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Climate Change Hazard Mitigation and Disaster Policy in South Louisiana: Planning and Preparing for a "Slow Disaster"

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Our climate is in a constant state of flux and disaster policy and hazard mitigation measures must anticipate and adapt to these and other changes. This is especially true in the parishes of South Louisiana where a combination of factors have created a highly dynamic landscape where residents must react to anthropogenic and non-anthropogenic forces simultaneously. Major policies and mitigation efforts along Louisiana's Gulf Coast as they relate to disaster management and/or climate change were chronicled to determine how they have incorporated the unique vulnerabilities of South Louisiana. In addition to exacerbating disasters, changes in climate can create a "slow disaster" because of far-reaching impacts on multiple natural processes. A "slow disaster" is difficult to encourage communities to prepare for because the impact is usually realized over the course of years and decades instead of a few hours or days, as is the case with most disasters. Proactive planning and inclusion of potential climate change impacts in hazard mitigation plans is a positive step in reducing the impact of future disasters.

KEY WORDS: climate change, South Louisiana, disaster policy, hazard mitigation, slow disaster

Introduction

Background

Climate is ever-evolving with regional and global changes occurring throughout the known historical record (Nickl, Willmott, Matsuura, & Robeson, 2010). There have been warm periods and cool periods as well as wet periods and dry periods, but over the twentieth century and into the twenty-first century the climate appears to be changing at an accelerated pace (Diffenbaugh & Ashfaq, 2010; Gleason, Lawrimore, Levinson, Karl, & Karoly, 2008; Jentsch, Kreyling, & Beierkuhnlein, 2007). Many researchers attribute this to anthropogenic influences, natural cycles, or combinations of both. Regardless of cause, policymakers must address these ongoing and future changes in order to mitigate the injurious impacts they will cause. It is difficult to examine climate change at a global

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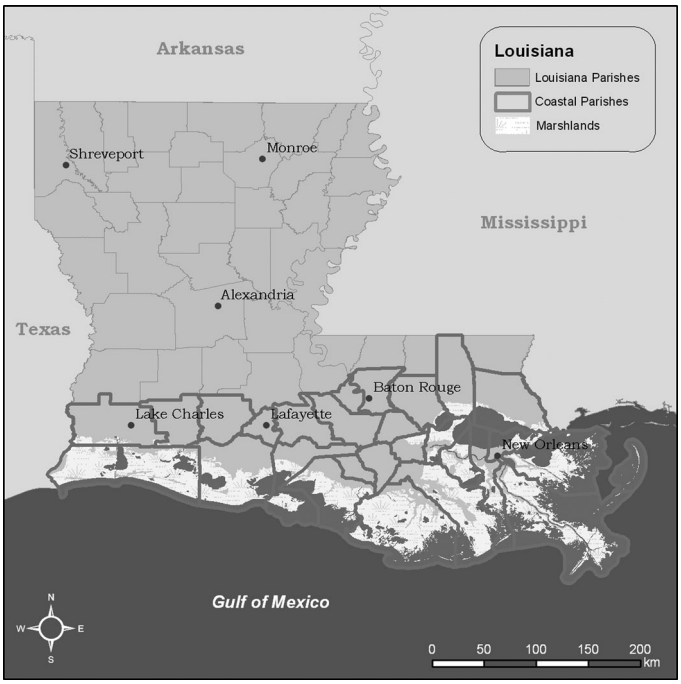

Figure 1. Louisiana With Coastal Parishes of South Louisiana Highlighted.

scale, but more reasonable to examine the potential effects at a regional or local scale. This study will focus on policies and mitigation efforts along Louisiana's Gulf Coast as they relate to disaster management and/or climate change (Figure 1).

Climatologist predict multiple climate shifts in the southeastern United States; including an increased frequency of heavy rainfall events (Gleason et al., 2008), increased fluctuation and variability of streamflow (McCabe & Wolock, 2002), and the salinization of coastal waters (Conner et al., 2007). An increased variability in streamflow may lead to both major flooding and severe drought conditions. Changing fluvial conditions as well as coastal inundation caused by a combination of land subsidence and sea level rise (SLR) will have considerable impacts on the coastal landscape of Louisiana. Louisiana's lowlands and marshes provide a suitable study area in which to examine many of the policy and socio-economic questions that arise from these changes in climate. Louisiana's estuaries and wetlands support a vibrant array of wildlife and provide a natural buffer for storm surges as well as a culturally unique and rich environment for long-time residents.

Objectives & Research Questions

This study will examine current hazard mitigation policies and laws (at the community, regional, state, and federal levels) to determine how they affect the

local communities and to ascertain whether they optimally address the potential impacts of climate change. We will address the following research questions: How have policies, laws, and strategies evolved in southeast Louisiana to address climatic concerns, and recently climate change? Are mitigation plans implemented to limit the potential damage of a disaster or do they also limit the exposure of a community to environmentally vulnerable areas?

Policies, Laws, and Strategies

There are many policies, programs, and laws in place that affect southeast Louisiana. These include (but are not limited to) the Flood Control Act of 1928, National Flood Insurance Program (NFIP), Special Flood Hazard Area (SFHA) designation, Title VII of the Water Resources Development Act (WRDA), the Biggert-Waters Flood Insurance Reform Act of 2012, Section 404 of the Clean Water Act, Coastal Zone Management Act (CZMA), Special Area Management Plans (SAMPs), Louisiana State and Local Coastal Resources Management Act (LSLCRMA), Louisiana Local Coastal Resources Program (LCRP), Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA), Multiple Lines of Defense Strategy (MLODS), Coastal Barrier Resources Act (CoBRA), and the Resources and Ecosystems Sustainability, Tourist Opportunity, and Revived Economies of the Gulf States Act of 2011 (RESTORE) (Figure 2). The Disaster Mitigation Act of 2000 (DMA) was also a major initiative that provided funding for hazard mitigation plans across the country.

