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Disasters Are Not, They Become: An Understanding of Social Vulnerability in the United States Gulf Coast with Respect to Hurricanes

Katherine Franklin
Scripps College

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by
Katherine Franklin

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Professor Melinda Herrold-Menzies

Professor Branwen Williams

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Abstract:

Scientific literature is concerned with the impact that climate change will have on natural disasters in the near future. These events disrupt our daily lives and can cause damage that may never be repaired. Merging science and social science, the study of vulnerability looks at how human systems will be impacted by these natural disasters. In the United States, hurricanes in the Gulf Coast are projected to increase in intensity as well as have an increased capacity for damage with a rise in sea level. Therefore, it is important to understand who is systematically vulnerable to these impacts of natural disasters and how we can mitigate this damage.

Through this thesis, I argue that these impacts of hurricanes will put already vulnerable populations at a greater risk for damage caused by these events in the future. I will briefly outline the scientific basis on which the claims of increased hurricane activity are founded, as well as outline concepts of vulnerability. I examine case studies of Hurricanes Andrew and Katrina, both of which can inform how social disparities delineate vulnerability in the United States. Based upon this historical understanding that recovery from a storm is highly contingent upon social and economic resources available to an individual or community, I argue that vulnerable communities must be highlighted. I then project vulnerability based upon demographic characteristics of communities within the Gulf Coast in order to highlight these areas of necessary attention.

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INTRODUCTION

Natural disasters are almost always events that receive an overwhelming amount of media attention, and then fade in urgency from public memory within months of the event. Disasters have commonly been recognized as a disruption and extreme experience that has no place in daily life. As a result, disasters are seen as something that must be weathered and overcome for an attempt to return to a previous state of normalcy. What is left out of view to those not directly affected, is the stress residents endure as they must seek information about their safety, and hope that the government has adequately prepared to help them with the aftermath. They can then be burdened with months or years of recovery as they wade through bureaucratic red tape and hope for assistance, or more likely have to rebuild their lives and start from scratch. This reality refers largely to individuals without social or economic capital to make the problem go away quickly, those who are already vulnerable- based on social inequalities of race, class, gender, and age among other social determinants.

Within the United States, hurricanes regularly threaten the lives and livelihoods of many people living on the US Gulf Coast and Atlantic Coast. I have chosen to focus on the US Gulf Coast because of the increasing effects hurricanes will have on already vulnerable populations due to climate change. Hurricane activity has been linked to climate change as projected storm models indicate an increase in the number of high intensity storms in the future. In addition to this prediction, the tangible impacts of climate change can be observed in sea level rise, which will cause more damage to human settlement in any magnitude of future storm (Bender et al., 2010).

Through my research I explore how vulnerable populations are unequally burdened with preparation and recovery efforts beyond their means of resilience. Barriers experienced by vulnerable populations at every stage of recovery are imbalanced and often lead to lag-time of low-income and minority communities in rebuilding from storms. I begin by examining Hurricanes Andrew (1992) and Katrina (2005), which had various impacts on human populations due to location, intensity, preparedness, and support among other influencing factors. These case studies will help to inform our understanding of the struggles that vulnerable populations face and why this critical issue should be addressed. I then identify vulnerable populations to future storms to demonstrate that vulnerable populations will be at an increased risk with projected changes in hurricane activity.

I argue that these impacts of hurricanes will put already vulnerable populations at a greater risk for damage caused by these events in the future. Based upon this historical understanding that recovery from a storm is highly contingent upon social and economic resources available to an individual or community, I argue that vulnerable communities must be highlighted. I then project vulnerability based upon demographic characteristics of communities within the Gulf Coast in order to highlight these areas of necessary attention. It is imperative that we spark a discussion that illuminates this issue facing vulnerable populations so that we can move forward to assist these populations before they see these projected effects.

CHAPTER 1: LITERATURE REVIEW

Disasters: The Dominant Paradigm

Until recently, scholars accepted a view of disasters as simply a battle between man and nature. As such, disaster studies belonged to a more scientific field of understanding Earth's systems. Since they have been seen as being a simple problem, the field focused intently on the idea that technological fixes were the right solution (Mileti, 1999). This paradigm allows us to point the blame at the disaster and wash our hands of social structure that created risk for the poor (Dyson, 2006). In the 1970s, joint research between sociologists and scientists began to emerge which set the stage for contextualizing disasters from a social standpoint (Mileti, 1999; Scandlyn, Thomas, & Brett, 2013).

Now, we understand that disasters are not just random events, but rather the impact of a natural event on a dynamic human population. Human adjustment to disaster takes place in four steps: preparedness, response, recovery, and mitigation (Mileti, 1999). In this respect, scholars are beginning to view disasters as a distinct event that exemplifies the purest form of pre-existing social conditions in an area. With the changed conceptualization of disasters, the study of vulnerability has emerged in the past few decades (Wisner, Blaikie, Cannon, & Davis, 2004).

Intersecting Risk and Hazard

Disasters happen at the intersection of risk and hazard, that is social vulnerability and event. One model that explains vulnerability in relation to recovery is called the Pressure and Release Model. In this model Pressure is the underlying social vulnerability, deeply rooted in social processes and Release is the disaster itself. The Release of a disaster works to actually release pent up social pressures. The pressure can also be released through a reduction of

vulnerability, which is a difficult process because it requires addressing big societal issues of racism and poverty (Wisner et al., 2004). This can also help to explain recovery patterns of vulnerability as components of inequality are essentially unpacked through their release in disaster.

Social Vulnerability

In order to understand exactly what makes a person more likely to face negative effects of a certain hazards, it is important to know how scholars measure vulnerability and its effects. The type of vulnerability discussed for the purposes of this paper is called *social vulnerability.* At its most basic level, vulnerability is the potential for harm or loss and examines circumstances that work to place individuals and localities at risk (Cutter, Burton, & Emrich, 2010). On an individual level, social vulnerability is a measure of a person's ability, or lack thereof, to cope with and recover from external stress placed on their livelihood(Cutter, Boruff, & Shirley, 2003; Cutter et al., 2010). On a community level, it can refer to broader existing infrastructure and how it is aggravated by outside forces (Adger & Kelly, 1999). It is a measure that is deeply rooted in the historical context that informs social structures of a population, and therefore can be a highly localized phenomenon (Bolin, 2007; Cutter & Finch, 2008; Fordham, Lovecamp, Thomas, & Phillips, 2013; Scandlyn et al., 2013). As the name suggests, social vulnerability is a highly social idea, derived from inequalities in the framework of society along lines of race, ethnicity and class in addition to gender, age, disability status, and many more identifiers of an individual. It does not stem from the misunderstanding of risk, but "is the failure of society to recognize that a condition, such as poverty, means you cannot necessarily mitigate risk, live in a safer location, or afford to evacuate when told to do so" (Fordham et al., 2013, p. 12). Thus,

many individuals and communities are socially vulnerable as a result of structural inequalities that disfavor minorities and those of lower socioeconomic status as well as other ascribed and attained characteristics. Social vulnerability exists within society at all points in time, and must be acknowledged by government and aid communities prior to onset of a disaster. Although it exists at all points in time, it is also important to remember that it is a spatially and temporally dynamic process (Mileti, 1999; Wisner et al., 2004). It is important to note that social vulnerability is largely tied to lack of resources- both economic and social- and as such, people usually understand their position but cannot act on pre-existing knowledge to prepare for disaster (Scandlyn et al., 2013).

Social vulnerability can be broadly broken down into four categories: socioeconomic status, race, age, and gender (Cutter et al., 2003; Wisner et al., 2004). These components of an individual's life can be measured through proxy data in order to indicate correlation to risk. Proxy data can be measured through census data, for example socioeconomic status can be measured by annual income, educational attainment, renter status, number of individuals in household, etcetera. These categories are not necessarily in place to separate components of vulnerability, but rather to inform how we are able to measure this risk. They interact with each other to provide a holistic understanding of vulnerability(Wisner et al., 2004).

Social vulnerability is related to a person's capital and access to capital in order to prepare for, stay safe during, and recover from disasters and can therefore be measured through class. While it is true that the rich have more financial damage to property in the face of disaster, it is important to note that in terms of relative wealth the poor come out behind (Scandlyn et al., 2013; Wisner et al., 2004). This puts people at greater risk in face of a disaster

as poor quality housing is heavily damaged, and in its aftermath as they receive limited amounts of money to rebuild (R. Bullard & Wright, 2009b; McCoy & Dash, 2013; Mileti, 1999; Scandlyn et al., 2013). Loans available to the low-income are often unrealistic to repay, reinforcing existing social power structures or domination (Wisner et al., 2004). In addition to having more household income and assets to draw from, high-income households are also more likely to receive both private and federal assistance in the face of disaster, reducing their future vulnerability to similar events (Peacock & Ragsdale, 1997; Wisner et al., 2004). In the United States, there is large income stratification, leaving many with low income in powerless positions. In disasters, wealth directly relates to ability to cope and recover because wealth denotes a certain level of power. This system of wealth and power distribution is in place before a disaster strikes and affects all stages of the hazard(Wisner et al., 2004). This power comes in the form of available credit, monetary assets, flexibility in evacuation and returning, and large social networks (McCoy & Dash, 2013).

Class plays a large role in vulnerability because it measures people's personal ability as well as resources available to them to cope with disaster (McCoy & Dash, 2013). Social vulnerability from the community perspective can also be related to class, although there is no direct link between socioeconomic status the presence of wealth can help a community. Wealth denotes a larger tax base, and thus more money available to a community but more importantly it denotes political power. Communities that tend to be better organized, with elected officials representing the interests of their constituents are able to use this power to gain resources in a disaster setting.

Race and ethnicity are another aspect of vulnerability because they come with an ascribed status in US society. Social conditions that ascribe a hierarchy tend to marginalize minorities in many respects, including barriers from attaining certain status of class and wealth. Minority individuals tend to have a lower income, and face more discrimination limiting their ability to attain resources (Morrow, 1997a). It is for this reason that vulnerable communities are largely minority status(Dash, 2013). In the face of disaster, these variables, such as socioeconomic status and racial inequality take on added significance proliferating vulnerability and its effects (Mileti, 1999; Peacock & Ragsdale, 1997).

Vulnerability also means that it is hardest to reconstruct livelihoods after disaster. Those who prove to be of marginally importance to decision makers are those who are already economically and environmentally marginal. This affects distribution of resources and the perceived ability of vulnerable populations to affect themselves (Wisner et al., 2004). Thus, vulnerability can explain barriers in stages from preparation for a disaster all the way through recovery.

