Spring 5-8-2024

Breaches in the Levee: Increasing Sea Level Rise and Hurricane Activity in New Orleans

Ian A. Gere

Breaches in the Levee:

Increasing Sea Level Rise and Hurricane Activity in New Orleans

Ian Gere

Abstract

Studies have shown that, since 2010, an unprecedented acceleration of sea level rise (SLR) along the U.S. East Coast and the Gulf of Mexico has exacerbated the devastation wrought by hurricanes in these regions. This paper focuses on the risks this acceleration poses to the city of New Orleans, highlighting how the city is extremely vulnerable and unprepared for a major hurricane in spite of efforts to mitigate the impacts of hurricanes since Hurricane Katrina. Chapter One uses data from the National Oceanic and Atmospheric Administration and the United States Geological Survey to illustrate how an increase in SLR combined with the loss of coastal wetlands along the Mississippi River Delta makes New Orleans extraordinarily vulnerable to flooding. Though the 20th century is often cited as the moment in which New Orleans dedicated itself to levee usage as a means of mitigating flood risks, Chapter Two dispels this idea and discusses the environmental history of New Orleans, emphasizing the need to look at the Antebellum Period as the moment where levee construction became an integral part of the city. Chapter Three explores the government's responses to Hurricane Katrina, exploring how Katrina's political failures have shaped current flood-control policies and disaster management protocol. Expanding upon this, Chapter Four uses environmental justice concepts to analyze the environmental racism incurred by Black residents in the aftermath of Katrina. Chapter Five provides achievable solutions for New Orleans, such as the restoration of the coastal wetlands, calling on lawmakers to hold the U.S. Army Corps of Engineers accountable for levee breaches, ensuring that city officials and residents are educated on disaster protocol in the event of hurricanes and floods, and halting all construction on lands below sea level.

Keywords: New Orleans, Mississippi River Delta, sea level rise, levees, environmental history, environmental justice, environmental politics, environmental racism

Table of Contents:

Introduction: Dredging up the Past

During the early years of Thomas Jefferson's presidency, the acquisition of the Louisiana territory from the French was a matter of great importance. Ownership of this region would nearly double the size of the country, grant control over the Port of New Orleans, and secure access to the Mississippi River Valley. Although the third President of the United States was eager to acquire the Louisiana territory, he was well aware of New Orleans's ecological limitations. Before the Louisiana Purchase, in the President's 1803 pamphlet, *An Account of Louisiana*, he felt, "it may be necessary to mention here, that the whole lower part of the country…is subject to overflowing in hurricanes," but reassured potential settlers that "fortunately they are not frequent" (Jefferson, 1803, 14-15). At the time of the pamphlet's publication, a notably destructive hurricane in New Orleans had not occurred since 1794. However, a cyclone of devastating proportions struck New Orleans in 1812, the same year Louisiana was granted statehood.

Jefferson's confidence in the safety of New Orleans from hurricanes and subsequent flooding was not unwarranted. Under French colonial rule, the first levees, made of earthen material and supported by timber, were put in place throughout the lower Mississippi Valley. Construction of the first levees in the early eighteenth century gave settlers a sense of security and a boost of confidence, for the levees reminded French colonists that they had conquered the Mississippi River (Morris 2012, 95). However, the self-assured hubris among colonists regarding their artificial levees was rechallenged time and time by flooding spurred by various hurricanes or other tropical storms that are a regular feature of New Orleans's climate. Nevertheless, even after the levees had breached and the city was rampant with floodwater, the solution was always to reconstruct them but ensure they were higher than the previous ones.

