flood and some of the startling statistic's that occurred. The floods forced thousands of people to evacuate from their homes and caused over a billion dollars in damages. The Midwest, especially Iowa, is known for its farming and unfortunately, many of their crops including corn and soybeans were destroyed. This affects all consumers because the damaged crops make the price of food

rise. Twenty four people were killed and 148 were injured, due to the severity of the floods I am glad the fatalities were not worse.

Midwest Flood Statistics:

- Two dozen people killed and 148 injured
- Approximately 35,000-40,000 people evacuated from homes
- Flood warnings cover a span of about 325 miles from Dubuque, Iowa to St. Louis, Missouri
- Mississippi crested at 37 feet in St. Louis area, seven feet above flood level
- Iowa's agricultural economic losses are estimated to exceed $2 billion
- Nine Iowa rivers crested at record levels
- 83 of 99 Iowa counties are disaster areas
- 21 Illinois counties declared disaster areas
- Cedar Rapids water covered 1,300 city blocks , 9.2 square miles
- Cedar Rapids City Hall, Lin County Jail, the fire department, police communication equipment, most of the public library's collection and 3,900 homes were all under water
- Cedar River flood crest exceeds historic 1929 record
- Cedar River flood crested at over 32 feet Friday, June 13 2008
- South Dakota, Minnesota, Wisconsin, Nebraska, Illinois and Indiana have also been affected
- Floods have wrecked the Midwest corn and soybean crops

- At least 22 levees breached
- Abnormally heavy snow pack with unseasonably heavy rainfall are root causes of flooding
- Cedar Rapids recorded 24.09 inches of rain for the year, more than ten inches above normal
- Other parts of eastern Iowa within the Cedar watershed recorded from 15-20 inches of rain between May 10-June 10
- Cedar River has flooded more than 4,000 homes and many businesses in Cedar Rapids
- Areas of Cedar Rapids are flooded beyond the so-called 500 year flood level of 26.5 feet
- Damage cost in Cedar Rapids estimated at over 1.5 Billion

Table 1. Midwest Flood News & Statistics

Source: MCEER: http://mceer.buffalo.edu/infoservice/disasters/iowa-flood-news-statistics.asp

Midwest Floods Compared to the 1993 Flood

The 2008 Midwest floods are drawing comparison in weather and events associated with the Great Flood of 1993 on the Mississippi River. Steve Hilberg, director of the National Oceanic and Atmospheric Administration (NOAA) Midwestern Regional Climate Center (MRCC) at the Illinois State Water Survey states that the precipitation levels are higher in the Midwest region and cover a larger area than for the same period in 1993. In 1993, the major rains occurred in June and July and the most significant flooding was later

than what has occurred this year (Hilberg, 1). In 1993, there were major levee breaks on the Missouri and Mississippi Rivers. The current flooding damages have been mainly on the tributaries of the Mississippi.

Another difference between the 2008 and 1993 floods relates to the amount of precipitation in the previous winter and fall. "Precipitation amounts during the fall of 1992 (September-November) were 125 to 150 percent of normal from Missouri through Illinois and northern Indiana north through southern Minnesota, much of Wisconsin and Michigan" (Hilberg, 1). In the fall of 07, the central Midwest received only 50 to 70 percent of normal rainfall. As a result, soils this spring were better able to handle the heavy rain that occurred (Hilberg, 1).

Jumpstart Iowa Recovery Initiative

Many victims of the Midwest floods had to evacuate their homes and were left homeless. Houses were totally destroyed because of the flood waters. The Jumpstart Iowa Recovery Initiative is a housing and economic development program developed to address the financial needs of Iowans affected by the 2008 storms, flooding and tornadoes. The program will help homeowners make a down payment on a new house, repair their current home, or maintain their mortgages while waiting for a potential buy out from FEMA. "The maximum award is a $50,000, up to $12,000 for interim- mortgage assistance, plus an additional $10,000 for energy efficient appliances" (Hilberg, 1).

Funding for the Jumpstart Iowa Recovery Imitative is being drawn from existing state and federal funds. Next, I will discuss the role of race, class and ethnicity and examine whether or not it made a difference during Hurricane Katrina.

Chapter 4

The Role of Race, Class and Ethnicity

In this chapter I will discuss the role of race, class, and ethnicity between New Orleans and California. I chose to leave out the Midwest floods states in this section. In my opinion, the race and class differences between New Orleans and California are much more obvious and profound. Hurricane Katrina exposed decades of inequality and discrimination towards African Americans and the lower class. Gregory Squires professor of sociology at Columbia college, wrote a book called *Did Humans Cause the Midwest Flooding? "* For the past five decades, social scientists studying disasters have disputed that disasters are not natural, but socially constructed events, which are influenced by demographic and socio-economic characteristics, social and cultural norms, prejudices and values" (Squires, 1360). It has long been argued that factors such as race, class, ethnicity and gender have a significant influence on the outcomes or consequences of disasters. That is, low-income individuals, minorities, women, the elderly and other disenfranchised groups are disproportionately affected by disasters, as Hurricane Katrina demonstrated (Squires, 1360).

Racial and class differences influenced human responses to Hurricane Katrina. This perspective is echoed in Molotch's (2005) commentary on events immediately following Hurricane Katrina. Answering his own opening question, "Would so many white people struggling for life be ignored for so long?" Molotch writes that, "Racism explains some of what went on, but its route was indirect. One of the race-based explanations is that those left behind are consistently the most deprived. The legacy of slavery, exclusion, and segregation corrals those with the least resources into a vulnerable space, natural and economic" (Elliott, 299). James Elliott, a Social Science Researcher from Tulane University in New Orleans,

shows that especially in the Deep South close friendships, neighborhoods, churches, and social clubs remain highly segregated by race. These divisions are important for understanding human response to natural disasters because people respond to disasters not as isolated individuals but as members of these overlapping forms of social affiliation. This is not to say that class differences are unimportant, but rather that in times of crisis, class differences are likely to shrink and racial differences expand as individuals define, interpret and respond to the situation before them (Elliott, 299).

It is well known that the poor African –Americans live in the environmentally dangerous parts of New Orleans. "Industry and government officials locate environmental hazards in low-income, minority communities because these communities lack the social, political, and economic power to resist such treatment" (Elliott, 301). In addition to polluting industries and toxic landfills in New Orleans, the region has long been uneven with respect to elevation and flood protection. During the 1900's the development and proliferation of new pumping stations allowed developers to drain and build new communities in New Orleans' traditional low-land swamps where significant African American neighborhoods subsequently grew and solidified high vulnerability to flooding and levee failure (Elliott, Pg.301). This system allowed middleclass whites to use restrictive covenants to block African-Americans from the newly drained but still low-lying subdivisions.

The Media during Hurricane Katrina

Media coverage during Hurricane Katrina provided a real-world opportunity to see the relationship between the media, race, and the general public. Samuel Sommers, experimental Social Psychologist, said we must consider media language use, including the two hallmark controversies of the Katrina coverage: debate regarding the use of "refugees". The word was used to describe survivors of the storm, and the widely circulated photo captions that described a black man as "looting" and a seemingly comparable white couple as "finding food" (Sommers, 40). Jesse Jackson and Al Sharpton argued that the use of "refugee" was racially biased, as it depicted the primarily black population in out group terms and implied that the victims were less than full citizens (Sommers, 41).