Resilience

Resilience is a term that is often discussed in this body of literature. While it is not the primary focus of this paper, it is an important term to define because of it is often used as a measuring tool for preparedness and recovery. A standard understanding of resilience is related to ability to withstand disaster, which is how mitigation attempts and government agencies tend to utilize it (Cutter et al., 2010). In a more holistic understanding, it refers to the ability of an individual or community to prepare for and successfully rebuild after a natural disaster (Jenkins, 2013; Scandlyn et al., 2013). The slight difference in these two definitions is a result of

a focus, or lack thereof, on the understanding of the social context in which preparation, disasters themselves, and recovery occur. Resilience is an important measure for social vulnerability because it allows us to analyze the aftermath of a disaster (Cutter et al., 2013, 2010; J. Liu, 2010; Posey, 2009; Tobin, 1999). It can provide the climate for economic opportunity, community strengthening, and increasing communication after a disaster, which in turn assists in preparation for future events. This analysis allows for an hopeful outlook on recovery, allowing an area to find success in the aftermath of an event(Cutter et al., 2010; Jenkins, 2013; J. Liu, 2010; Squires & Hartman, 2006). Optimistically speaking on resilience Liu asserts, "if a place norm is undesirable, disaster can create opportunity for a different future" (A. Liu, Anglin, Mizelle, & Plyer, 2011, p. 24).

Measuring Vulnerability in the United States

One of the most prominent scholars in this field, Cutter, developed an index called the Social Vulnerability Index (SoVI), which utilizes a statistical method to analyze vulnerability, by coding relevant demographic to map social vulnerability within the United States (Cutter et al., 2003). Through this mapping tool, it is relatively easy to visualize relative vulnerability of populations across the country, and the tool has been utilized in analysis by many authors since its development (Cutter et al., 2013; Schmidtlein, Deutsch, Piegorsch, & Cutter, 2008).

The SoVI was utilized to complete a temporal-spatial analysis of vulnerability and determine that within the United States, there has been a large change in variability of vulnerable populations (Cutter & Finch, 2008). More specifically, the analysis indicates that between 1960 and 2000 there has been a shift from extreme to smaller concentrations of vulnerable populations over time, which informs our efforts at disaster mitigation to emphasize

the importance of place-based modeling of disaster analysis. They observed that counties with dramatic change in vulnerability are often due to extreme influx or exodus of populations, indicating that the demographic makeup of community is indeed strongly correlated to vulnerability. Components of this analysis can be utilized to confirm social-based theories of vulnerability including her conclusions that areas of high vulnerability are associated with urban development, low socioeconomic status and race. In stark contrast, areas with low vulnerability are majority white, and young population (Cutter & Finch, 2008).

Logan and Xu completed a similar temporal analysis of vulnerability in 2015 with a more specific focus on hurricanes in the Gulf Coast. They determined that risk to hurricane damage has changed in this region temporally because certain groups are able to minimize their damage by making themselves indifferent to it. Indifference can be accomplished by moving out of dangerous areas, or building up social capital so that insurance and money are available for rebuilding efforts. This theory of indifference is corroborated by other scholars, that there is an element of choice associated with wealth and desirable location which is part of the opportunity of some to "self-protect" from damage (V. K. Smith, Carbone, Pope, Hallstrom, & Darden, 2006; Wisner et al., 2004). These patterns showed a clear distinction between blacks and whites, as vulnerability of blacks increased from 1950 to 2000 and then dramatically decreased between 2000 and 2010. This indicates the effects of massive storms Katrina and Rita in this region led to a change in population distribution rather than direct vulnerability (Logan & Xu, 2015). This analysis of vulnerability composition is an important piece of literature that has captured temporal dynamics of vulnerability within the United States.

Due to the intersection of physical and social environments that create impacts of disasters, it is important to understand these underlying social factors related to an individual's ability to address the stress of a natural event. Therefore, it is important that we understand not only how it is conceptualized, but also how it is measured by scholars. With this contextual understanding of vulnerability, we can examine impacts of specific natural events and draw connections between vulnerability and these impacts. While vulnerability is important to understand from a theoretical standpoint, it is often difficult to see how it will affect a given community without a retrospective analysis of a specific event (Mileti, 1999). I will utilize this framework of social vulnerability to understand impacts of Hurricanes Andrew and Katrina in the Gulf Coast, as well as to project future vulnerabilities.

Chapter 2: Scientific Background

Hurricanes affect the United States in the Gulf of Mexico, which touches the states of Texas, Mississippi, Alabama, Louisiana, and Florida. They cause great damage to coastal settlements as well as areas of wind damage where the storm makes landfall. Within the dynamics of global climate change, hurricanes are projected to see shifting patterns and thus their impacts on human settlement will also change in decades to come. In addition to changing patterns of hurricanes, a global sea level rise will lead to greater impacts of storms on coastal communities. Although the science of climate change, in particular with respect to hurricanes, is an ongoing process it is important to highlight how and where these changes are occurring if we are to address the risk that human society poses based upon coastal settlement patterns.

Hurricanes

Hurricanes are one regional name for what is broadly called cyclonic storms in the scientific community, and the two may be used interchangeably for the purposes of this paper(Webster, Holland, Curry, & Chang, 2005). Hurricane impacts generally take two forms, wind speed and storm surge both of which have varying degrees of impact on human communities. Hurricanes are measured on the Saffir-Simpson Scale, which is where the Category 1-5 rating system that most people are familiar with comes from. This scale measures wind speed of hurricanes, with those placed in category three to five being considered dangerous to human settlements(National Hurricane Center, n.d.-a). Storm surge is the rise of water generated by a storm that is not associated with normal tidal processes. It is produced by wind activity of a hurricane pushing onto the water, and usually results in extreme flooding in coastal areas(National Hurricane Center, n.d.-b; National Hurricane Center, Storm Surge Unit,

n.d.). Many of the most devastating storms have large surges, as the pure weight of the water causes extreme damage to property and human life(National Hurricane Center, n.d.-b). Due to the fact that storm surge occurs at landfall, it is harder to predict and track than wind speed. The effects of storm surge can be great regardless of the category of the storm, for example Hurricane Katrina was a category three storm at landfall, but storm surge was close to twenty-eight feet which was responsible for the flooding of the city(National Hurricane Center, Storm Surge Unit, n.d.). Information on storm surge is reported in units of feet, for the United States at least, and prediction measures for storm surge are not as accurate as wind speed measures at present(National Hurricane Center, n.d.-c). Within the United States, storm surge is an important factor of damage done by a hurricane as most of the Gulf Coast lies less than ten feet above mean sea level(National Hurricane Center, n.d.-b). Hurricane damage can be very great on the coast because of storm surge, and inland as a result of wind shearing, making them one of the costliest natural disasters. Because the majority of human populations, and their infrastructure are present near the coastline, hurricanes are an important phenomenon to understand and predict.

Changes to Hurricane Patterns

One of the many changes to our planet as a result of climate change will be hurricane activity(Emanuel, 2008; Emanuel, Sundararajan, & Williams, 2008; Geophysical Fluid Dynamics Laboratory/NOAA, 2015). Because it is a process generated in the atmosphere and ocean, cyclonic events are bound to see changes in their patterns as a result of the multitude of the ways effects of climate change exist. It is important to understand that projections of changes to hurricane activity are highly contingent upon very complicated climate modeling, and as such

it is difficult to say with certainty what these effects will be. The International Panel on Climate Change (IPCC) believes with medium confidence that models of extreme events are strong (Flato et al. 2013). In their 2013 Report, the IPCC stated definitively that North Atlantic tropical cyclones are more likely than not to see an increase in occurrence of the strongest storms (Christensen et al. 2013).

Some of the uncertainty in these modeling projections comes from the dynamic nature of Earth's systems(Emanuel, 2008; Webster et al., 2005). For example, sea surface temperature is related to the formation of storms, and there is a potential that maximum intensity of storm events is dictated by sea surface temperature. Other debates on compounding factors revolve around the concertation of carbon dioxide and hurricane activity remain heated(Webster et al., 2005). There is also little historical data regarding hurricanes, with technology pre-1970s being unreliable to detect more than storm count, and few events occurring per year making it difficult to complete statistical analysis(Emanuel, 2008; Lin, Lane, Emanuel, Sullivan, & Donnelly, 2014; Mann & Emanuel, 2006; Walsh et al., 2014). Changes to tropical cyclone patterns are also likely to vary by region (Christensen et al. 2013). It is partially because of this regional variation that the scientific community remains hesitant to definitively conclude patterns of hurricane activity.

When looking at the United States Gulf Coast, or for hurricane activity the Atlantic Ocean, we can see an increase in sea surface temperature that is positively correlated to regional hurricane activity. This increase in sea surface temperature is one reason why projections over the Atlantic Ocean see an increase in hurricane intensity(Elsner, Kossin, & Jagger, 2008; Mann & Emanuel, 2006; Vecchi, Swanson, & Soden, 2008). In their analysis, Mann

and Emanuel conclude that this increase in sea surface temperature, as an underlying cause of changes to storm patterns, is unrelated to forces of ocean oscillation, indicating that this change is unrelated to larger oceanic processes, and therefore is likely a new trend related to climate change(Mann & Emanuel, 2006). The connection between sea surface temperature and hurricanes is very important in understanding climate change projections related to hurricane activity. There has also been a statistically significant increase in observed number of events in the North Atlantic in the past thirty years, which can corroborate some results of modeling as apparent recent trends emerge(Dwyer et al., 2015; Walsh et al., 2014; Webster et al., 2005).

Results of modeling programs tend to indicate a decrease in frequency, number of storm occurrences, and an increase in intensity of storms(Bender et al., 2010; Emanuel, 2008; Emanuel et al., 2008; Knutson et al., 2015; Walsh et al., 2014; Webster et al., 2005). The number of category four and five storms almost doubled within this observation window of thirty years, which falls in line with these modeled projections(Webster et al., 2005). These results are cause for concern as coastal communities are rarely equipped to handle the storms of such a high intensity, and effects to human systems will likely increase with these intense storms. Any changes in hurricane activity as a result of global climate change will be problematic for natural ecosystems and human settlements alike as shocks to the system will have unknown consequences.

Sea Level Rise

The IPCC 2013 report identified sea level rise as being of integral importance to understand in respect to climate change, with estimates of being “very likely” that rate of global mean sea level rise in the twenty-first century exceeding observed sea level rise in past

decades. Rates of almost 2 mm per year were observed during the twentieth century, and will continue to increase. This increase is largely related to melting of ice sheets which is accelerating with greenhouse gas concentrations in the atmosphere and will likely continue even if greenhouse gas concentrations are stabilized (Church et al 2013).

In one study, Neumann and his co-authors argue that it is important to consider combined effect of sea level rise and storm surge in analyzing risk as they generated modeling of effects of storm surge given these new parameters. They found that there will be a dramatic increase in economic costs with storms if mitigation and adaptation measures are not taken to reduce risk of coastal communities(Neumann et al., 2014). For example, the government of Florida is concerned about sea level rise because eighty percent of their economy is coastal, and three-quarters of their population live in coastal cities (Florida Oceans and Coastal Council, 2010). The state's concern, which resounds throughout human settlements, is that the infrastructure in coastal communities is practically fixed. The risk of surge was actually measured for a portion of the Florida Gulf Coast, and found that the area is extremely susceptible to storm surge and higher magnitude storms will result in greater surge impacts(Lin et al., 2014).