Officials initially implemented the Flood Control Act of 1928 in response to devastating floods on the Mississippi River of 1927. Major investments in flood control and prevention followed with the U.S. Army Corps of Engineers (USACE) assuming responsibility for flood control projects with a special emphasis on levee systems (Dunham, 1959). Practitioners accounted for maximum floods or

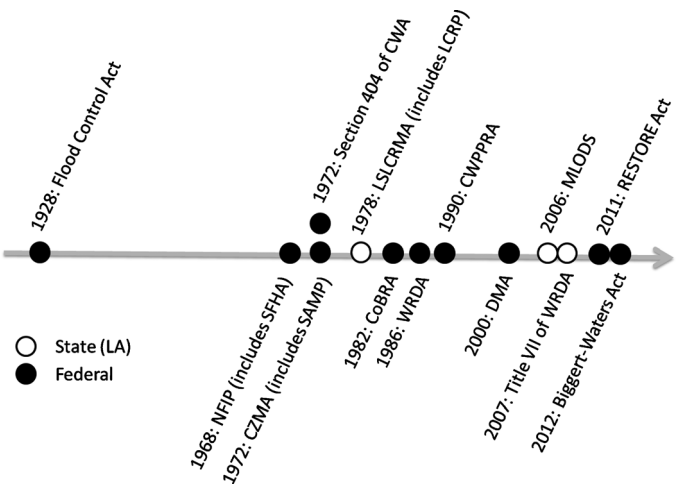

Figure 2. Timeline of Policies, Programs, and Legislation Discussed in Study.

Standard Project Floods, by estimating the maximum potential of severe events (Burby, 2001). This information later evolved into the 100- and 500-year flood estimates that we currently use to designate flood zones and determine flood insurance requirements (Kriesel & Landry, 2004). After USACE officials established flood estimates, the U.S. government soon began to mandate flood insurance in specific areas, thus developing the NFIP that required flood insurance for inhabitants of 100-year flood zones (Kriesel & Landry, 2004).

Established by Congress in 1968, the NFIP mandated affordable insurance to the residences of a floodplain, but with many caveats. For example, the NFIP required a community to enforce certain regulations concerning where to build and in some cases required individuals to build on higher ground or on pilings in order to obtain insurance (Bin, Crawford, Kruse, & Landry, 2008). The NFIP was used to outline SFHAs where houses and other buildings can be constructed as long as they comply with the aforementioned building regulations in which all structures are raised above 100-year flood elevations (Crowell et al., 2010). Zoning within a SFHA is further based on storm surge potential and other flooding hazards (Crowell et al., 2010). Substantial issues concerning the NFIP were debated over the last several decades (Burby, 2001; Griffith, 1994; Houck, 1985). Burby (2001) outlined three major concerns regarding NFIP that included inaccurate mapping and flood zone identification, a lack of accountability concerning compliance with mitigation requirements, and the inadequate spread of risks through insurance. Houck (1985) argued that NFIP was highly influential in Louisiana because of the expansive areas of flood-prone, low-lying land. In Louisiana, the NFIP dictates where people can live and who is required to purchase flood insurance. Houck (1985) suggested that officials need to evaluate relief benefits for flooding disasters, and that they should also examine upstream river controls due to their influences on downstream flooding. Houck (1985) argued that new flood control structures and adjustments to old structures could alter the extent of floodplains farther downstream, which coincided with the previous concern by Burby (2001) that flood zones identified by the Federal Emergency Management Agency (FEMA) and the USACE are mapped inadequately and inaccurately.

In addition to the NFIP, Congress passed the WRDA of 1986 somewhat in conjunction with flood insurance policy and the Flood Control Act. WRDA's design helped local authorities or sponsors share the cost of maintaining flood control structures (Reuss, 1991). This "shared burden" gave more control to local authorities, but in doing so it also loosened federal oversight for flood control structures, leading to unequal protection in some places (Cigler, 2007). The resulting inequality was never more evident than in post-Katrina New Orleans where levee failure was blamed on flooding 80 percent of the city and culpability oscillated between the parish levee district and the USACE (Cigler, 2007). A 2013 report from the Water Science and Technology Board (WSTB) of the National Research Council (NRC) highlighted the inadequacy of not requiring flood insurance for properties located within an accredited (or certified) levee system (that otherwise would be in an SFHA); likewise, the loss of levee system

accreditation has the effect of treating the impacted area as if a levee did not exist at all and can subsequently necessitate that all property owners purchase flood insurance. The 2013 NRC report also indicated that even within a leveed area, there can be multiple gradations of risk (NRC, 2013). Approximately half of the population of Louisiana lives within a leveed area, but the risks inside these leveed areas change drastically with geography. Levee accreditation can depend on the height or construction of a levee and, just like property that has subsidence-induced elevation changes, levees are susceptible to subsidence.

Because of the elevated vulnerability of coastal Louisiana, it is difficult to obtain private insurance-policies are either excessively costly or are not offered for specific locations or hazards owing to the necessity of the NFIP. After the 2005 hurricane season, the NFIP became financially untenable and basically insolvent. Hurricane Sandy reinforced the inadequacy of the current methods of subsidizing flood insurance through the NFIP because far greater costs were incurred than the NFIP obtained through policy holders. It became obvious that insurance reform was necessary (e.g., Cigler, 2009; WSTB NRC, 2013 Report, and US GAO, 2013 High Risk Report) and the Biggert-Waters Flood Insurance Reform Act of 2012 (BW12) was passed in an effort to reorganize the NFIP to make it soluble. To achieve this goal, the BW12 aims to alter current NFIP rates to reflect true flood risk (http://www.fema.gov/flood-insurance-reform-act-2012). In south Louisiana, this has resulted in a contentious debate over how the newest DFIRM maps (currently in the adoption process) are drawn and how to assess homes that were built at the recommended elevation, but are now within the BFE zone. There are multiple reasons that homes may be within a flood zone now, but were previously outside of the zone. Two of the biggest reasons are that the home subsided (e.g., was built 1 foot above BFE, but has since subsided 2 feet and is now 1 foot below BFE) and/or that a nearby levee was de-certified. As the BW12 is currently written, homes under these circumstances would be subject to a substantial flood insurance rate hike.