The media also exaggerated reports of violent crimes in New Orleans after the storm. Yes, the lack of reliable channels of communication was unprecedented in contemporary America, obstructing the media's ability to obtain and confirm information. "This was not the case at the Superdome and Convention Center, where operations were carried out by the National Guard and where reports should have been easily confirmable" (Sommers, 46). However, communication issues did not lead to similarly misleading coverage in storm affected areas with largely white populations. The inaccuracies regarding the behavior of the storm survivors portrayed these individuals more negatively, more violently, more stereotypically; there were few if any stories that depicted the predominantly black population in a more positive light than the facts warranted (Sommers, 46). These observations suggest that demographic factors such as race contributed to the nature of the inaccurate reporting.

New media outlets such as mass e-mails and web blogs spread untrue rumors about the Hurricane Katrina evacuees. In the aftermath of the storm, several mass e-mails began circulating describing survivors in an unflattering stereotypical light. Below is an email that was sent out about the behavior of evacuees at a Texas rest area:

Last Friday my dad, who works for TX DOT, answered a call for TX Dot employees to go to help with the refugees at this rest stop. These buses from New Orleans start pulling in. As they get off the bus, they are greeted and shown to the rest rooms where they pee all over the walls, floors, mirrors, etc. They do not even flush the toilets. Left the restrooms in a horrible mess…He and my mom said the people were HORRIBLE. Nasty, filthy mouthed, ungrateful…Why the hell can't they line up themselves and help unload all these trucks and cars full of FREE stuff? Okay, let them have a day or two of rest but then put those folks to work taking care of themselves. Why the hell should any of them want to get a job when they can lay around all day in free air conditioned stadiums where they don't have to spend a dime and they have TV, entertainment and education and great food? (Sommers, 48)

The Texas Department of Transportation (TX DOT) was unable to confirm these allegations, and the supervisor of the rest stop refuted the alleged incidents in the restroom. This email is full of negative stereotypes that the evacuees are dirty, lazy, ungrateful and manipulative. Another popular e-mail circulated in Utah stated that the National Guard removed 43 handguns, 20 knives, 20 pounds of marijuana, 10 pounds of crack, 15 pounds of Methamphetamines, 10 pounds of various other controlled substances including Heroin. One man supposedly had $100,000 in cash and men attempted to rape a relief worker (Sommers, 48). Again, all of these allegations were false. Public safety officials and the Governor of Utah immediately and categorically denied these allegations.

Race and Class Differences between New Orleans and California

There is a stark difference in treatment from the government between the Hurricane Katrina and San Diego 2007 fire evacuees. Journalist & Press Secretary in Washington, Bob Keefe's article, "Stadium *like a Resort vs. Superdome*", shows the differences in the way the evacuees were treated. "In San Diego over by Gate A you can get a free massage or acupuncture treatment. Up on the plaza level are group counseling sessions and medical checkups. There's a yoga class in the morning and live music—roving mariachi bands, rock 'n' roll acts, singers with acoustic guitars at night. Hungry? Go to Gate F for hot meals, Gate D if you want a kosher or Gate N for Mexican. Is this a giant health fair or vacation theme park? No, its San Diego's Qualcomm Stadium, the primary wildfire evacuation center" (Keefe, 1). This is a far cry from the Superdome in New Orleans where evacuees had to fend for themselves with little government aid. At Qualcomm the mayor and Governor Schwarzenegger came by to see the evacuees often. Even President Bush and Homeland Security Secretary Michael Chertoff stopped by. Do the stark difference in treatment between Katrina and the San Diego fire evacuees have something to do with government leaders learning from their mistakes during Katrina or does the difference have to do with poverty, race and politics? California is relatively rich and has fewer black residents than most states; Louisiana is among the poorest and blackest states. "I'm from New Orleans, and this place is completely different, there's a different culture here" said evacuee Dean Beavers (Keefe, 1).

Reasons for Effective Response during California Wildfires

FEMA stated that part of the reason that the wildfire response was such an effective team effort was that people don't wait to be asked to offer help in a crisis. The Administration seems to have learned from its slow response to Hurricane Katrina and doesn't want to be bitten again according to former FEMA Director Joe Allbaugh. According to Matt Mayer, writer and researcher on national security, President Bush offered assistance quickly. "For example, President Bush called California Governor Arnold Schwarzenegger to offer help before Schwarzenegger had even asked for federal assistance. President Bush subsequently anticipated the state's request to declare a state of emergency and approved it just one hour after the request had been filed" (Mayer, 3). Even before California authorities asked for help, the National Guard Bureau deployed military aircraft to California on a training mission, placing them in a better position to help fight the fires. FEMA has provided $4,571,714 to rebuild homes destroyed by the fires. FEMA has provided California with a substantial amount in homeland security grants to equip the state with fire-equipment. Between 2001 and 2007, California fire departments received $147 million under the Assistance to Firefighters grant program (Mayer, 3).

Differences between Hurricane Katrina and California Wildfires

Compared to Hurricane Katrina, the California wildfires were insignificant. There were many differences between the two including communication, transportation, and electricity never failed in California as it did in New Orleans. The local disaster infrastructure remained intact in California; local elements were destroyed during Katrina. The preservation of communications infrastructure allowed California residents to evacuate more effectively than would have been possible in the flooded Gulf Coast even with a perfect disaster response

plan (Mayer, 4). One other major difference between the two events is the nature of the population most affected by the two disasters. " Most of the evacuees in the Gulf Coast were poor urban residents, while most California evacuees were more affluent citizens with access to cars and enough money for alternative housing" (Mayer, 4). This reduced the burden on the first responders because a lot of the evacuees could help themselves.

Chapter 5

Communication Technology in Disaster Management

The world witnessed the terrible aftermath of Katrina and the flooding of New Orleans. Those who stayed began to realize no one was getting them out. Those who left began to realize they weren't going home for days. People were displaced from their homes, their city, their work or school, friends and family. The infrastructure that held society together broke down: communication, transportation, electricity, water service and bureaucracy fell apart. It was hard to find friends and family, anyone with a boat rescued people. Coast Guard helicopters rescued people from rooftops, street corners and inside buildings. School buses were stuck on the interstate, unable to rescue people in the Superdome and Convention Center. The world watched in disbelief and horror. I thought I was watching images from a third world country, but I wasn't. This was happening right here in the United States. Why did the mayor initially call for a voluntary evacuation instead of a mandatory evacuation? The mayor and governor knew that many people did not have means for getting out of the city. Why weren't people rescued sooner? In this chapter I will discuss the communication practices that occurred during Hurricane Katrina, California fires and the Midwest floods.

Communication Failures

New Orleans suffered not only from technological breakdowns but direct communication failures that could have been avoided. Good communication depends on leadership among those charged with responsibility. Former FEMA Director Michael Brown regretted his inability to persuade Governor Blanco and Mayor Nagin to sit down, get over their differences and work together. Mayor Nagin took over Governor Blanco's

authority in advocating federalizing the National Guard; the National Guard is normally under the control of the governor. Michael Dyson, writer and professor of sociology at Georgetown University stated that the Bush administration sent a memo to Governor Blanco. The memo proposed the Governor request the federal government take charge of the evacuation of New Orleans. President Bush, it seems sided with Mayor Nagin and not Governor Blanco. However, Blanco rejected the offer and did not surrender her authority to Bush (Dyson, 103). President Bush subtly blamed Nagin and Blanco for the disastrous slow response to Katrina. Governor Blanco stated the frustration she was feeling dealing with FEMA. Social Science professor Peter Burnes from Loyola University in New Orleans explains the anger Governor Blanco was feeling. "In describing her difficulties with FEMA, Governor Blanco stated that no one, even those at the highest level, seems to be able to break through the bureaucracy to get this important mission done. I am angry and outraged" (Burnes, 521).