Ever since the French colonial era to the present, the use of levees to mitigate flood risks has been a prominent feature of New Orleans; however, the efficacy of such levees has remained contentious, especially after the levees failed in 2005 during the catastrophic Hurricane Katrina. Climate change will challenge the effectiveness of these levees as it continues to exacerbate the effects of hurricanes and other tropical cyclones in New Orleans. The city's low-lying elevation also puts more pressure on its levees due to the acceleration of sea level rise in the Gulf of Mexico as a result of climate change. Therefore, this thesis will grapple with the paradoxical nature of New Orleans's inadequate flood management system and the severe risks posed by climate change. Chapter One will begin with an overview of the Mississippi River Delta's ecology, followed by a quantitative analysis of the risks of climate change on a wetland city dedicated to levees. Typically, discussions associated with New Orleans's failed levees point to 1928, after the Great Mississippi Flood of 1927 propelled the city to reevaluate its levee systems. Chapter Two of this thesis, however, will explore the environmental history of the Mississippi River Delta, arguing that it was levee construction by enslaved people in the Antebellum Period that resulted in the city's dependence on levee systems. Chapters 3 and 4 will both examine Hurricane Katrina through different disciplines. Chapter 3 will employ political science to analyze government officials' decisions during and after Katrina, exposing how such decisions transformed a natural disaster into a man-made catastrophe. Given the severe inequities spurred by Hurricane Katrina on residents of color, Chapter Four will explore the environmental injustices faced in the aftermath of this catastrophe and how this has affected the city's plan for future flooding events. In Chapter Five, this thesis will offer policy recommendations that will help better prepare the city for future hurricanes and floods. This thesis will show that levee construction in the Mississippi River Delta since the pre-Civil War era has trapped New Orleans

in a conundrum when it comes to preparing for rising sea levels induced by climate change, so much so that current infrastructural plans will need to update to a scale that has not been thought of thus far.

Chapter 1: The Business of New Orleans's Ecology

New Orleans, otherwise known as the birthplace of jazz, is highly regarded for its Creole cuisine, unique dialects, and the city's opulent Madis Gras celebrations. While such attributes give the city its distinctive character, many forget the very foundation upon which the city sits: the Mississippi River Delta. As the city lies amid the confluence of the Mississippi River and the Gulf of Mexico, New Orleans's environment – much like its cultural life – is rather intricate. As such, it would be remiss to understand the city's ecology as monolithic. Thus, this chapter breaks down the city's environmental issues into three parts. In order to do so, this chapter begins by employing the concepts of ecosystem services to illustrate the city's natural ecology best. Having discussed the region's natural environment, the second section will reveal how implementing levee systems throughout New Orleans has led to the degradation of the city's natural environment, amplifying the effects of climate change. In conjunction with the environmental implications levees pose to the city, the final section concludes with an assessment of related data concerning how increased hurricane activity and sea level rise (SLR) threaten the coastal city. Because New Orleans is on the frontlines of climate change, it is necessary that this chapter chronicles the relationship between the city's current environmental problems within the broader context of its complex ecology.

Per the Millenium Ecosystem Assessment framework, there are four identifiable types of ecosystem services: provisioning, regulating, cultural, and supporting (Millenium Ecosystem

Assessment Program 2005, 39). Supporting services include processes such as nutrient cycling, soil formation, and primary production, which are all necessary for the production of all other ecosystem services. Provisioning services encompass the materials or energy products of ecosystems, whereas regulating services maintain the ability of an ecosystem to provide material contributions. Cultural services are benefits through aesthetic, spiritual, and cultural values that allow humans to create a connection with nature. Understanding this issue through the lens of ecosystem services is important because a report found that "coastal Louisiana's provision of ecosystem services stated that the delta generates at least $12 billion to $47 billion (2007 dollars) in ecosystem benefits" (Herrera 2019, 261). Therefore, this chapter uses the concept of ecosystem services to illuminate the challenges posed to saving an urbanized deltaic city in the wake of climate change.

Meet Me in the Louisiana Bayou. When Mark Twain recounted his escapades along the Mississippi River in his memoir, *Life on the Mississippi*, he began by proclaiming that the Mississippi "is not a commonplace river, but on the contrary, is in all ways remarkable" (Twain 2006). Though the American writer lacked the necessary background to assess the scientific character of the Mississippi River formally, Twain was well aware of the fact that there was something remarkable about the river and its surrounding ecology. While the complex environment of the Mississippi River Delta clung to Twain's mind, he was not wrong to claim that the river and its surrounding ecosphere were remarkable; in fact, data from the natural sciences echoes the writer's sentiments.