Summary

While climate change modeling and the scientific community are unable to give a definitive answer on changes to hurricane activity, these projections in themselves indicate a need for action to address environmental changes associated with these storms. The definitive increasing patterns of sea level rise are an important component of hurricane activity as storm surge itself will be greater in hurricanes. This indicates that regardless of changes to frequency

or intensity of hurricanes, coastal communities will face greater impacts of storms as more water inundates their communities when hurricanes hit. These damages will interact with patterns of vulnerability, both social and locational, in future storm events. It is therefore important to understand both social and climate components of the picture to mitigate and respond to natural disasters in the future.

Chapter 3: Hurricane Andrew

Hurricane Andrew is important to understand from a vulnerability standpoint because of the location of its landfall. The storm's path devastated poorly constructed housing units, and led to delayed recovery of certain community members. It was one of the hardest hitting and most expensive storms in the history of the United States, doing almost $25 billion in damages (Mileti, 1999). The coastal population of the United States had been increasing by nearly 50% every decade. This increase can, in part, explain how difficult the recovery process was for survivors of Andrew (Wisner et al., 2004). The hurricane made landfall on August 24, 1992. Residents were given little warning as it was upgraded from tropical storm to category 5 hurricane within a period of two days (Morrow, 1997a). It struck a largely unincorporated area next to Miami, in Dade County as well as a portion of South Florida. The impacts of the storm surge were greater in South Dade, with a survey reporting that 90% of housing units were damaged compared to North Dade, which saw around 50% of units damaged(S. K. Smith & McCarty, 1996). The area of Dade County was ethnically and racially diverse, with a large Hispanic population, including a notably strong Cuban community, as well as many Blacks, both African-American and Caribbean blacks. The unique ethnic and racial makeup of areas affected by the storm affords us the opportunity to review components of resource availability and the effect that political and social capital play on its distribution.

Climate of Race Relations prior to Andrew

Prior to the storm, the greater Miami area was known as a city of contrasts and extremes with a large proportion of foreign-born and first generation residents. The city was

originally founded by whites, locally known as Anglos, in the 1880s. The city remained highly Anglo until the Great Depression when its residents could no longer afford to be elite, the upper class residents were forced to allow the middle-class into their social clubs and neighborhoods. This led to the development of Miami as a popular tourist destination, when blacks began to congregate as employees in the service sector. As time passed, there was migration of lower-class Anglos away from the city, resulting in a largely upper class Anglo population of the area. These were businessmen and entrepreneurs, and were therefore able to maintain a degree of political power despite their relatively small proportion of the total population(Greiner & Morrow, 1997). Estimates from the 1990 census indicate that Anglos made up 30% of the Dade County population prior to Andrew(Morrow, 1997a).

Post World War II, an increase in Cuban residents occurred, with many seeking refuge from the Cuban Revolution and by 1980 half of all Cuban Americans lived in Dade County(Greiner & Morrow, 1997). The Hispanic population of Dade County made up half of the total Dade County population in 1990, most of whom were Cuban(Morrow, 1997a). The majority of the Cuban community were members of small family-owned businesses, which looked out for their own. The Hispanic community attained a strong economic and political presence within Dade County which allowed them to demand attention for their community(Greiner & Morrow, 1997). As a whole, the Hispanic community in the Miami area was more concentrated prior to the storm, which benefited them in many was both before and after the storm.

Blacks in the Miami-Dade area were less concentrated, but saw some patterns of segregation as many were concentrated in neighborhoods with older homes that were often

run down(Morrow, 1997a). The Black community made up 20% of the total Dade county population, but was divided between Caribbean and African-American, making it harder for them to act collectively as a cohesive group, so many of their interests were not systematically protected by local governments(Greiner & Morrow, 1997; Morrow, 1997a). The Dade County area affected by Hurricane Andrew had a mixed ethnic and racial background, contributing to a unique gradient of social vulnerability among minority citizens(Greiner & Morrow, 1997). While minority status is generally accepted as positively correlated with vulnerability, the capital that the Hispanic community of Dade County had attained before Hurricane Andrew allowed them to protect their interests at the expense of the Black community. There was a longstanding history of competition for resources between these two minority communities, and impacts of Andrew only served to perpetuate this competition.

Preparation

Because the storm increased in intensity rather quickly, individuals had little time to prepare appropriately. In many cases, the costs of properly closing up one's home and evacuating caused people to stay home and to wait out the storm. Emergency managers and government officials believed that televised hurricane warnings provided enough information to properly prepare for the storm and advise residents of proper courses of action (Gladwin & Peacock, 1997). Many prepared for the storm by fulfilling basic needs, with a survey by Gladwin and Peacock indicating that over 90% of the sample population had lighting(flashlights, candles, etc), water, and radios and non-perishable foods(Gladwin & Peacock, 1997). Beyond acquiring basic supplies, the decision to evacuate is of fundamental importance to individuals in coping with a storm. Patterns of evacuation indicate that families with young children, social networks

urging them to leave, and high incomes tended to leave while ethnic minorities were less likely to evacuate. In fact, due to a myriad of factors, Blacks were measured as being two-thirds less likely to evacuate than Anglos (Gladwin & Peacock, 1997). While preparation for and response to storm warnings is important to the protection of human life, there are many social factors that can inform a person's decision to leave that fall outside logical processes. Access to resources and personal experience tend to have a large impact upon a person's decision to act upon storm warnings and may inhibit recovery processes.

The Storm

Andrew made landfall in an area that was nearly fifty percent minority community, with South Dade being hardest hit. Blacks suffered more damage than Anglos or Hispanics as they tended to be concentrated in older communities (Morrow, 1997a). Government response to the storm was problematic because of the bureaucratic system in which decisions were being made, or not being made. Most elected government officials whose job scope included emergency management had never been called to act upon those duties, and the novice of many leaders concurrently did little to help the situation. These leaders represented small communities, which led them to be acting in the self-interest of their communities(Averch & Dluhy, 1997). While government plans relied upon cooperation of leaders to make collective decisions, there were no actual plans in place to delineate how cooperation should take place. The reality of the stressful environment of the emergency command center, along with inexperience of leaders led to the failure of the initial disaster response. According to Averch and Dluhy, this resource distribution was highly related to political power, officials turned to a barter system in which some leaders could better act in the interest of their constituency.

Those with greater political power and capital representatives of the affluent or Anglo communities as well as the stronger minorities. For example, the largely Anglo city of Homestead hired a media relations team for a fee of $75,000 out of city budget which paid off in the amount of aid they received as a result of their publicity(Averch & Dluhy, 1997). As a result of this government failure to properly respond to the storm, certain areas of the affected county received more resources than others. In this case, those whose interests were protected were the more affluent and the Anglos while minority and low-income communities received inadequate resources.

Scholars who study disasters and recovery efforts agree that the quicker a community is able to respond and begin to rebuild, the less time it takes to recover, so groups that were already less vulnerable were on the fast track to recovery while vulnerable groups were not protected. The system of non-cooperation created within the local government through direct response to the storm also created a poor tone for recovery efforts (Averch & Dluhy, 1997). Dade County was unequipped to handle a disaster of this magnitude, and the efforts of government leaders to respond to the storm highlight the lack of attention paid to low-income and minority communities by local government.

Recovery

Recovery efforts usually begin immediately after a storm and can encompass everything from first response to long term revitalization projects. In recovering from a disaster, people tend to rely on personal resources, informal kinship, and government resources in that order (Morrow, 1997b). In Dade County, over 160,000 people were left homeless immediately

following the storm and 86,000 jobs were lost(Mileti, 1999). Citizens faced a struggle to return home, find jobs, and resume normal functions with varying degrees of difficulty.

Returning "Home": Tent Cities

Returning home for most residents was a long process, but most difficult for low income and people of color. Of the 130,000 households made homeless by Hurricane Andrew, three quarters of households were families and half of these families were minority status(mostly Hispanic and Black). This means that around 50,000 minority families were displaced and made homeless as a result of the storm (Morrow, 1997b).

As a direct response to this homeless crisis, the federal government set up a handful of "tent cities" which were campgrounds set up on public lands and run by the military. These campgrounds were military issue tents set up on wooden platforms, hosting cots for about twenty residents each. Showers and toilets were placed far away from living quarters, and were a communal affair. Meals were served by the military, and the bulk of a resident's day was spent waiting in line for facilities, food, or aid. These encampments were not exactly a pleasant place to live, as there was no privacy, no escape from the heat, and little freedom afforded to residents(Yelvington, 1997). As predicted by disaster literature, existing social inequalities between races also escalated in this time period as many were forced to compete for limited resources. Within the tent cities, Anglos and Blacks believed that Hispanic political power led them to an imbalance in treatment(Yelvington, 1997).

Initially, the camps were underutilized, but in the aftermath of the storm officials began to condemn many homes that remained occupied by owners or residents. In a survey conducted by Morrow and her colleagues, around 20% of Dade County respondents reported that they were forced to move out of their homes. As a result, the tent cities soon became

overrun with low-income and minority groups who had no other resources to turn to. Almost forty percent of Tent City dwellers had family who were also living in these camps, indicating a level of the resource network available to the average resident (Morrow, 1997b). In addition, the city hosted a large proportion of undocumented workers, and other minorities who were conditioned to mistrust the government and needed assurance their needs would be met. With no one to turn to but the government, tent cities became the only viable housing option for low-income and minority individuals as they did not have social or economic capital for other options.

Many people were forced to leave home and recovery efforts to move into tent cities a month after the storm because they believed they would be preferentially treated for FEMA assistance. While this was not intended to be true, FEMA began allocating relief trailers to tent city dwellers in an attempt to close the temporary shelters. FEMA gradually accepted more responsibility for these dwellings, taking over admissions and other basic functions from volunteers. FEMA began to tighten the reigns on residents, noticeably so with admission to the camp, they began to restrict admission by requiring documented proof of residence and identification. These procedures worked to keep out those in need of services such as low-income who had been subletting or living with multiple families and undocumented immigrants. The operation and functioning of these temporary structures exemplified the maintenance of the status quo of inequality (Yelvington, 1997). Systems of these camps keep the most vulnerable from returning to normal functions, further delaying the recovery process of themselves and their communities.

In a rush to close these cities which existed outside their intended parameters, FEMA knowingly left over 2,000 people homeless but claimed since this was lower than the pre-Andrew rate of homelessness this action was justified. This is just another example of ways in which an attempt to return to the status quo pushes vulnerable populations away from view when disasters offer an opportunity to make positive changes.

Rebuilding for Some

The plight of the low-income homeowner in the case of recovery from Andrew went unnoticed because of their attempt to be self-sufficient. They were more likely to be living in condemned housing and less likely to receive aid from FEMA or other government sources because they were not deemed as needy as residents of tent cities. In addition, low-income homeowners, as opposed to higher-income homeowners, were more likely to have "temporary" residents living with them for greater than four months as opposed to higher-income homes (Morrow, 1997b). Low-income homeowners are among the many who systematically receive inadequate compensation from insurance, as they are less likely to be insured by major corporations and/or have the knowledge to navigate the system of insurance companies(Peacock & Girard, 1997).