While many issues can impact insurance rate changes post-BW12, the BW12 provides an example of how difficult it is to address subsidence and ultimately SLR in South Louisiana. Over the course of several decades since levees were constructed, land/levee subsidence coupled with a loss of marshland buffers culminated in the failure of several levee systems (Cigler, 2007). Title VII of the 2007 WRDA began to address some of the issues related to the loss of land in coastal Louisiana (USFWS, 2001). The loss of land was attributable to two main causes: natural subsidence and SLR (USFWS, 2001). The main purpose of Title VII was to "counteract land loss and restore coastal ecosystems to reestablish flood and storm protection for the coastal population" (WRDA, 2007, p. 2). Title VII functions within the confines of the USACE's comprehensive plan that combines restoration plans and previous legislation in addition to hurricane protection plans (WRDA, 2007). While the federal government is slow to enact comprehensive climate change legislation and other comprehensive reforms have unknown consequences (i.e., BW12), smaller efforts such as Title VII begin to address SLR and the future impact of hurricanes under a changing climate.

The structure of coastal laws will largely influence how vulnerable coastal communities respond to SLR and climate change with one extreme being forced realignment, thus creating climate change refugees and perhaps forced construction of sea walls to protect disappearing land (Peloso, Caldwell, & Orbach, 2009). Both of these extremes are being set in motion in the tiny island-nation of the Maldives which has built many sea walls around its population centers, but has also set aside revenue to purchase land in the near future for relocation purposes (Linnenluecke, Stathakis, & Griffiths, 2011). The evolution and interpretation of such laws will likely play out in more locations over the next several generations, especially in south Louisiana where existing legislation is already being tested (Peloso et al., 2009).

Land loss in southeast Louisiana most commonly refers to wetland loss with large amounts of Louisiana's wetlands deteriorating and transforming into open water (FitzGerald, Fenster, Argow, & Buynevich, 2008). Section 404 of the CWA was enacted in 1972 to delineate wetlands for regulatory purposes and to protect wetland resources. Specifically, Section 404 allows the USACE and the US EPA to regulate "isolated" wetlands—those that are not adjacent to navigable waterways or tributaries (Priolo, 1995). These regulations were interpreted to include most wetlands in Louisiana and they served to regulate or prevent the drainage of wetlands, which were severely impacted by agriculture, dredging, and a lack of sustenance caused by levee construction over the past century (FitzGerald et al., 2008; Theis, 1991).

Another important legislative act that influenced coastal Louisiana was the CZMA of 1972. The CZMA transferred authority of a state's coastal zone from the federal government to the state government. This transfer created a highly varied landscape of management efforts and regulations along the coastal United States. To gain full jurisdiction over its coastal zone, a state submits a federally approved Coastal Management Plan (CMP) that outlines a comprehensive method of protecting natural, ecological, and cultural entities while at the same time being compatible with and enabling economic development (Manaster & Selmi, 2010). These goals often conflict with offshore federal regulations and permitting, which subsequently lead to coastal zone degradation, especially along the Louisiana Gulf Coast (Seidemann & Wilkins, 2007). Seidemann and Wilkins (2007) examined a 2007 law-suit filed by Louisiana against the federal government aimed at requiring more in-depth studies concerning how offshore oil and gas activities affect the coastal zone. The state of Louisiana argued that the federal government should be held accountable for violating the state's CZMA regulations and severely impacting the vulnerable coastal environment. In addition to granting more authority to state's concerning their coastal zone, the CZMA also established a framework to address land and water use issues known as SAMPs (Davis, 2004). SAMPs were designed to address more specific problems that arise in a state's coastal zone including land subsidence, SLR, and fluctuating water levels; they often supplement existing management plans and policies (Davis, 2004).

In Louisiana, specific legislation is followed in accordance with the CZMA to regulate coastal development. For Louisiana, the SLCRMA of 1978 required Coastal Use Permits (CUPs) for dredging, construction, shoreline maintenance,

and other development projects (Jessen, 2006). The SLCRMA outlined certain building requirements such as construction elevations as well as prevention of net loss of wetlands during oil exploration. SLCRMA also allowed parishes to gain jurisdiction over their coastal areas to impose more powerful regulations if deemed necessary. The Louisiana Coastal Resources Program (LCRP) was established in 1978 in conjunction with SLCRMA to evaluate impacts of proposed actions on coastal resources (Norris-Raynbird, 2003).

The CWPPRA had an intended goal of identifying, preparing, and funding construction of coastal wetlands restoration projects which have largely been confined to coastal Louisiana (Davis, 2007). CWPPRA projects enhanced storm protection and restored several wetland ecosystems in multiple locations (Davis, 2007). Rapid land-building efforts were also funded by the CWPPRA and resulted in mostly positive outcomes (Petrolia, Kim, Moore, & Caffey, 2009). Funding and cost-sharing procedures for the MLODS were also established through the CWPPRA (Lopez, 2009).

MLODS was created prior to Katrina and published online in 2006 (http://www.mlods.org/). The Nature Conservancy (TNC) and the Lake Pontchartrain Basin Foundation (LPBF) promoted MLODS with the main purpose of providing increased protection to coastal Louisiana from hurricane-induced storm surge (LPBF, 2006). The strategy emphasized the combined use of levees and coastal wetland buffers to reduce storm surge potential and multiple methods of wetland restoration and levee construction were proposed with some proposals already completed such as the closure of the Mississippi River Gulf Outlet (MRGO) (LPBF, 2006). Many other aspects of the strategy are in progress or are currently in the planning and permitting stages (Lopez, 2009).

A major component of the MLODS proposal was the effective management of coastal barrier islands. The CoBRA legislation was enacted in 1982—long before the establishment of MLODS—but the purpose of the legislation complemented the goals of MLODS. The goal of CoBRA was to reduce federal expenditures on coastal inundation by protecting and restoring barrier islands to subsequently allow their use as a first line of defense against storm surge (Salvesen, 2005). CoBRA established a Coastal Barrier Resources System (CBRS) that was utilized by the federal government to maintain and monitor barrier islands throughout the country (Beatley, Brower, & Scwab, 2002).