To understand the quantitative data concerning New Orleans's environmental issues, defining terms used to identify the region's geographic and physiographic settings is necessary. These distinctions are necessary because many of these terms are used interchangeably (Saucier

1994, 22). The Mississippi alluvial valley was formed "during the last glacial state, when sea level was several hundred feet lower than at present, the Mississippi River valley system became deeply incised within the coastal plain sediments" (Fisk 1944, 5). Within this valley lies the Lower Mississippi Valley, which is "the overall Mississippi River system of the United States that lies between the latitude of Cape Girardeau and the Gulf of Mexico" (Saucier 1994, 22). New Orleans sits on the Mississippi River's deltaic plain; its average elevation is only 5 ft above sea level (Saucier 1994, 24). Specifically, in Louisiana, the alluvial valley merges with the deltaic plain, with the latter extending roughly 150 miles (Saucier 1994, 24). By the Middle Archaic period (6000-2000 B.C.), sea levels reached their modern levels along Louisiana's deltaic lobes (Rees 2010, 39). Furthermore, the river's hydrology creates a natural levee made of soil deposits at the river's delta, meaning mud and seasonal flooding are a staple of the river (Kelman 2007, 695).

Rather than being a deterrent, the Plaquemine people of the lower valley (A.D. 1200-1700) attached spiritual values to the Deltaic Plains wetland environment (Morris 2012, 17; Rees 2010, 172). From an archaeological standpoint, it is clear that the Plaquemine people understood their environment as a cultural ecosystem service, as evidenced by their earthen mounds reserved as mortuary temples and residences of chiefs (Rees 2010, 176). The Plaquemines also saw the seasonal flooding of the Deltaic plain as sacred, serving as a form of regeneration to the wetland environment (Morris 2012, 17). As archaeological evidence suggests, the Native Americans of the Lower Mississippi Valley attributed spiritual values to the environment long before the arrival of the Europeans.

Though Plaquemine people of the lower valley attached a spiritual value to New Orleans's environment, they were unable to comprehend the extent to which the Mississippi

River shaped the conditions of southeastern Louisiana. Saucier (1994) contends that the waning of the first glaciation (~2 million years ago) in present-day Minnesota produced a significant amount of discharge, creating and continuously augmenting the Mississippi River's drainage network (68). Every second, over 600,000 cubic feet of freshwater flows down the river and into the Gulf of Mexico (Morris 2012, 2). Water is the critical geomorphic agent that causes the fluvial erosion of soil and decomposed parent material to the deltaic plain, forming the coastal wetlands found at the mouth of the Mississippi River (Saucier 1994, 69-70). The Mississippi River's high flow rate resulted in 200 to 300 million metric tons of dirt being brought to Louisiana's coast (Morris 2012, 2). As a result of this constant influx of sediments, the river's main channels will begin to clog, leading the river to rise and switch channels to find a faster path toward the Gulf of Mexico.

The Mississippi River's meander belt shifts about every 1000 to 2000 years, with these deltaic building cycles sustaining the lower valley's inland swamps, marshes, and sand barriers (Saucier 1994, 137-153). Deltaic building cycles depend on the rate of sediment deposition and the river's water flows; thus, certain portions of a deltaic plain become submerged during these reconstructive phases. As a result of these building cycles, certain channel movements and distributary formations continually reshape the Deltaic plain (Rees 2010, 39). Avulsion and flooding, then, are consistent features of Louisiana's Deltaic zone. As a result, when New Orleans' marshlands are flooded, sediments emerge along the coast, delivering mineral sediments to form soil (Nyman et al. 1993, 269). Because of the high influx of nutrients brought to the delta, southeast Louisiana's soil "is composed primarily of tightly interlocking root networks that reduce the susceptibility of mineral sediments to erosion" (Nyman et al. 1993, 269). By virtue of the delta's compacted and nutrient-rich soil, New Orleans's wetlands purify and recharge

groundwater, providing the provisioning service of fresh water to the city's residents in the form of municipal drinking water (Yates 1999, 591).

Furthermore, the meandering stream is a subsystem of New Orleans's deltaic region, tasked with maintaining the environment's lakes, swamps, and bottomland hardwood forests (Morris 2012, 2-3; Rees 2010, 39). The ancestral process of the Mississippi River bringing sediments to the Louisiana coast results in drainage equivalent to an area of $3.34x10^6$ km^2 (Walker 1987, 190). The Louisiana wetlands, then, are primarily a result of the Mississippi River, producing wetlands with an area of $15.3x10^3$ km^2 (Walker 1987, 190).