In addition to single and multi-unit homes, mobile homes were a popular feature of the Dade County area. Because these homes were relatively inexpensive, but offered a degree of privacy and above all the American Dream of homeownership they were a desirable housing unit(Wisner et al., 2004). However, these units were low-value and overwhelmingly destroyed by the storm, with total losses estimated at 9,000 mobile home units(Mileti, 1999). Residents

faced many barriers in rebuilding as insurance payouts, if available at all, were below necessary costs to replace the units (Peacock & Girard, 1997).

Along with mobile home owners, renters suffered greatly from impacts of the storm for many reasons. Primarily because federal funding, and insurance tends to be concerned with the homeowner rather than the dweller. In the case of Andrew, renters tended to be low-income or middle-income individuals and usually have little say in how the land owner chooses to rebuild from a storm. Demographic patterns of relocation after Andrew showed middle class and white renters moving out of highly damaged areas concurrent with an increase in low-income renters(V. K. Smith et al., 2006). These trends can explain some of the increasing segregation post Andrew as the hardest hit and most damaged areas had large influx of low-income and Black populations. These trends also reiterate the idea that wealth denotes mobility as the middle class was able to collect their money and rebuild elsewhere, avoiding a sluggish recovery process in an effort to return to normal.

FEMA guidelines for receiving money were also difficult for low-income and people of color to navigate because guidelines were based largely upon the model of the middle-class nuclear family. These guidelines did little to address the unique cultural habitation patterns of the area. In processing funding applications, FEMA regarded the “head of household” and rightful applicant to be the first individual to file for help. They categorized all additional applications for the same address as fraudulent, which led to barriers for many living in crowded housing conditions in receiving appropriate funding. In addition, because of FEMA’s strict guidelines the poor had the hardest time receiving aid because it took a great deal of time, energy, and skill to receive assistance. Thus, people who needed the most were unable to

receive assistance because of structural bias against the poor, culturally diverse region hit by Hurricane Andrew (Morrow, 1997b). The increasing heterogeneity of American households should have been addressed in government aid available to survivors of hurricane Andrew as it encompasses largely minority populations among other socially vulnerable groups. The reality of the bureaucratic process of Andrew recovery went put vulnerable populations farther away from recovery as they could not receive money because they did not fit the middle-class all American mold standards of the government(Peacock & Ragsdale, 1997).

Among the housing lost in the storm, close to 20,000 units both state and federally funded was destroyed. These units were subsidized rent and public housing leaving some of the storms poorest survivors out of luck (Morrow, 1997a). One government official went so far as to state that the housing market would “sort itself out”, indicating in no uncertain terms the dependence of the federal government upon private markets(Peacock & Girard, 1997). This statement speaks clearly to the reality that dependent citizens cannot place faith in the government to have the desire to care for them.

The reluctance of government to rebuild or fix up this low-income housing led to inability of many who had been reliant on this housing to find new places to live. Residents were effectively forced to remain in homes that should have been condemned because they had no other options. Remaining rental properties could charge more for rent and be more selective as to their renters. In an effort to remedy the closing of these housing units, the government issued rent vouchers however these proved to be a poor solution. Moving to available housing units would have meant uprooting their lives, which many recipients did not want to do. Others who received these vouchers did not end up receiving them because of

bureaucratic processes involving the issuing of the checks. At one point, FEMA realized they had made a mistake in processing and actually tried to collect already distributed aid checks, which recipients had already spent (Morrow, 1997b).

Evidence of uneven recovery can also be observed in resulting racial makeup of Dade County. South Dade in particular saw a great deal of storm damage, with 90% of Blacks in the area living in the most damaged homes (Girard & Peacock, 1997). In this damaged area of South Dade, the Black population actually increased following the storm while Anglo and Hispanic flight was observed(V. K. Smith et al., 2006). General trends of the storm found that areas in which uninhabitable damaged homes existed at a rate of over fifty percent actually grew in population. Of these areas, it was found that low-income renters were moving in while White and middle-class renters were moving out(V. K. Smith et al., 2006). In areas most damaged by the storm this process created distinct racial segregation where previously there had been little to none. The segregation that resulted from resource availability in recovery led those with decent insurance payouts to move to more desirable location, accelerating pre-impact trends of poor Black communities within Dade County.

Homestead versus Florida City

The path of destruction that Andrew wrought left two cities, Homestead and Florida City, in almost identical states of damage but the story of their recovery serves to highlight realities of social vulnerability. Although the entire case study of Hurricane Andrew explains matters of social vulnerability, these two cities offer an important lens through which to compare more direct impacts. Because they experienced the same storm surge, but responded and recovered differently we can more directly observe the impact that political power,

economics, and race play on an area. Florida City was a black community, 60% black, on the edge of poverty with a larger renter population, over 50%. The economy of the town was dependent upon agriculture as its main industry, and had a small local government which was not equipped to handle race and class needs of the area. In addition, (Dash, Peacock, & Morrow, 1997; Morrow, 1997a). Homestead was a middle class Anglo community with a 20% greater income and home value than Florida City. In addition, it had a larger and more diverse economy, allowing it to rebound much faster(Dash et al., 1997; Morrow, 1997a). As noted above, Homestead's city budget allowed them to respond to the storm and the confusion surrounding disaster management. Through the PR team the city was able to increase its exposure and external donations, and become a priority for government aid. This led to a net gain in resources for the city(Averch & Dluhy, 1997).

In the long-term recovery process, Florida City lost 80% of its residential buildings as compared to 60% in Homestead. Florida City also lost nearly 50% of its businesses, and while the city did campaign to revitalize the area through the addition of new business citizens protested. Citizens were opposed to this change were concerned because the new business plan was overshadowing any talks of rebuilding of housing. Florida City residents were seen to have low application rates for federal funding, which can be explained by the idea that there was mistrust of Federal government. Overall, Florida City saw greater rates of Anglo and Hispanic flight and increased Black populations in addition to a decreasing economic industry. Pre-storm racial segregation and disparities in home values carried through impacts of the storm to highlight that idea that disasters serve to exacerbate pre-impact trends. This change in area composition extends beyond the Florida City divide to create long-term consequences of

increased inequality and heightened segregation(Dash et al., 1997). A direct comparison of the two cities allows for a more concrete example of how race and socioeconomic status affect recovery processes and resources available to a community.

It Could Have Been Worse

While this story depicts a harsh story of surviving and recovering from a major natural disaster as well as $25 billion worth of damage, Andrew was not the worst case scenario. Landfall in South Dade affected many, but if the path of the storm had veered toward North Dade there would have been greater impact to Black and Hispanic groups as well as renters and the poor because North Dade had larger proportions of each(S. K. Smith & McCarty, 1996). And if the storm had hit the major metropolitan city of Miami, just 20 miles off course, it would have done unimaginable damage.

The story of Hurricane Andrew explains how those solely reliant upon government assistance in a disaster are disproportionality burdened with recovery efforts as they attempt to rebuild from disaster. Beginning with lack of government agency, continuing on to live in tent cities, and moving back into damaged homes, the low-income residents were barred from attempts at recovery as they lacked both economic resources and social support to rebuild and return to some state of normalcy. The failure of government support was both a perpetuation of existing systems, which failed to address needs of the most vulnerable, and an elucidation of capacity low-income and minority citizens have to address shocks to the normal lives. These demographic, social, and economic components of vulnerability lead to inequalities in recovery processes as individuals who start with less before a storm have more to lose. The case of Hurricane Andrew exemplifies disaster frameworks that indicate pre-impact trends are

accelerated in recovery efforts, as low-income and minority populations became more poor and segregated as a result of the storm. Through analysis of the storm, lessons can be taken in understanding that there is currently little priority of attending to needs of low-income and minority communities even though they are the ones that face the greatest impacts of storms.

Chapter 4: Hurricane Katrina

Hurricane Katrina is probably the most infamous hurricane of the past fifty years because of the level of destruction it caused. Most people, at least within the United States, are aware of some level of mismanagement on the part of government authorities that shaped the event not just as a tragedy, but also as an injustice to many Americans. Van Heerden, a disaster science researcher and part of the team that addressed assessment of the storm reminds us of the realities of vulnerability stating, "Hurricane Katrina was both a natural disaster and a systematic failure on the part of our society" (van Heerden & Bryan, 2006, p. 4). There is ample of literature related to race and environmental justice that examines what went wrong in both preparation and recovery phases that explains how much of New Orleans is still struggling nearly a decade later. Katrina will serve as an important case study for hurricanes and vulnerable populations because the storm made landfall in a physically and socially vulnerable area, and its story explains the realities of how a vulnerable population must deal with such an event.

A Pre-Existing Condition

Historically, the city of New Orleans has faced social inequality from its beginnings as a slave post. The city also had a number of free blacks, which grew substantially after the American Civil War. While these individuals were free, they were largely poor and unemployed thus settled along back swamps, the levee walls (R. Bullard & Wright, 2009b; Khan, 2009). The city has a long history of pushing blacks to less desirable locations through segregation and economic policies. Several urban development measures of the 1900s led to a suburbanization for white residents and urbanization for blacks (R. Bullard & Wright, 2009b; Dyson, 2006; Khan,

2009). Between 1970 and 2000, although poverty only increased by three percent, the number of neighborhoods with concentrated poverty increased by nearly two-thirds (Khan, 2009). The city of New Orleans had a twenty-three percent poverty rate as compared to a national average of twelve percent (Dash, 2013). As a result of this history, about thirty percent of blacks lived in poverty compared to only ten percent of whites in 2000. In addition to these staggering poverty statistics, it is important to note that more than forty percent of these poor blacks lived in poor neighborhoods (Dyson, 2006; Squires & Hartman, 2006). This stark contrast between available land to blacks, and particularly low-income blacks, is an important reminder that vulnerability is not random, but historically guided. Hurricane Katrina simply realized the potential for environmental injustice that had been brewing in the city for decades.

Not only did New Orleans have an overwhelming amount of blacks living in poverty, these areas were also in direct danger of known engineering problems. The levees, a man-made engineering fix, were designed to protect the city from floodwaters shaped property values of the city, leaving the poor with a kind of geographic vulnerability. The location of majority-black and low-income neighborhoods can be closely correlated with risk of levee failure partly because the land was initially more dangerous, and partially because levee repairs in these areas were few and far between (R. Bullard & Wright, 2009b). While it was an accepted fact at the time that the levees were not strong enough in all places to withstand a strong hurricane, funding was consistently cut from the Army Corps budget to maintain and upgrade them (Dyson, 2006). Adequately termed “levee roulette” even before the storm residents understood that the national government was not utilizing its available means to protect them (Sanyika, 2009). This explains why 87% of flooding by volume in New Orleans was caused by levee

breeches (van Heerden & Bryan, 2006). Going into the storm, it was clear that the government could not protect citizens to the extent it should.