Prior to 2010, most policies, programs, and legislation were flooding- and/or hurricane-centric, but this changed when the Deepwater Horizon oil spill disaster occurred. The Deepwater Horizon disaster marked one of the most traumatic environmental and economic events in recent memory. From April to July 2010, the oil well spewed nearly five million barrels of crude into the Gulf of Mexico. As the nation watched and read media coverage, months of images of dead and dying sea creatures, out-of-work fishermen, and tar balls plagued the national stage. It would not be until roughly two years later that a policy bright spot would emerge: the RESTORE Act.

Public Law 112-141 (Moving Ahead for Progress in the 21st Century Act) included a far-reaching, complex piece of legislation: The Resources and

Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE Act). This law carved out a creative series of benefits to improve natural and economic systems along the Gulf of Mexico coast. The RESTORE Act had broad bipartisan support, and was even cosponsored by nine of the ten Gulf Coast Senators (Senator J. Cornyn of Texas was the only Gulf member not to cosponsor).

The RESTORE Act has several components and mechanisms. The foremost goal of RESTORE is to direct funds from civil and criminal penalties and fees to Gulf states' recovery processes. Both the civil and the criminal amounts and processes are quite different. The criminal penalties are more ecosystem and research oriented than the more diversified civil penalties which will benefit the economy as much as the natural setting of the Gulf of Mexico.

Before RESTORE, regulators directed total funds from criminal penalties to the national Oil Spill Liability Trust Fund; however, RESTORE Act redirects 80 percent toward the Gulf Coast Restoration Trust Fund. The three criminal contributors to this trust fund are British Petroleum, Transocean, and MOEX; each having played varying roles in the Deepwater Horizon disaster. BP and Transocean are the principal contributors: Transocean agreed to pay $400 million and BP agreed to $4 billion. These criminal penalties will be paid to the National Fish and Wildlife Foundation (NFWF); the National Academy of Sciences; and the Oil Spill Liability Trust Fund. A portion of the BP penalties will go to the North American Wetlands Conservation Fund (Table 1).

Of these monies, only NFWF distributes according to a formula where Louisiana is the largest recipient and Texas the smallest (Table 2).

The full extent of these penalties remains unclear as the trial to determine their amounts has yet to conclude. The RESTORE Act divides any such penalties into five categories known as buckets or pots (Table 3).

While many policies and laws have focused on flood insurance, coastal zone regulations, coastal restoration, and resource management, another major legislative act had a major impact on hazard mitigation efforts in the region. The DMA of 2000 provided a roadmap for regions, states, and communities to develop hazard mitigation plans as well as spur creativity and more local-level involvement. The DMA was an amendment to the Robert T. Stafford Disaster Relief and Emergency Assistance Act that put more emphasis on a coordinated mitigation effort that started at the local or state level instead of the federal level (Moss, Schellhamer, & Berman, 2009). This emphasis somewhat conflicted with the

Table 1. Distribution of Funds From Criminal Penalties Delineated by the Principal Contributor (Ramseur, 2012)

	BP	Transocean
National Fish & Wildlife Foundation	$2,394,000,000	$150,000,000
National Academy of Sciences	$350,000,000	$150,000,000
Oil Spill Liability Trust Fund	$1,150,000,000	$100,000,000
North American Wetlands Conservation Fund	$100,000,000	N/A

Table 2. State Proportion of Funding From the NFWF

National Fish & Wildlife Foundation Fund Distribution by State	
Louisiana	50%
Alabama	14%
Florida	14%
Mississippi	14%
Texas	8%

"chain of command" hierarchy normally followed by FEMA and accentuated in the National Incidence Management System and Incident Command System (NIMS/ICS) established by FEMA (Lester & Krejci, 2007). The NIMS/ICS framework established a top-down approach where procedures and instructions were passed down a chain of command that often started at the federal level during a large scale disaster and eventually ended with emergency planners and

Table 3. Allocation of Civil and Administrative Penalties as Determined Through the RESTORE ACT (Environmental Law Institute, 2013)

Pot 1: Equal-share State Allocations (35%)	Equal State Allocations
	Funds must be for ecological and/or economic restoration of the Gulf Coast
	7% to each state: of this Louisiana divides it into 70% for the State and 30% to parishes based on percentage oiled
Pot 2: Gulf Coast Ecosystem Restoration Council (30% +50% of the interest)	Creates the Gulf Coast Ecosystem Restoration Council
	Funds must target restoration and protection of Gulf natural resources.
	11 members: Secretaries of Interior, Army, Commerce (selected as chair), Agriculture, and Home Land Security; Administrator of EPA; and Governors of each Gulf state
Pot 3: Impact State Allocations (30%)	Impact-based State Allocations
	Funds must pay for projects, programs, and activities that will improve the ecosystems or economy of the Gulf Coast region.
	Louisiana Coastal Protection and Restoration Authority (LCPRA) administers funds
Pot 4: Regional Science, Observation, Monitoring, and Technology Program (2.5%)	NOAA, FWS, and the Centers of Excellence (LCPRA in La.) develop coordinated plan
	This program must "carry out research, observation, and monitoring to support, to the maximum extent practicable, the long-term sustainability of the ecosystem, fish stocks, fish habitat, and the recreational, commercial, and charter fishing industry in the Gulf of Mexico"
Pot 5: Centers of Excellence (2.5%)	Louisiana Coastal Protection and Restoration Authority (LCPRA)
	Funds have to be for competitive grants to nongovernmental entities and consortia in the Gulf Coast region

first responders (Bigley & Roberts, 2001). The role of the ICS was to delegate authority, establish incident facilities, establish the use of common terminology, and prompt the creation of an Incident Action Plan (IAP).

Overall, the NIMS/ICS framework categorizes those affected by disasters as victims (Lester & Krejci, 2007), but the DMA empowered those same people to plan for and react to future disasters. Whether this brings together an ideal balance of the top-down chain of command approach or the bottom-up community involvement approach is undeterminable, but the DMA does outline a more coordinated effort that starts with a bottom-up approach to mitigation planning. Many communities in Louisiana have taken advantage of the Hazard Mitigation Grant Program (HMGP) related to the DMA to provide a detailed strategy about how they will confront and plan for potential emergency or disaster situations.