I believe that FEMA's refusal of assistance has caused many lives to be lost. For example, The USS Bataan, an 844-foot ship that carries Marines, was in the Gulf before the storm. The ship waited for authority for a full mobilization that never came. The ship contained beds, physicians, helicopters, food and water yet, FEMA never asked to use their considerable resources including six hundred patient beds that remained empty (Dyson, 120). Michael Brown blamed state and local officials for the inefficient and ineffective evacuation of the city. He referred to governance in Louisiana as "dysfunctional." One example involves the late mandatory evacuation of the city designated by Mayor Nagin, who was more concerned about the city's liability if he forced businesses to close rather than the safety of the citizens.

The absence of collaborative action led to problematic decision making during the crisis. For example, Amtrak offered to transport evacuees out of the city, but Mayor Nagin did

not accept the offer. For two years prior to the hurricane, the city, the Red Cross, and the University of New Orleans tried unsuccessfully to create a ride-sharing program in the event of a major hurricane. In May 2005 the New Orleans Emergency Preparedness Director stated that they did not have the resources to evacuate everybody if there was a hurricane. Peter Burns, a professor at Loyola University in New Orleans, stated that they lacked the capacity to evacuate the city in general and people in the poorer areas in particular. "At the beginning of August 2005, the mayor, the president of the city council, state legislators, officials from the state police and the local Red Cross, and others participated in a public service video to warn residents in low-income areas that they must fend for themselves in the event of a hurricane That tape was intended for distribution to churches in the area eventually hit by hurricane Katrina in September. The video never made it to its intended audiences, but rather remains in a Los Angles warehouse awaiting distribution" (Burnes, 522). This example shows that the government wants churches, nonprofit organizations, and other community based groups to assume the job the government should be providing to the citizens of New Orleans.

Technological Failures during Hurricane Katrina

The damage caused by Katrina increased drastically due to technological communication failures which caused destruction and death in many of the affected areas. The first responders were unable to coordinate search and rescue operations effectively without communications to guide them to the locations requesting assistance. Supplies and assistance from other states could not be delivered in a timely manner due to lack of communications. Lack of interoperability of communications equipment presented another problem. Solutions to these problems will require enforcement of common standards as well as funding to enable organizations to get compatible communications equipment. What led to this massive communication breakdown? "Communications were limited at all levels due

to infrastructure problems, insufficient interoperability and lack of equipment. This lack of communication kept the media confused about isolated incidents and put them in a position to report misinformation. Lacking access to critical communications assets government and assistance organizations could not dispute media reports or defend their efforts. They had no valid intelligence" (Meeds, 5). Proper response efforts could not be put together by state, local or federal agencies during the first two days due to communication failures which led to a slow response and more misinformation.

For example, Lieutenant Colonel Heather Meeds with the United States Army National Guard stated that six of the eight police districts were out of commission because of flooding, limiting their ability to establish command and control. They couldn't perform basic law enforcement functions because their communications were destroyed. During a rescue operation, six helicopters hovered over the same roof top to rescue civilians (Meeds, 9). If the proper communications would have been in place, only one helicopter would have been sent to the roof top and the other five would have rescued other victims. Hundreds of commercial trucks with food and supplies stopped in Mississippi and refused to continue without armed escorts because they had the false perception those shootings were taking place in various locations. In New Orleans, the National Guard assets in Jackson Barracks were unable to communicate the massive flooding to higher headquarters; they were unable to pass critical data (Meeds, 9). These are a few examples to show the importance of communications and interoperability.

The Louisiana Army National Guard's main communications infrastructure was also destroyed by the hurricane. FEMA dispatched Amateur Radio Operators to hospitals, evacuation centers and county Emergency Operation Centers to send emergency messaging 24 hours a day. (Meeds, 10). Many areas in Louisiana were without communication for four

days, while areas in Mississippi were without communication for two days. Medical assistance, firefighters, law enforcement, search and rescue could not be distributed to areas that needed it the most due to lack of functional communications systems. Cell towers were blown down and telephone lines were damaged so there was no phone service in the hardest hit areas. "In Louisiana, most of the parishes did not have satellite phones because they chose to disconnect the service after the state stopped paying the monthly fees for the phones" (Meeds, 10). Satellite phones and other equipment were brought in but became quickly overloaded the satellite bandwidth. Interoperability of radios, downed radio antennas and poorly distributed base stations hindered communications at all levels. The new 700 MHz radios in St. Bernard and Plaquemines Parish were deaf to the 800MHz equipment in New Orleans and Jefferson Parish therefore; we need one interoperable system covering every jurisdiction in this country and other technological solutions.

Interdisciplinary Solutions

Many of these problems can be solved by using interdisciplinary solutions. An example of the use of an interdisciplinary solution is from the Hurricane Pam exercise, a fictional exercise to prepare for a category 4 hurricanes in New Orleans which was done in July 2004. They used realistic weather and damage information developed by the National Weather Service, the U.S. Army Corps of Engineers, the LSU Hurricane Center and other state and federal agencies to help officials develop response plans in the event of a catastrophic hurricane in Louisiana. A lot of the problems that occurred during Katrina could have been overcome if the Hurricane Pam training was completed. Hurricane Pam brought sustained winds of 120 mph, up to 20 inches of rain in parts of southeast Louisiana and storm surge that topped levees in New Orleans. Professor of Public and International Affairs at Virginia Tech, Patrick Roberts gives details about Hurricane Pam training. The five day

exercise included emergency officials from 50 parishes, state, federal and volunteer organizations. “Yet, $850,000 into the exercise, FEMA’s funding for Pam was cut, and key decisions that would vex authorities in Katrina had not yet been made.” (Roberts, 5). No one had walked through how to handle communications failures, and there was no plan to organize evacuation or transportation and medical care immediately after the hurricane. The 121 page plan that emerged from the aborted exercise left many issues “to be determined” (Roberts, Pg. 5). If the Pam exercise was allowed to be completed and done well, it would have forced Louisiana and New Orleans officials to have backup plans when communication broke down and federal help failed to arrive.

Many emergency response efforts were crippled by the lack of back-up or alternate communications. As companies continue to use IT as a core function of their business, there needs to be a clear understanding of what will happen to the organization if IT resources become unavailable. The following details about what to consider when designing an integrated communications system during a disaster came from the same source, author Jon M. Peha. Mr. Peha wrote an article called “Fundamental Reform in Public Safety Communications Policy.” Jon M. Peha is an Engineering and Public Policy professor at Carnegie Mellon University.