Preparation for the Storm

Often addressed in the literature, information availability and perceived risk are one large component of response to pre-storm measures. Survivors interviewed at the Superdome, one of the largest temporary shelters set up, indicated a number of distinct contextual reasons they had not, or could not evacuate. Among the most common was family ties, having immobile family members that they had to take care of, or lack of money to leave (Eisenman, Cordasco, Asch, Golden, & Glik, 2007). In more rural areas, information dissemination was a key issue as many people lived a great distance apart and did not receive proper updates about the storm. Resources available to the urban residents were not afforded to rural dwellers as resources are often a great distance from where people live (Bassett, 2009).

The issue with transportation for leaving the city was also a factor of economic means because many poor, especially in New Orleans, relied heavily on public transportation to move around within the city. In urban areas, more than half of primary transit users are people of color, and African Americans are almost four times less likely to have access to a car (R. D. Bullard, Johnson, & Torres, 2009). So low-income people of color did not have access to a vehicle, or a large enough vehicle for extended family, in order to protect themselves by leaving. Although New Orleans was one of the few cities that had accounted for this population, in the face of the storm leaders never activated the evacuation plan, leaving residents to fend for themselves (Scandlyn et al., 2013). All other disaster evacuation plans, including the mandatory evacuation order issued by New Orleans mayor Nagin, to residents operate under

the assumption that residents have access to private transportation (R. D. Bullard et al., 2009; Dyson, 2006). Although the government was aware of the reliance of a large portion of their vulnerable population on public transportation, "emergency transportation planners failed the most vulnerable of our society" (R. D. Bullard et al., 2009, p. 72).

In addition to lack of financial means to protect themselves, residents of New Orleans- especially the elderly- have a long history of enduring hurricanes (R. D. Bullard & Wright, 2012). As a result of locational vulnerability, some felt better prepared to wait out the storm rather than rely on limited government assistance in providing storm shelters or burden themselves by planning for evacuation (Eisenman et al., 2007).

A pre-existing condition of social vulnerability set the stage for difficulties poor residents had leaving the city, as well as their ability to process and react to information regarding the storm. Many decided to stay because they had always weathered the storm, but many more had no feasible way to leave the city and protect themselves simultaneously (Dyson, 2006). So, when the storm hit and the levees broke, the majority of stranded populations were low-income blacks waiting for government rescue that often came too little and too late.

A Second Disaster

In looking at recovery efforts of the city, it is clear that what little is being done to address these issues of vulnerability is not enough. While around twenty percent of whites permanently relocated after the storm, almost half of blacks relocated (R. Bullard & Wright, 2009b). Permanent relocation after Katrina can largely be tied to inability to return to, or become successful in the new city. This phenomenon can be closely correlated with pre-storm vulnerability as people have a harder time participating in recovery efforts if they have been

devastated themselves (R. Bullard & Wright, 2009b). Already vulnerable populations were either forced to start from scratch in a new city, or start from scratch in a place they had always called home. Almost more disturbing, is that while the city population decreased by almost a third following Katrina, the percent of vulnerable individuals in the Gulf Coast increased 1.5 fold (Khan, 2009). Along these lines, the government's efforts to reinforce dangerous levees can be seen to closely correspond with pre-existing protection of high lying, economically desirable, white land (R. Bullard & Wright, 2009b).

Renter Vulnerability and Housing

Another way that we can measure economic relations to vulnerability is through an understanding of home ownership, or lack thereof. Home ownership is a form of capital, and is a socially desirable notion because it represents for many the American Dream (Bassett, 2009). It is for this reason that, especially in rural areas, low-income families are often forced into old and poorly constructed housing or more affordable mobile homes. These are the conditions that many residents of Katrina's path found themselves in during and after the storm. In rural areas of Louisiana, uninsured or underinsured low-income populations had limited resources for their homes to weather the storm, and a nearly impossible time fighting with insurance for money to rebuild (Bassett, 2009). In New Orleans, there were many renters, with the low-income majority black populations especially, living in government housing or reliant on government assistance for rent. Almost a year after the storm, eighty percent of public housing had still not been reopened leaving its needy former residents without a way to go home(R. Bullard & Wright, 2009b). The government made decisions with respect to public housing that were not necessarily in the best interest of the housing poor market. They chose to

permanently close several of the complexes, and rebuilt some as mixed-income developments providing less housing for their previous tenants, and opening the city up to gentrification efforts in line with the increasingly white population (R. Bullard & Wright, 2009b).

In a survey conducted by the National Fair Housing Alliance (NFHA), the only national civil rights organization with a focus on housing discrimination, there was an observed bias in housing opportunities. They conducted a survey of rental housing across five states, those hit by Katrina and areas where survivors were concentrated in relocating. Through this survey, they conducted both caller survey and follow up in-person surveys at locations they observed discrimination against African-American survivors. These acts of discrimination included but were not limited to: differential treatment of applicants, failure to disclose available units, offering of discounts to White callers, and misquoting of prices. While the sample size for this study was relatively small, these represent illegal acts of discrimination in the states of Alabama, Georgia, Florida, Tennessee, and Texas. FEMA as well as the department of Housing and Urban Development (HUD) did not respond to the report submitted by NFAH, and failed to take independent action to research this issue. Considering that there were close to 125,000 families living in hotels funded by FEMA in addition to uncounted individuals staying with friends and family at the time of this study, any level of housing discrimination at the time should have proved a notable encounter in vulnerability studies(National Fair Housing Alliance, 2005).

Temporary housing for those rebuilding was given in terms of trailers, which were later found to be toxic with asbestos. Since nearly half of the housing units destroyed by Katrina were rentals, many people had no say over the fate of their homes. Because of the great deal of

destroyed unit, rent increased so dramatically that many residents were unable to return to the city, and those on housing vouchers from the government saw an increase by nearly one third in the value to compensate for this increase (Khan, 2009).

In addition to home ownership, insurance is a large component of recovery capital that systematically favors whites and middle or upper class. Recovery of private homes becomes a function of the owners' access to resources, including insurance and personal wealth utilized to rebuild (Bates & Green, 2009). Recovery options were limited to private insurance, loans from the Small Business Association, or grant money from the Road Home Program (Adams, Van Hattum, & English, 2009). The first two programs were limited to those with pre-existing wealth for insurance or credit for loans. The uninsured rate is almost 1.5 times greater for blacks than whites, and it is understood that blacks usually have worse coverage than others (R. Bullard & Wright, 2009a). The Road Home program was such a bureaucratic nightmare that it was eventually sued for improper resource distribution because black homeowners were systematically denied proper payments for their homes as compared to whites (Dash, 2013). Pre-storm housing values were used for many insurance payouts, leaving some with less money that adequate rebuilding process would cost (Bates & Green, 2009). Even those with insurance had little success receiving settlements as their policies were worse, and they had no resources or capacity to fight insurance companies for fair payouts. Many with lower value homes in black areas faced issues of redlining of neighborhoods and had to be insured through smaller companies which were lower quality with less resources than bigger names. Another issue specific to Katrina was storm damage as a result of flooding, which is not offered through insurance agencies but through a government program. Although it is considered mandatory,

many low-income individuals simply could not afford it and had let their coverage lapse and many older homes were not required to have it because they were grandfathered into previous policies (Bates & Green, 2009).

The amount of time spent in transition can greatly affect recovery, as the goal is always to return to "normal". Low-income people of color spend more time in temporary housing and shelters as compared to their middle-class and white counterparts. In addition, these population are more likely to remain permanently displaced as a result of the storm which accounts for the large decrease in blacks after the storm (R. Bullard & Wright, 2009b). Housing and rebuilding in New Orleans after the storm serve to explain some injustices to vulnerable populations in recovery to storms.

Finding Work

Another element that caused undue difficulty in residents returning home and assisting in the rebuilding efforts of their own city was the outsourcing of labor. While it is both socially and economically beneficial to hire storms survivors to fix their city, in the case of New Orleans migrant and immigrant workers composed the majority of construction workers. These temporary workers could be ready to work almost immediately as they were not struggling to recoup losses of the storm(Khan, 2009; Whelan & Strong, 2009). These low-skill construction jobs available to residents after the storm also did not cater to the elderly, women, or transportation-less survivors who were unable to fill these positions. So, in the face of recovery low-income storm survivors were barred from recovery in a catch-22 because they could not get the jobs to provide resources and they did not have basic resources to get jobs. In stark contrast to these low-skilled laborers, affected more skilled workers often chose to stay out of

New Orleans, relying on social networks and skill level to find employment in other cities. The exodus of the black middle-class can be largely explained by this phenomenon (Whelan & Strong, 2009).

Takeaway

The government failed vulnerable populations in New Orleans and beyond as a direct result of Katrina by improperly protecting levees designed to keep storms out, reacting to the disaster far too late, and removing longstanding support for living affordability to low-income residents. One returned resident likened recovery efforts to a "hamster wheel" because all the effort being put into recovery was going nowhere (Adams et al., 2009). A historically black city, rich in culture was stripped from many residents in a "black diaspora" following Katrina (R. Bullard & Wright, 2009a). Citizens were removed from their homes to shelters were disproportionately black, and they faced numerous roadblocks in returning to New Orleans that kept many permanently out. The economics of recovery were a means of kicking out the poor and keeping them out of the city(Adams et al., 2009). In a raw analysis, Sanyaki stated that the "national lesson of Katrina is that African-American communities across the country are especially vulnerable to major disruptions in the political-economy because of persistent patterns of inequality and unequal access to life-sustaining resources"(Sanyika, 2009, p. 203).

A climate of racial divide is still prevalent in post-Katrina New Orleans in line with unequal access to recovery resources and disparity of vulnerability. The climate of voting after the storm exemplifies this line as the platform rested on the political rights of the black population, and the black mayor was re-elected by blacks despite his previous white-majority support. Although he had no formal rebuilding platform, racial symbolism carried New Orleans

through the election exemplifying the black-white divide present within the city (Sanyika, 2009).

Bullard and Wright summarize the post-Katrina climate by asserting that the "Government's response to the impacts of Katrina on New Orleans and the Gulf Coast has challenged the beliefs of most Americans, black and white alike, that our government is competent to meet the challenges posed by most major disasters and, for African Americans particularly, that it will respond equally to the needs of all citizens, regardless of race or ethnicity" (R. D. Bullard & Wright, 2012, p. 42).

In looking at the impacts of Hurricane Katrina, it is clear that low-income and minority communities lack the ability to respond to devastating effects of natural disasters in a similar manner to Whites and those of higher socioeconomic status. While government systems are theoretically designed to reduce the burden that these communities face, they failed the people of New Orleans and will continue to fail vulnerable communities if they do not adapt to the needs of the population they are responding to. The many delays in resuming normal function came from the government's inability to provide resources it had before the storm, such as public housing and transportation, trapping those reliant on these services in a purgatory of reconstruction. Underlying causes of this reliance on the government are embedded with the social framework of the United States, which dictates the access individuals have to certain levels of resources. Recovery in largely black areas of New Orleans is ongoing, and represents failures of government and private enterprise to address the needs of many people. The story of Katrina reiterates the fundamental understanding that disasters serve to

accelerate pre-impact trends, leaving low-income and minority individuals further economically and socially segregated from Whites and those of higher socioeconomic status.