Through a cross-examination of many of these policies and laws, mitigation is not clearly defined, but an evolving definition has begun to emerge. Mitigation can be defined as a series of methods that seek to outline vulnerabilities in a community and address these problems prior to a disaster (e.g., develop barriers to impede storm surge, restore wetlands, fund local mitigation planning). Conversely, recovery can be defined as the series of methods that are undertaken in the post-disaster phase after damage has already occurred or in some cases continues to occur. These definitions are consistent with most legislative acts, but "mitigation" and "recovery" are sometimes misrepresented as being the same with many policies and laws incorporating both. Mitigation is the main focus of most of the previously mentioned policies and strategies, but post-disaster recovery is either implicitly or explicitly accounted for in several policies including the NFIP, Title VII of the WRDA, CZMA, and DMA. Many polices commonly address both mitigation and recovery efforts since they can be viewed as interlinked components of pre- and post-disaster planning.

Regional Hazard Mitigation Plans

Specific disasters or emergency situations have been described extensively, especially for the Gulf Coast region with studies conducted about a multitude of components related to Hurricane Katrina. Many studies examined disaster mitigation and preparation leading up to Hurricane Katrina and the disjointed response effort that exposed major problems with bureaucratic protocol and collaboration between local and federal agencies (Derthick, 2007; Dowty & Wallace, 2010; Lester & Krejci, 2007). Changes in the natural environment that may be related to climate change make these specific disasters even more catastrophic, especially in vulnerable coastal areas and inland floodplains. In addition to exacerbating disasters, climate change itself could also be considered a "slow disaster" because of its far-reaching impact on so many natural processes. A "slow disaster" would be extremely difficult to encourage communities to prepare for because the impact is usually realized over the course of years and decades instead of a few hours or days, as is the case with most disasters. While

hazard mitigation plans (HMPs) become more common in communities throughout Louisiana (and Mississippi) since Hurricane Katrina, climate change is rarely included in these plans. Some parishes and communities south and southwest of New Orleans, LA (e.g., Terrebonne and Lafourche) that are severely impacted by land subsidence, human influences, and SLR have actually addressed these problems in their HMPs.

Numerous HMPs were developed by local communities in response to recent hurricanes and in conjunction with the DMA. Many coastal Louisiana HMPs identified hurricanes, floods, storm surge, levee failure, land subsidence, thunderstorms, saltwater intrusion, and expansive soils as medium to high risk natural hazards (Jefferson HMP 2005, Lafourche HMP 2006, Orleans HMP 2006, Plaquemines HMP 2005, Terrebonne HMP 2005). Many of the same plans note that land subsidence and SLR exacerbate the potential for damage caused by flooding, storm surge, and saltwater intrusion. Mitigation plans in coastal Louisiana also allude to modeling and predicting the influence of SLR, land subsidence, and freshwater/sediment diversion as a means of mitigation and planning for future development. Increased mapping programs, land development regulations, and building codes were also suggested to mitigate the impact of looming disasters related to climate change. This proactive planning may yield unwanted, but necessary results and may encourage the relocation or "realignment" of populations that has previously been a suggested adaptation option (Peloso et al., 2009). Realignment may be initially caused by saltwater intrusion of groundwater sources as currently experienced in the Maldives (Linnenluecke et al., 2011).

While land subsidence is a concern in most areas of southeast Louisiana, accretion has occasionally exceeded subsidence in some locations (Day et al., 2008; Turner, Baustian, Swenson, & Spicer, 2006). The combined potential for more intense tropical cyclones (IPCC, 2008) and predicted SLR that will eventually exceed accretion rates (Rybczyk & Cahoon, 2002) may lead to an increase in vulnerability associated with flooding and storm surge. As part of the NFIP, repetitive loss properties (i.e., repeatedly flooded properties) were purchased in some areas of southeast Louisiana (Nance, 2009), but as the potential for flooding expands into new areas, flood zones need to be constantly re-evaluated. The previous HMPs for Louisiana parishes showed that an increased potential for coastal flooding and storm surge extents have been examined around estuaries and coastal floodplains, but a change in the return periods of such events caused by climate change may constitute a re-drawing of flood zones or a re-evaluation of flood control structures and mitigation plans.

HMPs in the region largely complemented the intended goals and policies of the DMA by outlining mitigation plans and defining coordinated, hierarchical responses to various major hazards that will likely occur. Many HMPs, however, were very similar in composition and substance and lacked detailed mitigation strategies, but instead seemed to fit into a "cookie cutter" approach to hazard mitigation that merely represented a document of preparation instead of a "culture of preparation." This follows the findings of Berke, Smith, and Lyles

(2012), which concluded that many coastal HMPs are moderate to low in quality, but that they have improved over the past decade. An underlying purpose of the DMA was to combat the reoccurring breakdown of the community structure post-disaster and the transformation of the community into a rigid police society as described by Kreps (1984) in regards to previous disaster response efforts. This repeated reaction has actually served to inhibit effective disaster response because of a lack of community involvement (Dynes, 1994) and it parallels the collective behavior versus complex organization behavior debate (Quarantelli & Dynes, 1977).

These conflicting behaviors originate from different angles (community-up vs. non-local/government response-down) and a balance between the two has often not been found resulting in a slower and less effective response. The idea behind a bottom-up approach lends itself to the creativity, care, and knowledge that a local community has for itself post-disaster. People in a community affected by a disaster know what "normal" is for them and generally can respond to a disaster more coherently and effectively than some outside entity (e.g., national government) that comes in to restore "command," but a lack of involvement at the community level during HMP-creation will only perpetuate poor disaster response efforts.

In addition to addressing a lack of specificity, another important area of concern for HMPs when considering climate change is how they currently address environmental mitigation. Many HMPs combined an approach that served to limit the potential damage that a disaster can cause (e.g., improving drainage systems to reduce flood risks) and an approach that limited the exposure that a community subjects itself to in environmentally vulnerable areas (e.g., buying of repetitive loss structures). With a lack of overarching federal regulations mandating the inclusion of climate change adaptation in HMPs, the development and implementation of strategies lays solely on the individual states and more specifically the communities that make up each state.