One important component is *interoperability*, which is the ability of individuals from different organizations to communicate and share information. *Spectral efficiency* is another component. It is technically possible to support today’s first responders using far less spectrum. When spectrum is used inefficiently systems will become highly congested during large emergencies, forcing first responders to either wait for long periods before communicating or to interrupt each other. Thanks to the transition to digital television, 84MHz of spectrum will became available in 2009, 24 MHz of which have tentatively been

allocated for public safety. This capacity roughly doubles the spectrum under 2 GHZ that is allocated to public safety. Moreover, this spectrum is around 700 MHZ, which means it has physical properties that are particularly useful when designing a communications system that must cover a large geographic region. The federal government also plans to invest $3 to $30 billion and a significant amount of spectrum in the Integrated Wireless Network (IWN) program, which is intended to provide communications services to first responders. *Dependability and Fault Tolerance* is important because pieces of the system should rarely fail. Some failures are inevitable but that should not bring the entire system down. "In fault-tolerant design, other parts of the system will continue to operate, and compensate for failures to the extent possible" (Peha, 5). *Advanced capabilities:* there are many other services that could be useful, including broadband data transfers, real-time video, and geolocation which would allow dispatchers to track the precise location of first responders during an emergency. *Security* systems should be designed so hostile parties cannot easily attack the communications system or eavesdrop on first responders. Finally, the *Cost* to build and operate should be as low as possible. All of these things must be considered to build an effective communications system (Peha, 5).

Recent incremental efforts at reform have tended to address one problem at a time. For example, spectrum has been reallocated to address the problem of spectrum scarcity, with limited attention to interoperability. There are grant programs specifically intended to improve interoperability without consideration for spectrum efficiency, dependability, or the capabilities made possible by new technology (Peha, 6). However, there are multiple problems that put lives at risk, and they are interrelated. Interoperability may be improved by deploying a piece of equipment for translations that will cause the entire system to fail. If this one component fails, the system will be less dependable. Interoperability can be

improved by boosting coverage areas and thereby consuming far more spectrum for the same communications (Peha, 6). Allocating more spectrum to public safety with little thought to standards could make interoperability failures even more common. Flexibility also greatly reduces spectral efficiency. When engineers design a wireless communication system to cover a large area, they can maximize capacity and minimize spectrum use by carefully determining where each transmitter is located, which technology it uses, what area it covers, and which block of spectrum it uses. These techniques can conceivably increase spectral efficiency for public safety by orders of magnitude. However, it is not possible to adopt this approach if each municipality makes decisions independently. Decisions to minimize spectrum use and to ensure seamless coverage must be made across large regions with many municipalities. The best way to improve systems is to address all objectives together rather than piece by piece (Peha, 8).

One of the interdisciplinary solutions involves using wireless information technology. Raheleh Dilmaghani, Communications Professor at the University of California, stated that the role of wireless technology during a disaster is very critical. "Recently Wireless Mesh Network (WMNs) has become very popular along with Wireless Wide Area Networks (WWANs). Hybrid Wireless network (HWN) architecture has been recently developed that integrates WMNs and WWANs which is primarily designed to provide an easily reconfigurable alternative for first responders handling emergency response" (Dilmaghani, 3). This is new technology that has not yet been used in rescue operations yet. However, many businesses have used this technology and it is steadily growing. "This architecture uses point-to-point and point-to-multipoint long haul wireless links in order to provide gateway functionality for multi-hop wireless networks. A hybrid wireless mesh network architecture provides a quickly deployable and highly reliable WMN infrastructure

that uses WWANs as backhaul links with no wired backhauls" (Dilmaghani, 3). This technology would aid first responders in emergency situations where the main requirements are for quick deployment with minimal configuration, simplicity of reconfiguration of network topology, fault tolerance in the case of failure of part of a network and a fully distributed architecture. It also would enable technical personnel to use different wireless user devices, and does not require any expensive network infrastructure for a broadband peer-to-peer network service.

In areas that are prone to floods like New Orleans, the design of the central telephone buildings needs to be able to withstand floods. This design will allow telephone building to remain operational throughout the hurricane and allow receiving calls internet traffic to and from outside the affected areas. Towers need to be able to continue to work even when their base and core electronics are submerged under water. Cellular towers

need to have their own automatic power supply that can last for a while and must be able to route calls without depending on land lines. "As an alternative for a cellular network for rescue workers, we can deploy Voice over IP (VoIP) technique with portable wireless mesh nodes. Users elsewhere simply need to access a broadband network in order to make and receive calls even if they are away and no longer at their home area. It is quite simple to redirect traffic over switches remotely to send traffic onto working networks overriding the damaged lines. When a couple of towers fail, switching to a lower bit encoding in cellular networks may provide minimum service at the cost of degrade quality of voice"(Dilmaghani, 6). An example of using Voice over IP in everyday life would be to imagine a caller in the U.S. who intends to call her friend in Germany using Voice over IP. She will use her PC and the call will be directed through her internet connection to a server of her Internet Telephony Service Provider (ITSP). The ITSP will route the users call through the internet to a gateway

in Germany, where the call is transferred to the public telephone network and eventually guided to the friend's telephone (Dilmaghani, 7). As today's technology enables real time, full duplex voice transmission, her friend in Germany might not recognize that she is using her PC in the U.S. to place the call.

Utilization of frequencies continued to be a problem during Katrina. Several bands of frequencies are set aside for different types of communications equipment. It is difficult to coordinate and de-conflict all the frequencies in a disaster since so many different organizations are involved. "The issue has come up because of an increase in the use of Unmanned Arial Vehicles (UAVs) competing for the same frequencies" (Meeds, 11). During hurricane Katrina the National Guard was deployed in Louisiana on September 6. The unit was told it would receive frequencies needed to set up its communications network within 24 hours. Due to confusion created by multiple systems sharing the same frequencies in the area and lack of an engineering tool, the frequency issue was not resolved until September 12 (Meeds, 11). Band-sharing will continue to be a problem given the increases in the types of equipment utilizing the same frequencies.

September 11th marks a fundamental change in requirements. It is now far more important that we are prepared to respond to large scale disasters that require a cooperative response from many public safety agencies. A failure rate for communication systems that was acceptable before 9/11 may not be acceptable today. Technology has changed drastically and the results of this progress are obvious in commercial and military wireless systems, but are not so apparent in public safety systems. In many cases current policy and its emphasis on flexibility is an impediment to adopting new technology. For example, effective use of wireless technology can require coordinated planning over a wide frequency band, a large geographic region, or both. Useful maps or photos may be stored in a

jurisdiction far from the emergency, and such information cannot be shared dynamically unless public safety agencies in both jurisdictions have independently decided to invest in a shared infrastructure to connect them (Peha, 4).

Costs have changed as well. In particular, the rapid growth of commercial wireless services has led to mass production, and low cost. Thus, equipment used by public safety could be much cheaper than was once possible, if it is similar enough to equipment used in commercial markets. On the other hand, demand for spectrum has increased, making it more valuable. Thus, the many public safety agencies designed to reduce equipment cost by consuming more spectrum is far less appropriate today (Peha, 5). Some people have expressed frustration over the progress achieved, despite all of the money allocated to incremental improvements. As stated by the House Select Bipartisan committee to investigate Hurricane Katrina, "Despite hundreds of millions in federal funding for technology and communications, the absence of true communication interoperability within and between affected jurisdictions severely hindered rescue and response efforts at all levels of government after hurricane Katrina" (Peha, 5). After all, Secretary of Homeland Security Michael Chertoff said in May 2006 that his department alone had allocated over $2.1 billion to states for interoperable communications since 2003 (Peha, 5). Perhaps the problem is not lack of resources for incremental change but a lack of vision to promote more effective change.