Chapter 5: Predicting Vulnerability

Given the understanding of changes to hurricane patterns, we can assume a greater level of damage to coastal communities in future events. This taken in conjunction with an understanding of how minority and low-income individuals are disproportionately burdened with preparation from, response to, and recovery from storm events as evidenced by case studies of Hurricanes Andrew and Katrina is cause for concern. Therefore, it is important to identify communities with characteristics that will put individuals at greater risk of damage as a result of these storms. This work will add to the great body of literature focused on mapping vulnerability (Cutter, 2009; Cutter et al., 2003; Prasad, 2012).

Methods

Data was taken from the U.S. Census Bureau's American Community Survey(ACS) 2008-2012 5-year estimate(U.S. Census Bureau). The 5-year estimate was chosen because it provides data for all census tracts, and is the most reliable data because it draws from the largest sample size. The ACS is annually collected data, which replaced the long-form census questionnaire after the 2000 census(US Census Bureau, 2013). It is important to note that this is a sample, not a comprehensive count. Data was taken from the following datasets: Race, Hispanic or Latino Origin, and Poverty Status of Families in the Past 12 Months by Household Type by number of Persons in Family.

Data provided by the Census Bureau was in the form of a count, so the author calculated makeup of county populations as percentages. The state of Louisiana uses the term parish in lieu of county. The author then calculated state averages for population makeup. Population makeup was then compared through generation of a bucket variable, which

identified counties above the state average. Bucket groups were created in 5% intervals for poverty and Hispanic data points and 10% intervals for Black population data points. This differentiation was created because the variance observed for Black communities was greater than that for the other variables.

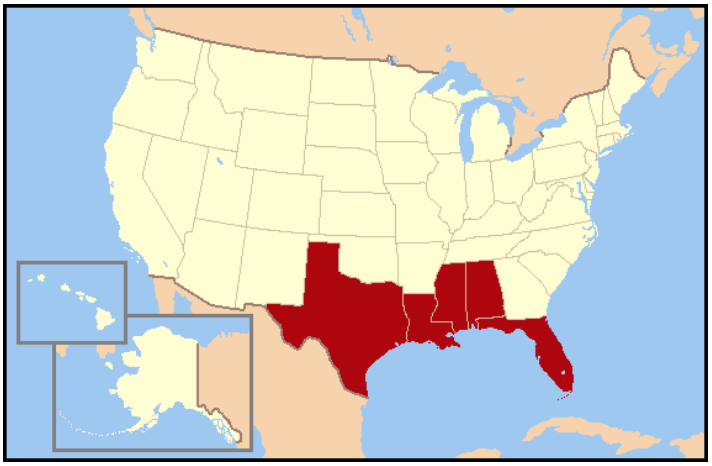

Figure 1. Map of United States with Gulf Coast states highlighted in red.

The study was conducted over the United States Gulf Coast states of Louisiana, Mississippi, Alabama, and Florida. Although Texas is part of the Gulf Coast, it was excluded from this study. Also highlighted were coastal communities, as defined by NOAA. NOAA developed this list of coastal counties by defining coastal as having 15% or more of their total land area in coastal watershed, or at least 15% of coastal cataloguing unit's land area(National Oceanic and Atmospheric Administration, 2012). Of these counties, there are 9 in Alabama,62 in Florida, 38 in Louisiana, and 12 in Mississippi.

Table 1. Variables measuring human vulnerability. Adapted from Prasad 2012.

Category	Indicator	Variable	Effect on Vulnerability
Demographic	Race	% population Black	(+)
	Ethnicity	% population Hispanic or Latino	(+)
Economic	Poverty	% households below poverty	(+)

Variables chosen of race, ethnicity, and poverty utilized as proxies for minority and low-income status (Table 1). Based upon analysis of events in the case study chapters, these are important indicators of vulnerability status. It can therefore be assumed that the presence of a population within these categories should be noted for concern.

Results and Discussion

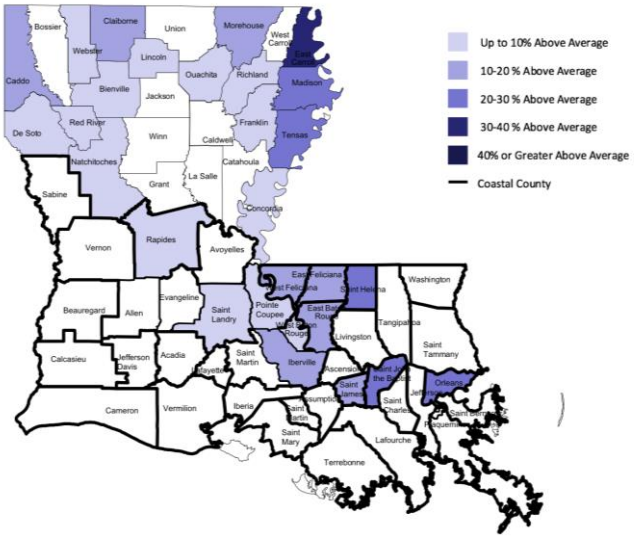

Figure 2. Census parishes in the state of Louisiana with Black populations greater than the state average.

In the state of Louisiana, 28 out of 64 parishes have Black populations above the state average. Of these counties, twelve lie within the coastal parishes as defined by NOAA(Figure 2). While there were relatively few counties falling outside the average Black population within Mississippi, with the calculated average of 32%, this falls dramatically above the a national average of 13% (US Census Bureau, 2015).

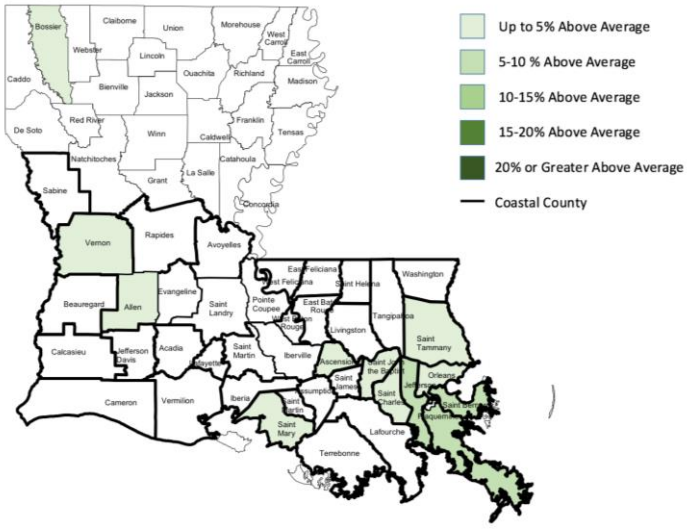

Figure 3. Census parishes in the state of Louisiana with Hispanic populations greater than the state average.

Louisiana shows 11 out of 64 parishes as having greater than a state average of Hispanic populations, with 10 of which being coastal communities (Figure 3). The majority of these appear to be concentrated in the New Orleans area which is reason for concern as the city is still not prepared for a major storm.

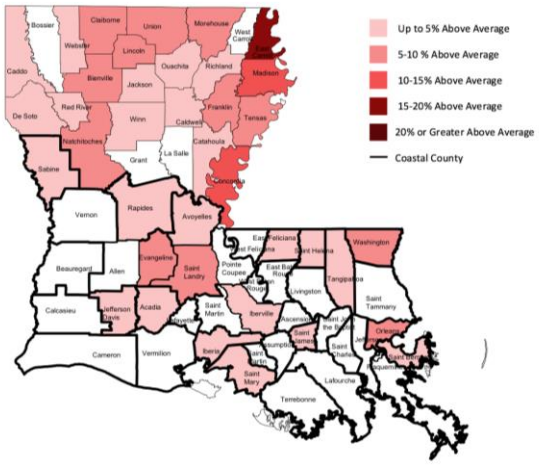

Figure 4. Census parishes in the state of Louisiana with percent of families in poverty greater than the state average.

There are 37 out of 64 parishes with families in poverty greater than the state average, 17 of which fall in coastal parishes (Figure 4). There is no apparent concentration of families in poverty. The state of Louisiana as a whole saw 13 parishes that fell in both Black and poverty indicators, 8 with Hispanic and poor, and 2 parishes that fell into all three categories. It likely that the correlation between Black and poverty indicators are interrelated, and such instances of this overlap add to our key understanding of vulnerability.

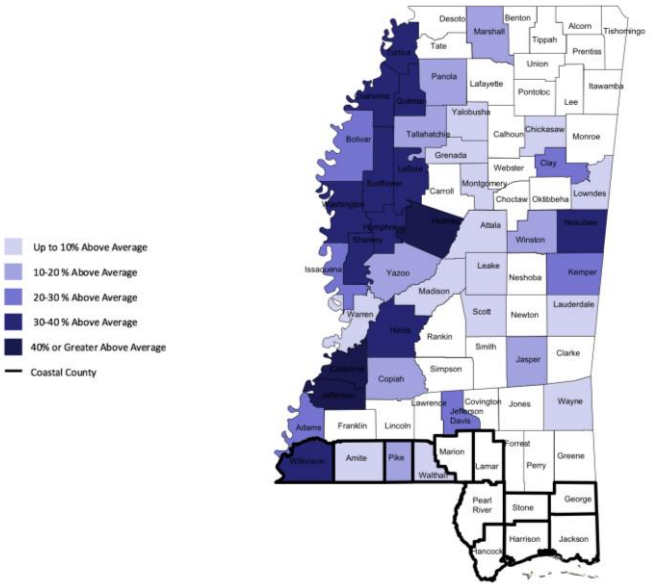

Figure 5. Census counties in the state of Mississippi with Black populations greater than the state average.

Mississippi has 42 out of the 83 counties as being greater than the state average for black populations. Of these Black counties, four fall within the coastal barriers as identified by NOAA (Figure 5). It can be observed by this figure that the majority of Black populations are concentrated along the western border of the state and is relatively aggregated in areas of higher concentration. This concentration of Black populations is concerning in highlighting vulnerability as presented literature in addition to both case studies indicate Black communities face impacts of social vulnerability at greater rates within the United States.

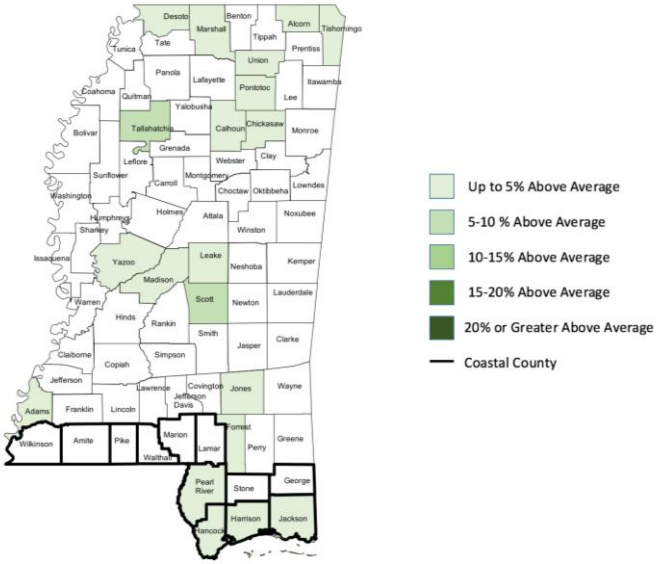

Figure 6. Census counties in the state of Mississippi with Hispanic populations greater than the state average.