Discussion and Future Research

Levels of awareness and concern over the potential impacts of climate change in South Louisiana have steadily increased over the past several years. The combination of increasing flood losses and a rapidly changing coastline helped to spur legislative action (e.g., Title VII of WRDA, BW12, etc.) and local mitigation (e.g., parish HMPs). Action at both the local and federal levels are helping to address the concerns of a "slow disaster" and not creating or exacerbating a "slow disaster." At the federal level, the potential for escalating costs associated with climate change resulted in a FEMA-commissioned report about the impact of climate change and population growth on the NFIP through 2100 (AECOM, 2013). The report found that the total number of policyholders participating in the NFIP in coastal areas is estimated to increase up to 130 percent through the year 2100. Coincidentally, an estimated population increase of approximately 60 percent in coastal SFHAs by 2100 based on "fixed" coastal

shorelines and approximately 100 percent based on "receding" coastal shorelines is expected. Additionally, more than 50 percent, and possibly as many as 75 percent, of the policies in 2100 will be considered "grandfathered" because they will not be representative of their floodplain depth risk classification.

The goal of the BW12 was to change the formula for assessing flood-prone properties (thus reducing "grandfathering") so that each policy represented the true risk of the property, but there are many complications that have arisen from the legislation. NFIP policy premium increases on the order of thousands of dollars per year is expected (according to articles from the *Times-Picayune* (http://www.nola.com/politics/index.ssf/2013/08/how_controversial_biggert-wate.html) and *New York Times* (http://www.nytimes.com/2013/07/29/nyregion/overhaul-and-a-hurricane-have-flood-insurance-rates-set-for-huge-increases.html?_r=0)), but exact numbers are difficult to calculate. Section 207 of BW12 is the most worrisome to Louisiana residents (as well as other Gulf Coast residents and residents impacted by Hurricane Sandy in the Northeast) because this section of the law ends grandfathered rates for homes that were built above BFE at the time of construction. As of the fall of 2013, issues surrounding the implementation of BW12 are still in flux and legislators are proposing changes to BW12, most notably Senator Mary Landrieu's "Strengthen, Modernize and Reform The National Flood Insurance Program" (SMART NFIP) Act, which would allow currently grandfathered homes to keep their subsidized flood insurance rate even if they are sold. It is difficult to know how the NFIP will changed based on the multitude of proposed changes to BW12, but at the very least there is a federal, comprehensive effort to address long-term concerns over the viability of the NFIP.

In addition to the FEMA-commissioned report about climate change, the NRC 2013 report about levees and the NFIP, and the BW12, the US Government Accountability Office (GAO) also added two areas to their "high risk" list in 2013: mitigating gaps in weather satellite data and limiting the federal government's fiscal exposure by better managing climate change risks (GAO, 2013). Within the second area, the GAO indicated that the federal government is not well-positioned for the potential impacts of climate change since many of its own assets (infrastructure, military installations, etc.) as well as insured property through NFIP collectively create a high level of exposure that could snowball into a larger financial issue.

Between the FEMA-commissioned report on climate change and the GAO report on areas of high risk, climate change is clearly a top priority at the federal level. The two reports contained several recommendations including a government-wide strategic approach, improved geospatial accuracy of policies/claims, improved elevation data, and improved data regarding property and property value distributions across floodplains. Beyond these recommendations, levee heights should be continuously monitored. Currently the Louisiana Center for GeoInformatics is studying this possibility so that levees can be improved to meet accreditation (1 percent flood) standards. In especially vulnerable areas of coastal LA, elevating homes should be considered even within leveed areas based on the level of potential risk.

Within the sphere of hazard mitigation, post-Katrina, Rita, Ike, and Gustav mitigation measures have promoted comprehensive flood planning and risk management based on both structural and nonstructural measures (Cigler, 2009). Cigler (2009) presented other challenges for coastal communities, namely insurance reform and risk perception. The two challenges can go hand-in-hand with insurance reform altering the current trend where the taxpayers incur most of the burden of disasters since insurance companies often shift liability by manipulating insurance losses so that the losses have to be covered by the federal government (i.e., through the NFIP). With risk perception, most individuals who live in levee-protected areas have a false sense of security and will likely not purchase flood insurance unless required to do so. BW12 is attempting to partially address this issue, but the lack of a comprehensive (cross-agency and cross-jurisdictional) levee management and assessment system it is difficult the level of risk within levee-protected areas. In addition to these measures, Godschalk, Brody, and Burby (2003) examined the hazard mitigaiton planning process and advocated for increased public input to hazard mitigation policies in local comprehensive plans because current public involvement is low, but the potential risks are very high. An increase in public involvement will likely aid in improving problems with risk perception as outlined by Cigler (2009).

Parish HMPs for southeast Louisiana represent examples of including climate change adaptation strategies, but more must be done if we are to avoid catastrophic economic losses (Medlock, 2010). Medlock (2010) outlined eight activities that should be enacted as part of a community's adaptive strategy for climate change and these strategies should and can be implemented in non-coastal regions as well because climate change will impact different regions in varying capacities. The proposed strategies include the adoption of long-term planning into HMP's involving anticipated withdrawal from at-risk areas, analysis of key industries and employers to evaluate commercial sector vulnerability, implementation of integrated water resource planning that accounts for water quality and supply, development of relationships with other communities in the same watershed in order to create regional adaptation plans, planning for natural resources adaptation, collection, and sharing of data to support analysis of local changes, involvement of the public health sector to better understand epidemiological adaptations, and collaboration with other groups to identify social impacts and improve public involvement (Medlock, 2010). Current processes of HMP-development provide a framework for the addition of adaptation strategies, but strategies will only be included at the discretion of the local community. A highly detailed guidebook was published that outlines the main components and needs for preparing for climate change at the local, regional, and state government levels (CSES, 2007). The overall opinion is that we cannot wait any longer to implement climate change adaption strategies and in some cases we have already waited too long (Peloso et al., 2009).