As the growth of technology escalates, privacy concern in information sharing and data manageability becomes crucial. Data should be secured for each specific organization so that others which have not been originally assigned to this specific task will not be able to access that data. When designing a disaster plan using Information Technology I would recommend the following recommendations to FEMA. All of these details are direct

quotes and came from the same source by author Jon M. Peha, in his article "Fundamental Reform in Public Safety Communications Policy."

- Increase use of wireless technology including wireless capabilities in laptops carried by some first responders, peer-to-peer use of Land Mobile Radio Systems (LMRS) radios, and walkie-talkies all can help to provide communications even when the communication infrastructure is damaged.
- Broadband data transfers, real-time video, and geolocation which would allow dispatchers to track the precise location of first responders during an emergency.
- Use of sensors, wikis (editable Websites), blogs and data mining tools to capture, analyze, and share lessons learned from operational experiences.
- Use of database, Web, and call center technologies to establish a service to provide information about available equipment, material, volunteers, and volunteer organizations.
- Use of planning, scheduling, task allocation and resource management tools to help in formulating disaster management plans and to ensure timely recognition of problems and associated follow-up decision making.

Jerry Brito, Professor of Law at George Mason University, states that the lack of interoperability exists when first responders who need to communicate with each other are using either different frequencies, or the same frequencies but with different communication standards. Interoperability should not have been a problem during Hurricane Katrina, "There would be no interoperability problem if public safety agencies agreed to share use of the same network and made sure that the system is built to be interoperable with every other licensee's system" (Brito, 462).

All of the interdisciplinary solutions listed above will help to ensure safety to residents during a disaster and could have saved many lives during hurricane Katrina. Lack of interoperability and the limited quantity of communications equipment available caused inefficiencies at a time when the American people in the Gulf Coast region needed it most. I hope that these technological recommendations will ensure that another Katrina communication breakdown will not happen again.

Technology Used During Midwest Floods

In March 2008 during the Midwest floods, Butler County in Missouri had a terrible flood due to heavy rainfall and the failure of three levies along Black River. Thousands of people's lives were in danger, "Since the levies failed during the night when most people were asleep, county officials discovered there was no way of effectively notifying the several thousand people who were in immediate danger of flash flooding" (Sliger, 5). The only thing that the county had was a siren to warn people. County officials wanted to buy the reverse 911 system but the system cost over $70,000 plus an extra $10,000 a year for maintenance (Sliger, 5). Due to the expensive price of the reverse 911 system, the county is developing a new system which will allow them to provide 24 hour notification during an emergency such as a flood. Butler's citizens will receive the notifications on their cell phones in the form of text messages. "This will give them the tools to alert our citizens of a variety of emergency messages such as: Flash Flood Warnings, Tornado Warnings, Hazardous Material Spills, Amber Alerts, Health Related Warnings, Road Closings, and School Emergencies" (Sliger, 5).

On October 24th and November 11, 2008 the Missouri Disaster Alert Notification system was successfully tested. The system is designed to contact up to 1500 important

individuals critical for a disaster statewide (Sliger, 5). A test will be conducted on a monthly basis to check the system. Hopefully, this program will work as planned "Local officials will be able to deliver emergency messages instantly to thousands of people in the database using the extensive national cellular networks" (Sliger, 5). This system will allow people, statewide, regionally or by county, to be reached anywhere or time during a disaster.

Some of the worst flooding in the Midwest occurred in Iowa, especially Cedar Rapids. Since FEMA received so much scrutiny after Hurricane Katrina most of the first responders during the floods were state and local groups. The residents praised them for doing a great job. Journalist Amanda Paulson's article talks about FEMA's improvements. "For the most part, they've also received high marks for quick, clear communication with residents, and for efforts that in some cases allowed key public works to be saved or gave people time to remove their possessions" (Paulson, 3). Joleen Gerst, whose farm in Oakville, Iowa, flooded received daily "code red" calls updating her on the situation when the levees overtopped. Iowa officials said that there was a major improvement with this flood compared to the 1993 floods because technology has improved along with better management centers (Paulson, 3). Bret Voorhees, a spokesperson for Iowa Homeland Security and Emergency Management, stated that in 1993 people were still writing stuff up on chalkboards but now Iowa has improved their emergency response center. Iowa now has a large building with 70 computer equipped work stations (Paulson, 3). The Army Corps of Engineers constantly updated their websites warning residents about levees. Schools were also protected by the Army Corps of Engineers "The Engineers also worked with Des Moines and Iowa City, both located near reservoirs, holding back on their scheduled water releases as long as possible to allow the cities to protect their schools, water treatment plants, and other key facilitates" (Paulson, 3).

Iowa officials also noted that the major reason evacuation went so smoothly is because after the major 1993 flood residents understood how to evacuate better. In Cedar Rapids over 25,000 people were evacuated "Most of the residents were notified by a reverse 911 system the city had in place and emergency shelters were set up" (Paulson, 3).

Experts argue that the comparison between the Midwest floods and Hurricane Katrina are unrealistic because Katrina occurred in a much larger city than the cities affected by the Midwest floods. Plus, the floods occurred in an area of the country that had less government capability than the Midwest (Paulson, 3). I disagree with the last statement because New Orleans had the same right to government aid that the rest of the country possessed. The only difference is that New Orleans did not ask for the governments help early enough to get the proper help that they deserved. The Midwest floods evacuation was better planned because the officials took control of the situation early and FEMA for once was on top of the evacuation process and made sure supplies were delivered promptly. FEMA knew the world was watching and they could not afford to mess up again FEMA had learned their lesson from Katrina.

California Technology GIS/GPS Systems

One of the main reasons California has had success with fighting their wildfires is because of their use of high-tech technology, such as satellite imaging and GPS technology. California also uses aerial photography to help firefighters track the fires. Todd Weiss, writer for C*omputerworld* magazine and website said that California is also trying other technology such as infrared images to "see" moisture levels on the grass and in shrubs (Weiss, 1). Glen Nader, the natural resources advisor for the University of California Agricultural Extension, said that one technology that continues to help firefighters is geographic information (GIS) mapping data. Glen Nader points out that this system can be combined in layers to provide details on topography, fire history roads, access and population. Another great use for the GPS system is that they help firefighters new to the area, "The GPS navigational technology help firefighters arriving from other areas during emergencies. Because they are from out of town, they don't know where the fire hydrants and other water supplies are and this system help them find everything" (Weiss,1).

Journalist for *Government Technology* website and magazine, Chandler Harris states that NASA's Ikhana Unmanned Aerial Vehicle (UAV) was also used to help California firefighters. It is an unmanned remote-controlled plane that made aerial flights over the wildfires to get digital imagery. Ikhana is a Native-American word that means intelligent, conscious or aware; this aircraft is similar to the ones used by the military in Iraq and for border security (Harris, 3). This aircraft is extremely important to firefighters in California, "The aircraft uses thermal infrared imaging technology and data telemetry to provide accurate wildfire data. The thermal images are sent through a communication satellite to NASA's Ames center. After that the information is sent back to the ground and integrated into Google Earth and other GIS formats " (Harris, 3). The data is then sent to the fire

commanders on the ground in less than ten minutes helping them to know the hottest part, speed and direction of the fire. NASA has also provided firefighters all over the world to access the Moderate Resolution Imaging Spectroradiometer (MODIS) Rapid Response System. This system provides daily satellite images of the Earths landmasses in near real time (Harris, 4). MODIS uses sensors that detect electromagnetic radiation "MODIS use infrared heat and visible light, once data on smoke and fire radiation is sent back to earth, NASA geographers merge maps of local roads, topography, vegetation and population density" (Harris, 4). These images are then sent to firefighter operations all over the world.