In the state of Mississippi, 21 out of the 82 counties saw Hispanic populations greater than the state average, 4 of which fall within coastal communities (Figure 6). There is no apparent trend of aggregation of Hispanic communities throughout the state.

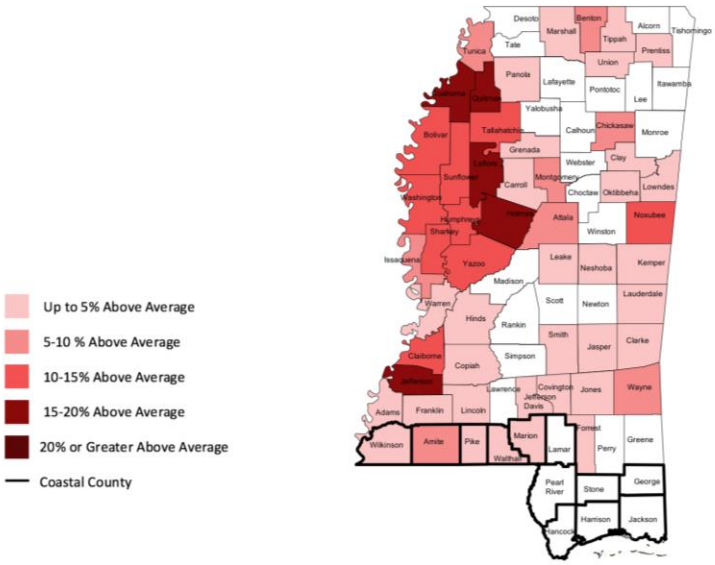

Figure 7. Census counties in the state of Mississippi with percent of families in poverty greater than the state average.

In the state of Mississippi, 55 out of the 82 counties fell above the state average for percent of families in poverty, 5 of which were within coastal counties (Figure 7). There appears to be a concentration of higher numbers of families in poverty along the western border of the state. Within the observed positive indicators of poverty, race, and ethnicity 42 counties in the state of Mississippi have some overlap. There were 30 counties with some level above average of both Black populations and families in poverty, 2 with Hispanic and Black populations above average, 2 with Hispanic and families and poverty, and 10 counties that had all three measured components. Once again, the aggregation of Black individuals and families and poverty correlates levels of social vulnerability.

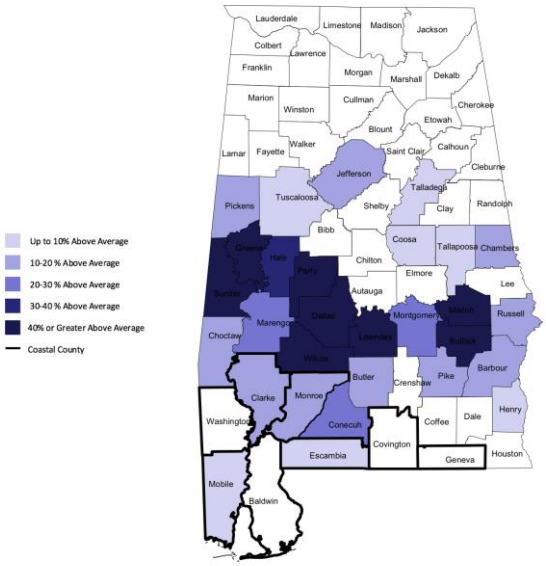

Figure 8. Census counties in the state of Alabama with Black populations greater than the state average.

In the state of Alabama, 29 out of the 67 counties saw Black populations greater than the state average. Of these counties, 5 fall within the NOAA coastal area (Figure 8). The concentration of these Black population appears to aggregate in the South West corner of the state.

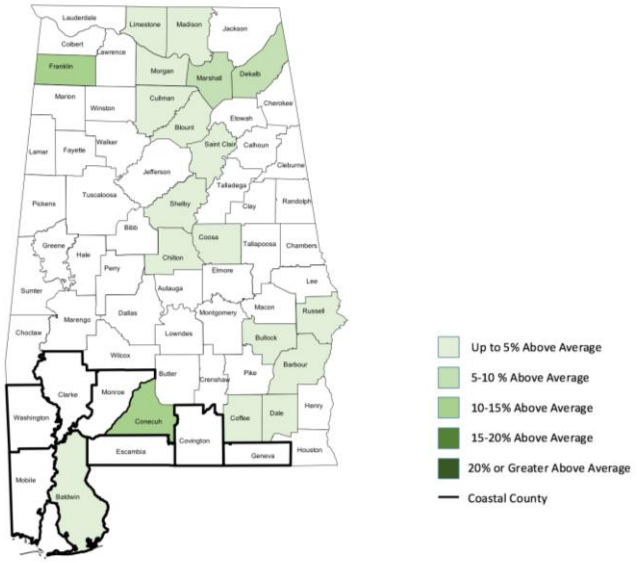

Figure 9. Census counties in the state of Alabama with Hispanic populations greater than the state average.

In the state of Alabama, 17 out of the 67 counties saw concentrations of Hispanic populations higher than the state average, with 2 counties in coastal region(Figure 9). There is no apparent geographic trend to explain distribution patterns. It is also important to note that no counties fall more than 15% above the state average for Hispanic populations and therefore it is not likely that Hispanic populations are concentrated enough to face certain levels of vulnerability in storms.

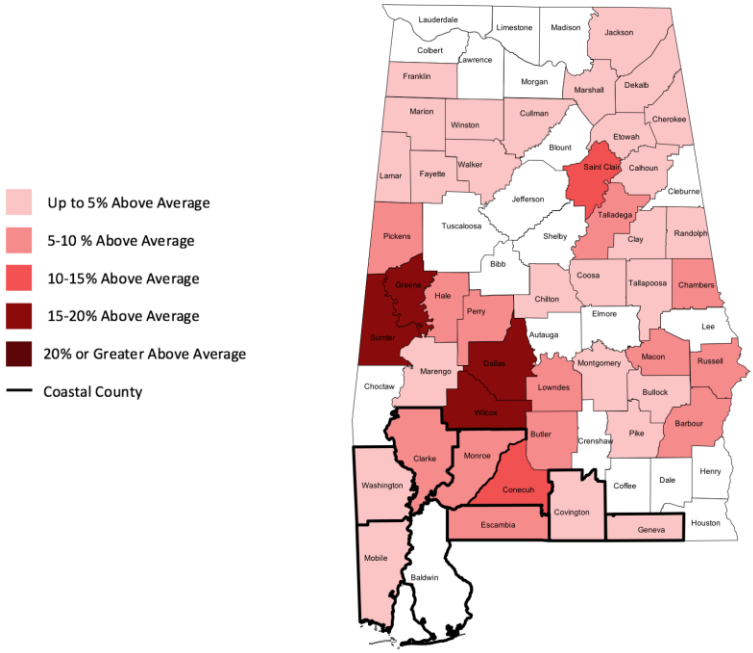

Figure 10. Census counties in the state of Alabama with percent of families in poverty greater than the state average.

There were 45 out of 67 total counties in the state of Alabama that have greater than average number of families in poverty, 8 of which lie in coastal communities (Figure 10). It is interesting to note that the majority of coastal communities show some degree of correlation with poverty. Overall the state had 22 counties that fell into categories of high Black and poverty concentrations, 5 that fell into categories of Hispanic and poverty concentrations, and 4

counties that expressed degrees of all three indicators of vulnerability. There appears to be a high correlation between counties that fall into both high concentrations of Blacks and families in poverty along the coastal region of the state. This is of particular concern because it may indicate a compounding of locational and social vulnerability that would drastically effect these populations if a storm event were to occur.

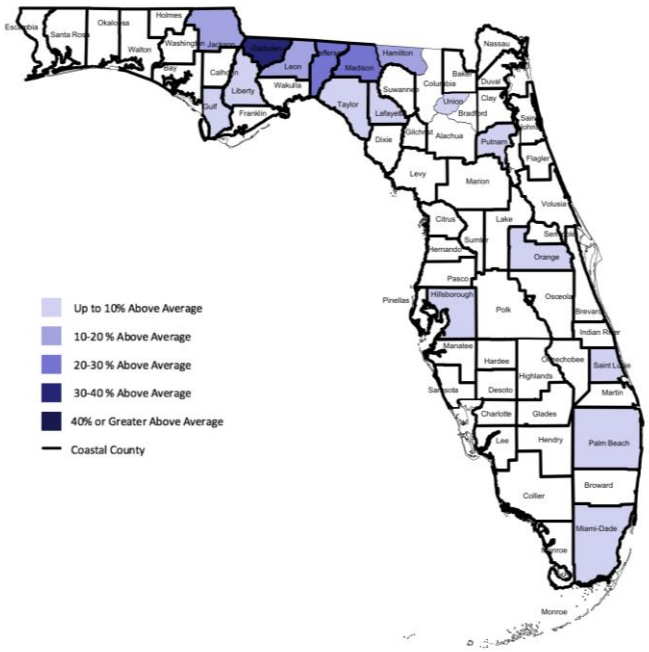

Figure 11, Census counties in the state of Florida with Black populations greater than the state average.

In the state of Florida, 24 out of 67 had Black communities greater than the average. Since most of the state falls within coastal boundaries, all but two of these counties are coastal (Figure 11). There appears to be a greater concentration of counties with higher proportions of Black populations on the panhandle.

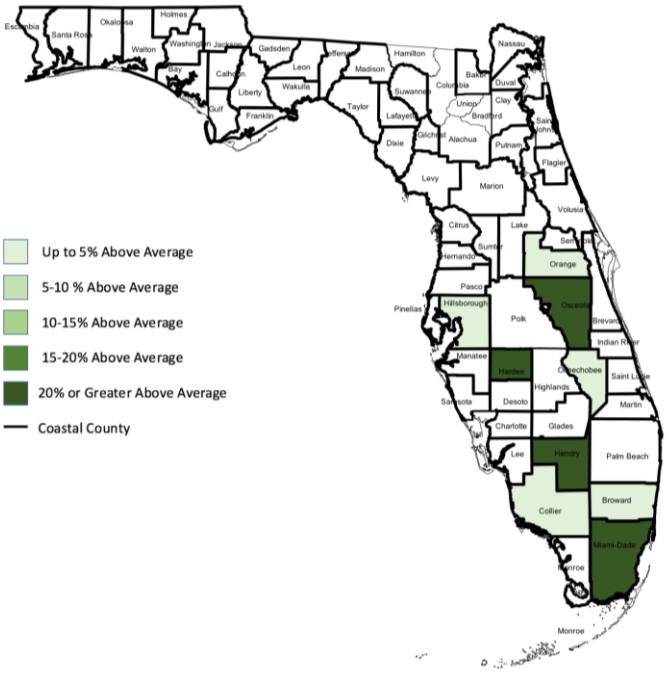

Figure 12. Census counties in the state of Florida with Hispanic populations greater than the state average.