The frameworks established by guidebooks, adaptation strategies, and HMPs collectively promote interaction with and input from local planners, community organizers, and government officials in an effort to address current and future

disaster mitigation efforts and decrease the current "knowledge resolution" gap that exist at the mitigation planning stage in most communities. These interactions are also needed to address how knowledgeable the communities are about the risks associated with climate change and how they can better prepare for and mitigate these potential impacts. It is anticipated that economic loss models such as FEMA's HAZUS-MH and USACE's HEC-FIA will assist many communities in quantifying future disaster impacts that may be worsened by changes in climate to better inform the public about the need to be proactive now instead of reactive later (Johnson & Weaver, 2009; Palmer et al., 2009). Future economic loss models will not be able to account for future development, but they may aid substantially in future mitigation efforts and development planning by identifying structures and areas that will eventually become more at risk. Community planners and government officials will have the tools and analyses needed to make an informed decision and prevent future loss, but a continued lack of cross-hierarchical coordination may hamper these efforts.

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References

2013. *Levees and the National Flood Insurance Program: Improving Policies and Practices*. Washington, D.C.: The National Academies Press.

AECOM. 2013. *The Impact of Climate Change and Population Growth on the National Flood Insurance Program Through 2100*. Michael Baker, Jr. Inc. and Deloitte Consulting, LLP.

Beatley, T., D. Brower, and A. Scwab. 2002. *An Introduction to Coastal Zone Management*, 2nd ed., Washington, DC: Island Press.

Berke, P., G. Smith, and W. Lyles. 2012. "Planning for Resiliency: Evaluation of State Hazard Mitigation Plans under the Disaster Mitigation Act." *Natural Hazards Review* 13: 139–49.

Bigley, G., and K. Roberts. 2001. "The Incident Command System: High-Reliability Organizing for Complex and Volatile Task Environments." *The Academy of Management Journal* 44: 1281–99.

Bin, O., T. W. Crawford, J. B. Kruse, and C. E. Landry. 2008. "Viewscapes and Flood Hazard: Coastal Housing Market Response to Amenities and Risk." *Land Economics* 84: 434–48.

Burby, R. J. 2001. "Flood Insurance and Floodplain Management: The US Experience." *Global Environmental Change Part B: Environmental Hazards* 3: 111–22.

Cigler, B. 2009. "Post-Katrina Hazard Mitigation on the Gulf Coast." *Public Organization Review* 9: 325–41.

Cigler, B. A. 2007. "The "Big Questions" of Katrina and the 2005 Great Flood of New Orleans." *Public Administration Review* 67: 64–76.

Conner, W. H., T. W. Doyle, K. W. Krauss, C. P. O'Neil, M. P. V. Melder, A. S. From, and M. M. Palta. 2007. *Tidal Freshwater Swamps of the Southeastern United States: Effects of Land Use, Hurricanes, Sea-Level Rise, and Climate Change. Ecology of Tidal Freshwater Forested Wetlands of the Southeastern United States*. Netherlands: Springer, 1–28.

Crowell, M., K. Coulton, C. Johnson, J. Westcott, D. Bellomo, S. Edelman, and E. Hirsch. 2010. "An Estimate of the U.S. Population Living in 100-Year Coastal Flood Hazard Areas." *Journal of Coastal Research* 26: 201–11.

CSES. 2007. *Center for Science in the Earth System (The Climate Impacts Group)—Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments*. Seattle, WA: University of Washington.

Davis, B. C. 2004. "Regional Planning in the US Coastal Zone: A Comparative Analysis of 15 Special Area Plans." *Ocean & Coastal Management* 47: 79–94.

Davis, M. 2007. "A Whole New Ballgame: Coastal Restoration, Storm Protection, and the Legal Landscape After Katrina." *Louisiana Law Review* 68: 419–42.

Day, J., R. Christian, D. Boesch, A. Yáñez-Arancibia, J. Morris, R. Twilley, L. Naylor, L. Schaffner, and C. Stevenson. 2008. "Consequences of Climate Change on the Ecogeomorphology of Coastal Wetlands." *Estuaries and Coasts* 31: 477–91.

Derthick, M. 2007. "Where Federalism Didn't Fail." *Public Administration Review* 67: 36–47.

Diffenbaugh, N. S., and M. Ashfaq. 2010. "Intensification of Hot Extremes in the United States." *Geophysical Research Letters* 37: 1–5.

Dowty, R. A., and W. A. Wallace. 2010. "Implications of Organizational Culture for Supply Chain Disruption and Restoration." *International Journal of Production Economics* 126: 57–65.

Dunham, A. 1959. "Flood Control Via the Police Power." *University of Pennsylvania Law Review* 107: 1098–132.

Dynes, R. 1994. *Disastrous Assumptions About Community Disasters*. Newark, Delaware: University of Delaware.

Environmental Law Institute. *The RESTORE Act: Comparing the Funding Mechanisms*. Washington, DC: The Environmental Law Institute. http://eli-ocean.org/gulf/files/RESTORE-Act-Comparison.pdf

FitzGerald, D. M., M. S. Fenster, B. A. Argow, and I. V. Buynevich. 2008. "Coastal Impacts Due To Sea-Level Rise." *Annual Review of Earth and Planetary Sciences* 36: 601–47.

Gleason, K. L., J. H. Lawrimore, D. H. Levinson, T. R. Karl, and D. J. Karoly. 2008. "A revised U.S. Climate Extremes Index." *Journal of Climate* 21: 2124–37.

Godschalk, D. R., S. Brody, and R. Burby. 2003. "Public Participation in Natural Hazard Mitigation Policy Formation: Challenges for Comprehensive Planning." *Journal of Environmental Planning and Management* 46: 733–54.

Griffith, C. 1994. "The National Flood Insurance Program: Unattained Purposes, Liability in Contract, and Takings." *William and Mary Law Review* 35: 727–765.

Houck, O. 1985. "Rising Water: The National Flood Insurance Program and Louisiana." *Tulane Law Review* 60: 61–164.

IPCC. 2008. *IPCC Technical Paper VI: Chapter 5: Analyzing Regional Aspects of Climate Change and Water Resources*. Geneva: IPCC Secretariat.