Reverse 911 Systems & EOC

Reverse 911 systems played a major role in helping the Midwest flood victims and this system also helped the California Wildfire victims as well. California officials credit two mass notification systems with saving lives during the wildfires and they include the reverse 911 system and a web emergency operations center (EOC). Ron Lane, emergency services director of San Diego County stated that the 911 system saved lives because many residents went to bed thinking they were in no danger only to be awakened by an alert telling them a new fire had started and was headed in their direction. Jim McKay, editor and writer for G*overnment Technology* magazine said that in 2005 the California sheriffs department made a life changing purchase. "The sheriffs department purchased a server-based reverse 911 system in 2005 that sent out 377,000 alerts during the 2007 fires. In 2006, the county purchased a Web-based system that made more than 170,000 calls during the latest fires" (McKay, 4).

The Web emergency operations center (EOC) system gave officials from 85 different agencies teleconference capabilities and cost San Diego officials $20 million (McKay, 4). This system made providing shelter and evacuation go smoothly. Ron Lane, emergency

services director of San Diego County, said that more than 300 people would be logged in at one time. The EOC system made everyone have situational awareness of what was going on like what areas were being evacuated and the status of the hospitals. The Web EOC system worked with Motorola "The Motorola WEB EOC system worked in tandem with the mass notification systems by letting everyone know what parts of the county were being evacuated at a certain time and where people are going. That allowed Red Cross, animal control and other agencies to prepare and respond accordingly" (McKay 4). This system has worked extremely well in California and has enabled them to save many lives.

California's Interoperable Communication System

It is well known that the delays in response from first responders due to lack of interoperability have caused many lives to be lost. California realized that interoperability was a major problem in their state; in 2003 the National Task Force on Interoperability outlined five obstacles to achieving county interoperability. Andy Opsahl is a journalist and editor for G*overnment Technology* magazine. The following is a direct quote he stated that the task force blamed:

- Aging and incompatible equipment
- Fragmented budget cycles
- Limited and fragmented planning and coordination
- Limited and fragmented spectrum; and
- Agency resistance to uniform equipment standards (Opsahl, 4)

In 2005 Orange County, California was able to have interoperable communication systems, "Orange County managed to connect all of its responders in 31 cities on the same 800 MHz trunk radio system. The system supports more than 17,000 radios and averages

about 55,000 transmissions daily. The trunk system uses 81 channels and has nearly 400 talk groups" (Opsahl, 4). Why is it that Orange County can have interoperable communication and other counties do not? According to Harlin McEwen, chairman of the Communications and Technology committee of the International Association of Chiefs of Police, first responders continue to fear that they will lose control over their system and the new system will not meet their needs. Scott Maddy, communications specialist for the Anaheim Police Department, which shares the Orange County system, said that was not a problem for them. There were steps taken to make sure this would not be a problem, "A technical-liaison committee that met monthly for six years to assure that the technical and operational issues was resolved" (Opsahl, 4). The committee included all disciplines including police, fire and public works. Scott Maddy points out that even if centralized communications teams understand how to address multiagency concerns enlisting those agencies into a centralized system would sometimes be difficult because the agencies are focused on their own budget agendas (Opsahl, 5). Unfortunately, that is one of the main reasons counties do not have interoperable communication systems.

Hurricane Katrina Updates

Seven years after Hurricane Katrina victims are still trying to rebuild their lives and make their communities better. Journalist Lise Olsen with the *Houston Chronicle* stated that the number of deceased is officially recognized by the state of Louisiana as 1,464 victims and more than 500 names have not been publicly released (Olson, 2). Efforts to tackle dozens of related cases of missing persons and unidentified bodies ran out of money in 2006 and have never been revived. In New Orleans, 31 unidentified victims' bodies were buried in a $1.5 million monument in 2008 (Olson, 2). Others, including John Mutter, a Columbia University professor, believe the true death toll from Hurricane Katrina is around 3,500. Professor

Mutter has been collecting public records of those killed by the storm. "Hundreds of other victims of the nation's most deadly modern natural disaster remain anonymous for unknown reasons. Many were elderly and poor. Around 64 percent of the storm victims were older than 65, based on a study by Louisiana State University pathologist who oversaw a massive temporary morgue in Baton Rouge that processed more than 900 cases from 2005-2006. Most came from New Orleans Parish" (Olson, 3).

Residents are moving back to New Orleans steadily everyday. According to Elizabeth Fussell, Associate Professor of Sociology at Washington State University, New Orleans population was between 100,000 and 160,000 in 2006. By mid 2008 that number increased to 311,853 according to the 2009 U.S. census bureau (Fussell, 21). The repopulation of New Orleans has been hard to analyze. The Displaced New Orleans Residents Survey (DNORS) is a survey of displaced New Orleans residents which is being fielded four years after Hurricane Katrina and will provide a better picture of return migration among displaced residents. (Fussell, 40). African American residents returned to New Orleans at a much slower rate than white residents. "We conclude that blacks tended to live in areas that experienced greater flooding and hence suffered more severe housing damage which, in turn, led to their delayed return to the city" (Fussell, 21).

Since Hurricane Katrina many lawsuits have been filed. For example, in 2008 fair housing groups charged Louisiana's Road Home program with discriminating against minority homeowners. "The grants were based not on replacements cost, but, on the pre-hurricane values of homes, which were on average less expensive than identical homes in wealthier neighborhoods" ("Fairer Treatment for Katrina's Victims" 1). A settlement was reached July 2011 $62 million in aid will be given to 1,400 homeowners whose homes were not livable ("Fairer Treatment for Katrina's Victims" 1). The federal government has to do

more to make sure residents, especially low income, receive their fare share of federal disaster aid money.

FEMA paid millions so victims could pay for essentials such as shelter, food and clothing. However, FEMA allowed thousands of improper and fraudulent payments. According to Michael Kunzelman, Journalist at the Associated Press in New Orleans, "FEMA employees awarded money without interviewing applicants or inspecting property and made errors that ranged from recording incorrect banking information to failing to check whether insurance had already covered damage, according to congressional testimony" (Kunzelman, 2). As a result FEMA is actually asking many residents that they provided aid money to give some of it back. There are hundreds that have been convicted of hurricane related fraud, Rachel Racusen; FEMA spokeswoman said many of the cases involved human errors by agency employees or the recipients themselves (Kunzelman, 2). FEMA's attempt to collect overpayments have stalled and many residents have filed class action lawsuits challenging having to pay the money back. The lawsuits argued that FEMA's debt collection efforts were full of errors, based on vague standards and without hearing that would ensure fair treatment (Kunzelman, 2). I think many residents that received aid money feel the same way one 75 year old New Orleans resident does. "They'll (FEMA) have to pry the money from my dead hands."

As recent as March 2012 a three judge panel of the United States of Appeals for the Fifth Circuit upheld a ruling that the Army corps of engineers is liable for property owners' claims. "The owners said that shoddy work on shipping channel caused billions of dollars in damage during Hurricane Katrina. The court ruled that the federal government is not

immune from lawsuits blaming flood damage on the corp's operation and maintenance of the New Orleans navigation channel" ("Louisiana: Army Corps Is Found Liable" 1).