The influence of the Mississippi River directly impacts the many supporting services in the southeast coastal region of Louisiana. Given New Orleans's subtropical climate, the region has a higher net primary productivity than other marshes along the Atlantic Coast (White et al. 1978, 757). Because 73% of the Mississippi River runoff is discharged through the delta, there are higher nutrient concentrations along the Louisiana coast, especially when compared to concentrations in other Atlantic Coast marshes. New Orleans waters contain 5.8 mg/l in nitrate levels and 3.8 mg/l in phosphorus levels, indicating that the Mississippi River heavily influences the delta's nutrient levels (White et al. 1978, 757).

Additionally, within the Deltaic Plain's complex systems of geomorphology and hydrology lies a robust biodiversity network. Louisiana's marshes are extraordinary in terms of primary productivity as a supporting ecosystem service. Unlike northern climates, which are subject to colder temperatures in the winter and effectively kill all growth, New Orleans's coastal region is spared this fate because of its lower latitude. James Gosselink remarked in his 1984 report that the Louisiana coast has a higher peak biomass than other temperate regions (Gosselink and Natural Ecosystems Team 1984, 44). According to data collected using the

species richness and Shannon-Weiner diversity indices (which used calculations based on 65 of the most abundant species surveyed), the National Oceanic and Atmospheric Administration (NOAA) found that the Mississippi's deltaic plain contained a range of 57 to 65 species present (Karnauskas et al. 2017, 19-20). These indices looked at mobile finfish and macroinvertebrates, like shrimp and crabs, but what is of note here is that Louisiana's coastal plain scored particularly high when looking at species richness. The Mississippi River Delta is also important for wintering birds, particularly the American waterfowl.

The convergence of the land and water in New Orleans naturally results in a wide-ranging diversity of fish and shellfish. As a consequence, the prevalence of high populations of fish and shellfish serves as both provisioning and cultural services. Fishing has been a part of New Orleans's culture since before the city's founding; however, the lack of a long-standing tradition of agriculture among the Plaquemine people of the lower valley will be touched upon more in Chapter 2. However, as Rees (2010) found, the abundance of animal species (though emphasizing fish and shellfish over large megafauna) allowed early Paleoindians to proactive generalized subsistence at a higher rate than previous scholarship has assumed (37). New Orleans's wetlands have long provided the provisioning service of fish, shellfish, and other wetland animals. Thanks to its wetlands, Louisiana's seafood harvest provides at least half of the nation's seafood production, with revenue valued from $2.5 billion to $4 billion annually (Yates 1999, 591). The high price tag of Louisiana's seafood is thanks to its abundance of species: shrimp, oysters, crabs, crawfish, and alligators. Additionally, Louisiana's wetland-heavy fisheries supply the state with over 90,000 jobs (Yates 1999, 591). According to the Louisiana Seafood Promotion & Marketing Board, fishing is a multi-generational endeavor in the Crescent City (Louisiana Seafood 2023). Given the small fishing communities in New Orleans, it is fair to

assert that the intimate familial dimensions of the city's fishing community are an example of a cultural service provided by the Deltaic Plain.

As illustrated by this section, New Orleans offers many ecosystem services. By examining the geomorphology and ecology of New Orleans under the framework of ecosystem services, it is clear that, like the Mississippi River, the city's environment is dynamic. There are many more dimensions to Southeast Louisiana's complex ecology, but for the purposes of this thesis, this author has chosen to limit the scale. Instead, an examination of the synergy between the Mississippi River and the Gulf of Mexico has shown that the ecology of New Orleans is complex, interconnected, and subject to changes in the Mississippi River's stream.

New Orleans: Dirty Weather. As described in the above section, the Deltaic environment of New Orleans is complex and is inextricably linked with the Mississippi River. Because sediment deposition from the river built New Orleans's wetlands, the city has a natural defense from flooding and storm surges (Al-Attabi et al., 2023, 1). Though the impacts of levee systems on New Orleans's environment will be discussed in the following section, it is necessary to initially note that levee construction directly impacts wetland loss in southeastern Louisiana (Bass and Turner 1997, 901). Before delving into the effects of levee construction on New Orleans's environment and level of hurricane preparedness, this section will outline the data regarding the city's naturally occurring relationship with hurricanes.