Jentsch, A., J. Kreyling, and C. Beierkuhnlein. 2007. "A New Generation of Climate-Change Experiments: Events, Not Trends." *Frontiers in Ecology and the Environment* 5: 365–74.

Jessen, A. 2006. "Louisiana and the Coastal Zone Management Act in the Wake of Hurricane Katrina: A Renewed Advocacy for a More Aggresive Use of the Consistency Provision to Protect and Restore Coastal Wetlands." *Ocean and Coastal Law Journal* 12: 133–160.

Johnson, T., and C. Weaver. 2009. "A Framework for Assessing Climate Change Impacts on Water and Watershed Systems." *Environmental Management* 43: 118–34.

Kreps, G. A. 1984. "Sociological Inquiry and Disaster Research." *Annual Review of Sociology* 10: 309–30.

Kriesel, W., and C. Landry. 2004. "Participation in the National Flood Insurance Program: An Empirical Analysis for Coastal Properties." *Journal of Risk and Insurance* 71: 405–20.

Lester, W., and D. Krejci. 2007. "Business Not as Usual: The National Incident Management System, Federalism, and Leadership." *Public Administration Review* 67: 84–93.

Linnenluecke, M. K., A. Stathakis, and A. Griffiths. 2011. "Firm Relocation as Adaptive Response to Climate Change and Weather Extremes." *Global Environmental Change* 21: 123–133.

Lopez, J. A. 2009. "The Multiple Lines of Defense Strategy to Sustain Coastal Louisiana." *Journal of Coastal Research* 54: 186–97.

LPBF. 2006. *Pontchartrain Coastal Lines of Defense Program*. http://www.saveourlake.org/wetlands.htm Accessed May 2, 2011.

Manaster, A., and D. Selmi. 2010. "Coastal Zone Regulation." *California Environmental Law & Land Use Practice* 4: 129–139.

McCabe, G. J., and D. M. Wolock. 2002. "A Step Increase in Streamflow in the Conterminous United States." *Geophysical Research Letters* 29: 2185–2189.

Medlock, S. 2010. "Local Response to a Global Challenge—How Communities Prepare the Nation for Climate Change." In *White National Flood Policy Forum*, ed. F. Gilbert. Washington, DC: ASFPM Foundation, 38–42.

Moss, M., C. Schellhamer, and D. Berman. 2009. "The Stafford Act and Priorities for Reform." *Journal of Homeland Security and Emergency Management* 6: Article 13.

Nance, E. 2009. "Responding to Risk: The Making of Hazard Mitigation Strategy in Post-Katrina New Orleans." *Journal of Contemporary Water Research & Education* 141: 21–30.

Nickl, E., C. J. Willmott, K. Matsuura, and S. M. Robeson. 2010. "Changes in Annual Land-Surface Precipitation Over the Twentieth and Early Twenty-First Century." *Annals of the Association of American Geographers* 100: 729–739.

Norris-Raynbird, C. 2003. *Capacity-Building: An Inquiry Into the Local Coastal Program Component of Coastal Zone Management in Louisiana*. College Station, TX: Texax A&M.

Palmer, M., D. Lettenmaier, N. Poff, S. Postel, B. Richter, and R. Warner. 2009. "Climate Change and River Ecosystems: Protection and Adaptation Options." *Environmental Management* 44: 1053–1068.

Peloso, M., M. Caldwell, and M. Orbach. 2009. *National Law & Climate Change Adaptation: A Comparative Analysis With Implications for Response to Sea Level Rise. Climate Change: Global Risks, Challenges and Decisions.* IOP Publishing, IOP Conference.

Petrolia, D., T. Kim, R. Moore, and R. Caffey. 2009. *A Cost Analysis of Rapid Land-Building Technologies for Coastal Restoration in Louisiana*. Paper presented at the Southern Agricultural Economics Association Annual Meeting (SAEAA), Atlanta, Georgia, January 31–February 3, 2009.

Priolo, D. 1995. "Section 404 of the Clean Water Act: The Case for Expansion of Federal Jurisdiction Over Isolated Wetlands." *Land and Water Law Review* 30: 91–108.

Quarantelli, E. L., and R. R. Dynes. 1977. "Response to Social Crisis and Disaster." *Annual Review of Sociology* 3: 23–49.

Ramseur, J. L. 2012. *Enacted and Proposed Oil Spill Legislation in the 112th Congress*, Congressional Research Service Report R41684.

Reuss, M. 1991. *Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986*. AD-A-253414/7/XAB; IWR--91-PS-1 United StatesTue Feb 12 16:22:10 EST 2008NTISGRA; GRA-92-20320; EDB-92-166035English.

Rybczyk, J., and D. Cahoon. 2002. "Estimating the Potential for Submergence for Two Wetlands in the Mississippi River Delta." *Estuaries and Coasts* 25: 985–98.

Salvesen, D. 2005. "The Coastal Barrier Resources Act: Has it Discouraged Coastal Development?" *Coastal Management* 33: 181–95.

Seidemann, R., and J. Wilkins. 2007. "Blanco v. Burton: What Did We Learn From Louisiana's Recent OCS challenge?" *Pace Environmental Law Review* 25: 393–440.

Theis, J. G. 1991. *Wetlands Loss and Agriculture: The Failed Federal Regulation of Farming Activities under Section 404 of the Clean Water Act*. DigitalCommons@Pace.

Turner, R. E., J. J. Baustian, E. M. Swenson, and J. S. Spicer. 2006. "Wetland Sedimentation from Hurricanes Katrina and Rita." *Science* 314: 449–52.

United States Government Accountability Office (GAO). 2013. *High Risk Series: An Update*. Technical Report GAO-13-283. February, 2013. 275 pp. http://www.gao.gov/assets/660/652133.pdf.

USFWS. 2001. *Economic Analysis of Critical Habitat Designation for the Piping Plover: Wintering Habitat*. Cambridge, MA: Industrial Economics, Incorporated.

WRDA. 2007. *Title VII LCA: The Water Resources Development Act Title VII Louisiana Coastal Area*.