Technological and Preparation Updates after Hurricane Katrina

Seven years after Hurricane Katrina they are still rebuilding trying to make their city better than it was before. Last year FEMA announced that they will continue those efforts. *Source*: All of the next details are a direct quote from journalist Rhonda Lee from Austin, Texas in her article Hurricane Katrina Rebuilding Will Continue into 2011.

Some of the improvements made since Hurricane Katrina includes:

- FEMA has obligated more than $16 million for 315 Hazard Mitigation Grant Program (HMGP) projects across the state.
- More than $138 million (includes hardening, 361 shelters, multi-purpose use shelters) was approved to protect approximately 33,613 residents and first responders-with more on the way.
- A total of $293 million has been allocated for HMGP in Mississippi. Communities throughout the state are more prepared then ever for future disasters as 284 jurisdictions now have MEMA/FEMA approved hazard mitigation plans –up from only seven approved plans before Katrina.
- More than 2.8 billion in National Flood Insurance Program claims has been paid to Mississippi policy holders since Katrina with 98.99 percent of claims closed out. Mississippians have learned the importance of flood insurance as the number of policies in the state has increased from 46,982 before the storm to the current level of 76,494.
- MEMA manages the Hazard Mitigation Grant Program in Mississippi; it identifies projects and oversees them from beginning to closeout.

Last year FEMA launched its first ever mobile website, making it easier to access critical information about what to do to prepare for a disaster. Disaster survivors can also apply from FEMA and other federal partners directly through their web enabled mobile devices ("Rebuilding Lives Revitalizing Communities Five Years after Katrina and Rita" 1). In 2008, FEMA established the National Emergency Family Register and Locator System

(NEFRLS) and National Emergency Child Locator Center to reunite families and children separated by the disaster. FEMA continues to improve its National Shelter System, a coordinated nationwide database of emergency shelter information on potential shelter resources. "The improved system includes an enhanced mapping function that allows state and local emergency mangers to see- in real time- shelter locations, critical infrastructure, and geospatial elements" ("Rebuilding Lives Revitalizing Communities Five Years after Katrina and Rita" 1).

Information Technology specialists still admit that they have made great progress with technology since Katrina but still have a long way to go. Ben Benjamin, journalist for *Federal Computer Week Magazine*, stated that one major program that the government is working on is the Integrated Public Alert and Warning System. "IPAAWS will send alerts via audio, video or text n multiple languages, including American Sign Language and Braille" (Bain, 2) IPAAWS is still a work in progress but it will be a step forward for disaster preparation. David Maxwell, Director of the Arkansas Department of Emergency Management, said that one of the biggest IT-related changes since Katrina is the growing use of social media. Evidence shows that social media is changing emergency response. "Many people now use Facebook and Twitter to report emergencies or call for help, and they can expect first responders to monitor those sites (Bain, 2).

It is disheartening to know that interoperable communication can be achieved but isn't because government and local officials do not want to take the time and spend the money to make it work. This thesis has shown that interoperability is possible if local community officials take the time and effort to research and plan the procedures. Brito points out the importance of collective action which refers to activities that, in order to be

successful, require two or more persons or entities to coordinate efforts (Brito, 462). There is a collective action problem with officials because it is important for them along with the government to work together to achieve a common goal which is interoperability. This system has the potential to make sure another Hurricane Katrina never happens again and if it does it will yield positive results in their rescue efforts like the California Fires and Midwest Floods.

BIBLIOGRAPHY

"*2008 Midwestern U.S. Floods*." National Climatic Data Center. July 2008 [Online] http://www.ncdc.noaa.gov/special-reports/2008-floods.html.

Achenbach, Joel. "*Iowa Flooding Could Be an Act of Man, Experts Say*." June 2008 Onlinehttp://faculty.ccc.edu/aberger/Iowa%20Flooding%20could%20Be%20An%20Act%20of%20Man_%20experts%20say.pdf.

Bain,Ben. "*Five Years after Katrina, Government IT Still Feels Storm's Fury*." Aug. 2010 [Online]http://fcw.com/Articles/2010/08/25/Web-Katrina-IT-Five-Year-Anniversary.aspx.

Bourne, Joel K. Jr. "*New Orleans: A Perilous Future*." Aug. 2007 [Online] http://ngm.nationalgeographic.com/2007/08/new-orleans-text.html.

Bowen, Debra. "*California Governor Schwarzenegger Takes Action to Bolster State's Firefighting Resources*." [Online] http://www.allamericanpatriots.com/48747176_california-governor-schwarzenegger-takes-action-bo.

Brito, Jerry. "Sending out S.O.S. Public Safety Communications Interoperability as a Collective Action Problem." *Federal Communication Law Journal* (June 2007) vol. 59: 462. Published by Indiana University School of Law and the Federal Communications Bar Association.

Brown, Michael D (February 2004). "*The California Fires Coordination Group*." [Online] http://www.fema.gov/pdf/library/draft_cfcg_report_0204.pdf.

Burns, Peter. "*The Failure of Non-regime How Katrina Exposed New Orleans as a Regime less City*." [Online] http://uar.sagepub.com/content/41/4/517.abstract. (Loyola University in New Orleans).

Dilmaghani, Raheleh B. & Roa, Ramesh R. "*Designing Communication Networks for Emergency Situations*." [Online] http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=04375882&tag=1.

Dyson, Michael. "*Come Hell or High Water: Hurricane Katrina and the Color of Disaster*." Published by Basics Civitas 2006: 120.

Elliott, James R. & Pais, Jeremy. "*Race, Class, and Hurricane Katrina: Social Differences in Human Responses to Disaster*." Apr. 2006 [Online] http://www.chssp.columbia.edu/events/documents/disasters_elliottandpais.pdf.

"Fairer Treatment for Katrina's Victims." *The New York Times* (July 11, 2011). [Online] http://www.nytimes.com/2011/07/12/opinion/12tue3.html?_r=1&ref=hurricanekatrina.

Fussell, Elizabeth. "*Race, Socioeconomic Status, and Return Migration to New Orleans after Hurricane Katrina*." Dec. 2009 [Online] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC28620061/.

Gertz, Emily. "*Cities, Floodplains and Climate Disruption*." June 2008 [Online] http://www.emilygertz.com/apartmentecology/2008/06/cities-floodplains-and-climate.html .

Griffis, F.H. "*Engineering Failures Exposed by Hurricane Katrina*." 2007 [Online] http://www.sciencedirect.com/science/article/pii/s0160791x07000097.

Harris, Chandler. "*Drone Enhances Firefighting Effectiveness*." Sept. 2008 [Online] http://www.digitalcommunities.com/articles/Drone-Enhances-firefighting-Effectiveness.html.

Heerden, Ivor and Bryan, Mike. "*The Storm: What Went Wrong and Why during Hurricane Katrina*." Published by Penguin Group Inc. copyright 2006: 35-37 & 79-80.

Hilberg, Steve. "*Midwest Heavy Rain and Flooding is Compared to 1993 Flood*." June 2008 [Online]http://mcc.sws.uiuc.edu/news/releases/2008/20080612_Midwest%20Heavy%20Rain%20and%20Flooding.pdf .

Keefe, Bob. "Stadium Like a Resort vs. Superdome." *New York Times* (June 2008*).* [Online] http://www.currentargus.com/ci_7272409.

Kersteins, Bob. "*California Fire Plan*." Mar. 1996 [Online] http://cdfdata.fire.ca.gov/pub/fireplan/fpupload/fpppdf32.pdf.