There were 9 out of 67 counties in Florida with higher than average Hispanic populations, all of which fall into coastal counties (Figure 12). The concentrations of Hispanic communities tend to be significantly above average which may indicate large pockets of Hispanic populations. In relation to previously mentioned Hurricane Andrew, it is clear that Miami Dade county has maintained a large Hispanic population that should be montiered for future vulnerabilities.

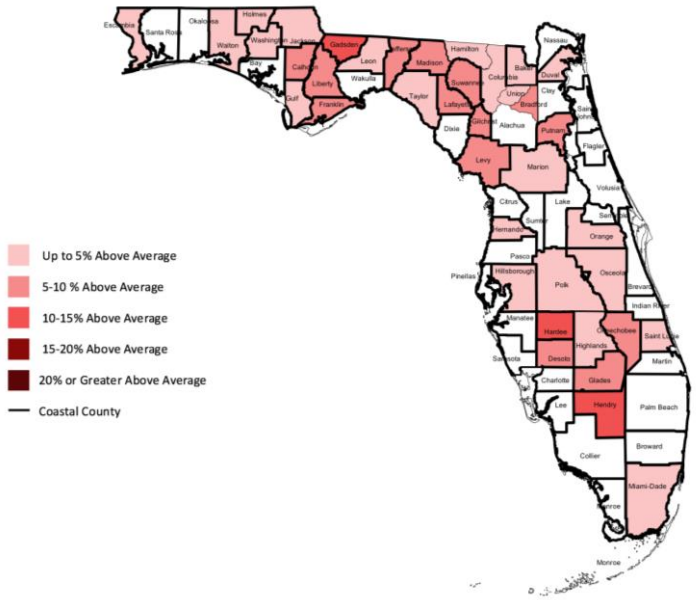

Figure 13. Census counties in the state of Louisiana with percent of families in poverty greater than the state average.

There were 39 out of 67 counties in Florida with concentrations of families in poverty above the state average, of which 45 are coastal (Figure 13). There does not appear to be any patterns of concentration of poverty within the state. Within the state of Florida, 23 counties had overlapping characteristics of Black populations and families in poverty, 4 counties with large Hispanic populations and 3 counties saw all three variables.

By far, the largest correlation between county vulnerability status from this data was Black and number of families in poverty. As explained by case studies, the connection between low-income and black communities is especially prohibitive to recovery processes due to limited social and economic capital generally associated with these two groups. Combining a historical analysis with current population trends, I would recommend study of these areas by emergency management agencies to identify needs of the community.

The counties identified as having greater than average populations for any of the three proxy variables for vulnerability should be analyzed by scholars and policy makers for

adaptation and mitigation strategies to be undertaken to reduce vulnerability. The counties that has observed above average populations for all three variables should be studied as soon as possible to ascertain an understanding of their vulnerability and measures that can be taken to reduce that. Mapping projects such as this one should mark a first step for scholars and government officials to identify areas in which attention may be needed with respect to vulnerability status of a community. Of particular note, coastal communities within these states that see observed trends of these vulnerability proxies should be studied with a sense of urgency as they will likely see the greatest impacts as a result of climate change.

Limitations

This study was limited in time and resources, and as such chosen variables represent a very small sample of indicators of vulnerability. Aggregation of this information in order to understand how these components interact with one another was also outside the scope of this research, therefore it is impossible to determine a comprehensive understanding of vulnerability based solely upon these results. In addition, statistical analysis was not completed on these variables to gain quantitative understanding of their significance.

Conclusions

Natural hazards are proven to pose extreme risks to social systems. Considering the impacts that global climate change is projected to have on hurricane activity, with an increasing number of intense storms being most likely in the near future it is important that we understand the risks of these storms to human settlements. Effects of sea level rise as a component of climate change, will increase damage of hurricanes to coastal settlements regardless of magnitude of the storm. In the United States, the effects of these changing hurricane patterns will be observed in the Gulf Coast, affecting the states of Alabama, Florida, Louisiana, Mississippi, and Texas.

In 1992, Hurricane Andrew devastated Dade County, leaving over 100,000 families homeless. In recovery efforts, the political system of resource distribution allowed represented Anglo and Hispanic communities to receive aid and rebuild infrastructure while low-income and black communities did not. These low-income and black individuals were pushed into makeshift housing, and returned to destroyed or nonexistent homes. Similarly, the devastation of 2005 storm Hurricane Katrina inundated New Orleans leaving many outside the scope of personal or government resources to respond and recover. Patterns of response to a storm and recovery between the two cases show an elongated recovery time for low-income and minority communities. Difficulty preparing for, weathering a storm, and finding adequate housing and jobs after a storm push vulnerable populations beyond their abilities to respond. Government systems of recovery tend to inadequately address the needs of these populations.

In understanding this

Supplemental Material

Table 2. Parishes in Louisiana with Black populations greater than state average.

Up to 10% Above Average	10-20% Above Average	20-30% Above Average	30-40% Above Average
East Carroll	Madison	Caddo	Bienville
	Orleans	Claiborne	Concordia
	St. Helena	East Baton Rouge	De Soto
	St. John the Baptist	East Feliciana	Franklin
	Tensas	Iberville	Lincoln
		Morehouse	Natchitoches

		St. James West Feliciana	Ouachita Pointe Coupee Rapides Parish Red River Richland St. Landry Webster West Baton Rouge

Table 3. Counties in Mississippi with Black populations greater than state average.

Up to 10% Above Average	10-20% Above Average	20-30% Above Average	30-40% Above Average	40% or Greater Above Average
Amite Attala Chickasaw Grenada Lauderdale Leake Lowndes Madison Montgomery Scott Walthall Warren Wayne Yalobusha	Copiah Jasper Marshall Panola Pike Tallahatchie Winston Yazoo	Adams Bolivar Clay Issaquena Jefferson Kemper	Coahoma Hinds Humphreys Leflore Noxubee Quitman Sharkey Sunflower Tunica Washington Wilkinson	Claiborne Holmes Jefferson

Table 4. Counties in Alabama with Black populations greater than state average.

Up to 10 % Above Average	10-20% Above Average	20-30% Above Average	30-40% Above Average	40% or Greater Above Average
Coosa Escambia Henry Mobile Talladega	Barbour Butler Chambers Choctaw Clarke	Conecuh Marengo Montgomery	Hale	Bullock Dallas Greene Lowndes Macon

Tallapoosa Tuscaloosa	Jefferson Monroe Pickens Pike Russell			Perry Sumter Wilcox

Table 5. Counties in Florida with Black population greater than state average.

Up to 10% Above Average	10-20% Above Average	20-30% Above Average	40% or Greater Above Average
Aluacha Bradford Calhoun Columbia Escambia Gulf Hillsborough Lafayette Liberty Miami-Dade Orange Palm Putnam St. Lucie Taylor Union	Broward Duval Hamilton Jackson Leon	Jefferson Madison	Gadsden

Table 6. Parishes in Louisiana with Black populations greater than state average.

Up to 5 % Above Average	5-10% Above Average
Jefferson St. Bernard	Ascension Bossier Orleans Plaquemines St. Charles St. John the Baptist St. Mary

	St. Tammany Vernon

Table 7. Counties in Mississippi with Hispanic populations greater than state average.

Up to 5% Above Average	5-10% Above Average
Adams Amite Chickasaw Forrest George Jackson Lamar Leake Marion Marshall Pearl River Pike Scott Stone Tallahatchie Walthall Wilkinson Yazoo	Hancock Harrison

Table 8. Counties in Alabama with Hispanic population greater than state average.

Up to 5% Above Average	5-10% Above Average	10-15% Above Average
Baldwin Barbour Blount Bullock Chilton Coffee Cullman Dale	DeKalb Marshall	Franklin

Limestone Madison Morgan Russell Shelby St. Clair		

Table 9. Counties in Florida with Hispanic population greater than state average.

Up to 5% Above Average	20% or Greater Above Average
Broward Collier Hillsborough Okeechobee Orange	Hardee Hendry Miami-Dade Osceola

Table 10. Parishes in Louisiana with number of families in poverty greater than state average.

Up to 5% Above Average	5-10% Above Average	10-15% Above Average	15-20% Above Average
Jefferson	St. Bernard Tensas	Ascension Assumption Claiborne Concordia East Baton Rouge East Feliciana Plaquemines	Acadia Beauregard Bienville Bossier Caddo Calcasieu Cameron

		St. Helena Terrebonne Vernon Washington	De Soto East Carroll Iberville Jefferson Davis Lafayette Lincoln Livingston Rapides St. James St. John the Baptist St. Martin St. Mary St. Tammany Webster West Carroll West Feliciana Winn

Table 11. Counties in Mississippi with number of families in poverty greater than state average

15-20% Above Average	10-15 % Above Average	5-10% Above Average	Up to 5% Above Average
Coahoma Holmes Jefferson Leflore Quitman	Bolivar Claiborne Humphreys Noxubee Sharkey Sunflower Tallahatchie Washington	Amite Attala Benton Chickasaw Issaquena Montgomery Tunica Wayne	Adams Carroll Clarke Clay Copiah Covington Forrest Franklin

	Yazoo		Grenada Hinds Jasper Jefferson Jones Kemper Lauderdale Leake Lincoln Lowndes Marion Marshall Neshoba Oktibbeha Panola Pike Prentiss Smith Tippah Union Walthall Warren Webster Wilkinson Winston

Table 12. Counties in Alabama with number of families in poverty greater than state average.

Up to 5% Above Average	5-10% Above Average	10-15% Above Average	15-20% Above Average
Bullock	Barbour	Conecuh	Dallas
Calhoun	Butler	St. Clair	Greene
Cherokee	Chambers		Sumter
Chilton	Clarke		Wilcox
Clay	Escambia		
Coosa	Hale		
Covington	Lowndes		

Cullman DeKalb Etowah Fayette Franklin Geneva Jackson Lamar Marengo Marion Marshall Mobile Montgomery Pike Randolph Tallapoosa Walker Washington Winston	Macon Monroe Perry Pickens Russell Talladega		

Table 13. Counties in Florida with number of families in poverty greater than state average.

Up to 5% above Average	5-10 % Above Average	10-15% Above Average
Baker Columbia Duval Escambia Gulf Hamilton Hernando	Bradford Calhoun DeSoto Franklin Gilchrist Glades Jefferson	Gadsden Hardee Hendry

Highlands	Lafayette	
Hillsborough	Levy	
Holmes	Liberty	
Jackson	Madison	
Leon	Okeechobee	
Marion	Putnam	
Miami-Dade	Suwannee	
Orange		
Osceola		
Polk		
St. Lucie		
Taylor		
Union		
Walton		
Washington		

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