Klein, Julie. "*Excerpt for Mapping Interdisciplinary Studies: The Academy in Transition*." [Online] http://secure.aacu.org/PubExcerpts/Mapint.html.

Kunzelman, Michael. "*FEMA to Demand that Hurricane Katrina Victims Return Aid Money."* Mar. 2012 [Online] http://www.huffingtonpost.com/2011/06/01/fema-to-demand-that-hurri_n_869584.html.

Lee, Rhonda. "*Hurricane Katrina Rebuilding Will Continue into 2011*." Dec. 2010 [Online] http://blogs.kxan.com/2010/12/31/hurricane-katrina-rebuilding-will-continue-into-2011/.

"Louisiana: Army Corps Is Found Liable." *The New York Times* Mar. 3, 2012. [Online] http://www.nytimes.com/2012/03/03/us/louisiana-army-corps-is-found-liable.html?_r=.

Mayer, Matt A. and Weitz, Richard. "*The Local Role in Disaster Response: Lessons from Katrina and the California Wildfires*." The Backgrounder (June 2, 2008) No.2141 Published by the Heritage Foundation.

McKay, Jim. "Notification System a Lifesaver during Southern California Fires." Dec. 2007 [Online] http://www.govtech.com/pcio/218882.

Meeds, Heather. "*Communication Challenges during Incidents of National Significance: A Lesson from Hurricane Katrina*." March 2006 [Online] http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA448607.

"Midwest Deluge: Another 500-Year Flood?" *Geotimes* Aug. 2008. [Online] http://www.agiweb.org/geotimes/aug08/article.html?id=nn_deluge.html.

Opsahl, Andy. "*Orange County, California May Be Successful Model for Interoperable Communications Systems.*" Feb. 2009 [Online] http://www.govtech.com/public-safety/Orange-County-Calif-May-Be-Successful.html.

Paulson, Amanda. "*After this Flood, FEMA Earns Praise.*" July 2008 [Online] http://www.csmonitor.com/USA/2008/0702/p01s06-usgn.html.

Peha, Jon. "*Fundamental Reform in Public Safety communications Policy*." June 2007 [Online] http:www.law.indiana.edu/fclj/pubs/v59/no3/9-peha.pdf.

Piazza, Tom. "*Why New Orleans Matters*." Harper Collins Publishers Inc. (2005): 66.

Olson, Karen. "*5 Years after Katrina, Storm's Death Toll Remains a Mystery*." Aug. 2010 [Online] http://www.chron.com/news/nation-world/article/5-years-after-Katrina-storm-s-death-toll-remains-1589464.php.

"*Rebuilding Lives Revitalizing Communities Five Years after Katrina and Rita.*" FEMA Website (2010). [Online] http://www.fema.gov/media/2010/rebuilding-lives/movingforward.shtm.

Roberts, Patrick. "*FEMA after Katrina.*" June 2006 [Online] http://www.hoover.org/publications/policy-review/article/7897.

Sliger, Rick. "*Missouri Catastrophic Emergency System Operational*." Nov. 2008 [Online] http://www.govtech.com/public-safety/99359804.html.

Sommers, Samuel. "Race and Media Coverage of Hurricane Katrina: Analysis, Implications, and Future Research Questions." *Analyses of Social Issues and Public Policy*, volume 6, No. 1, 2006: 40-41 & 46,48.

Squires, Gregory D. "There is No Such Thing as a Natural Disaster: Race, Class, and Hurricane Katrina Social Forces." *Muse Journal* Mar. 2008 Volume 86, Number 3. [Online] http://muse.jhu.edu/journals/social_forces/v086/86.3.rodriguez.pdf

Travis, John. "*Hurricane Katrina: Scientists' Fears Come True as Hurricane Floods New Orleans.*" Sept. 2005 [Online] http://www.sciencecases.org/hurricane/hurricane4.asap

Wang, James. "*Did Humans Cause the Midwest Flooding?*" 2008 [Online] http://blogs.edf.org/climate411/2008/06/19/midwest_floods/.

Weiss, Todd ."*As California Wildfires Rage, Technology Used to Track Blazes.*" Oct. 2007 [Online] http://www.computerworld.com/s/article/ 9043765/As _Calif._ wildfires_rage_technology.

ABSTRACT

COMMUNICATION TECHNOLOGY IN DISASTER MANAGEMENT

by

DENISE WALKER

August 2012

Advisor: Dr. Julie Klein

Major: Interdisciplinary Studies

Degree: Master of Interdisciplinary Studies

This thesis will analyze different case studies involving catastrophic disasters. I will compare their rescue response from the government to FEMA's response to Katrina, to establish a basis for comparison. The Midwest Floods and California fires will be compared to Hurricane Katrina in New Orleans because these places are prone to natural disasters. I will look at each of these states ecology to explain why these states are prone to floods, fires and hurricanes. Unlike the Midwest and California, Hurricane Katrina received far less help from the government and FEMA. I will explore the reasons why this unfair practice took place and propose solutions to make sure this will not happen again.

Chapter one focuses on defining what is interdisciplinary studies and discusses how it can be used to solve complex problems. I will discuss New Orleans background and give an overview of hurricane Katrina. I will examine the importance of the wetlands and show why New Orleans has always been prone to floods since it was founded. Chapter two will explore California's landscape and why this region constantly has wildfires. Yet, despite this they have a good track record for successfully fighting the fires due to technology, a sound

disaster plan and excellent leadership. Chapter three covers the 2008 Midwest floods and the different states involved. Due to torrential rainfall the world feared they were witnessing another Hurricane Katrina. However, thankfully our fears did not materialize due to the fast response from the government and FEMA. The purpose of this chapter is to study the Midwest to determine why floods are so prominent in these areas. I will also compare Hurricane Katrina rescue efforts to the Midwest floods.

Chapter four will show how the role of race, class and ethnicity played a role in the disaster relief efforts for Hurricane Katrina, California fires and the Midwest floods. I intend to show that low-income individuals, minorities, women, the elderly and other disenfranchised groups are disproportionately affected by disasters, as Hurricane Katrina demonstrated. Chapter five is the final chapter and it will explore technological solutions that need to be in place in every state to avoid another disaster like Hurricane Katrina. Hurricane Katrina suffered not only from technological breakdowns but direct communication failures that could have been avoided. These failures were the main culprit for hindering relief efforts. Information technology is important to employ successful rescue efforts but strong leadership and communication skills are crucial to make sure the technology is implemented correctly.

AUTOBIOGRAPHICAL STATEMENT

Denise Walker was born in Detroit, Michigan November 16, 1974. Both of my parents are from Virginia and I am the only child. I was fortunate enough to experience city and country life by frequent visits to my grandfather's small farm in Virginia. After graduating from Mumford High School I attended Wayne State University. I received my bachelor's degree from the School of Business in Management Information Systems and a minor in Psychology. During college I had the opportunity to work for the Interdisciplinary Studies Program. I started out as a work-study student but was able to gain a full-time position as the Program Records Clerk. The Interdisciplinary Studies Program was not only a job but a second family that helped me grow personally and professionally. Unfortunately the IS program was discontinued and I was moved to the Communication Sciences & Disorders Department. This is a wonderful department that provides speech services to stroke survivors and people with speech problems. Receiving my master's degree from Interdisciplinary Studies is a lifelong dream that I am thankful to be able to fulfill. I am looking forward to move on with the next chapter of my life.