First, a general overview of hurricane terminology will be useful. Globally, the term used for hurricanes is "tropical cyclone." Hurricane is a regional term reserved for tropical cyclones in the tropical North Atlantic (Rohland 2019, 20). The purpose of tropical cyclones is to "help redistribute energy across the earth's surface, oceans, and atmosphere" (Keim and Muller 2009, 56). More broadly, in New Orleans and the Gulf of Mexico, "the energy is then redistributed

northward by atmospheric and oceanic currents in an effort to maintain a balance of heat and energy across these latitudes" (Keim and Muller 2009, 56-57). Hurricanes require initial sea surface temperatures (SSts) greater than 80℉ as well as high evaporation rates of the ocean. Next, "upper airflow at approximately 25,000-50,000 feet must allow the rising moist tropical air around the center of the storm to vent aloft outward from the center (Keim and Muller 2009, 57). Finally, tropical cyclones must form between 5°N and 25°N latitude, as "Coriolis forcing causes a deflection in the direction of moving air, thus aiding in formation of cyclones" (Keim and Muller 2009, 58). SSTs are the driving factor for the seasonality and intensity of hurricanes, with hurricane season spanning the six-month period from June 1 to November 30 (Keim and Muller 2009, 60). Tropical storms, however, can occur outside of this window.

Historically, New Orleans's wetlands have added to the coastline's break effect, minimizing the impact of hurricanes (Rohland 2019, 27). Wetlands, then, serve as a regulating service as they aid in flood regulation. Given the ecology of the environment of New Orleans, a study by Stone et al. found that hurricanes can act as destructive or beneficial forces for Louisiana's marshes. In one scenario, hurricanes or intense storms can cause severe amounts of damage to wetlands, with some becoming wholly submerged under floodwater (Stone et al. 1997, 667). On the other hand, hurricanes can act as a source of sediment deposition for marshlands, with 0.7 m of mixed organic and inorganic debris found on natural levees following the 1957 Hurricane Audrey (Stone et al. 1997, 667). Stone et al. (1997) wrote that such sediment deposition spurred by hurricanes would help to counteract wetland loss; however, more is needed to make a substantial difference given current rates of wetland loss (667). Data collected by the U.S. Geological Survey showed that, out of the 3 million acres of wetlands along the Mississippi River Delta, they are lost at a rate of approximately 75 km^2 annually and are relatively costly to

reduce such losses (USGS 2023). Barbier et al. (2013) concluded that Louisiana's coast will likely lose 4,548 km^2 of wetland in 50 years (4). This study found that it would take roughly $25 billion over a 50-year period to restore wetlands along the coast, but there would still be a loss of 585 km^2 worth of wetlands (Barbier et al. 2013, 4).

Sea level rise also plays a factor in Louisiana's wetland loss (Bass and Turner 1997, 895). This is worrisome as a study conducted by Yin (2023) has shown that SLR has increased in the Gulf of Mexico at a rate of more than 10 mm yr^{-1}, higher than previously thought (4525). Furthermore, Volkov et al. (2023) found that again, since 2010, there have been extraordinary levels of sea temperatures warming and SLR in the Gulf coast, noting that flooding events in this region would have been 30 to 50 percent less than present had there not been this increase in sea temperature (7).

Between 1851 and 2007, 96 tropical storms and hurricanes threatened New Orleans; this averages out to slightly more than once every other year in this 157-year period (Rohland 2019, 27). Because tropical cyclones primarily depend on SSTs, IPCC data has shown an increase in ocean heat content over the past few decades is concerning for the coastal city (IPCC 2021; Wang et al. 2023, 2721). Echoing this distressing sentiment, Yin (2023) noted that the trend of SLR in the Gulf of Mexico has coincided with one of the record's most active and record-breaking North Atlantic hurricane seasons (4525). Additionally, Wang et al. (2023) found that the rate of warming at the ocean surface in the Gulf of Mexico is twice that of the global ocean (2732). With these factors in mind, it is clear that New Orleans—with a now worse-for-wear wetland regulating flood defense system—is on the precipice of disaster if a major hurricane were to strike.

Landscape of Levee. With the onset of climate change, the anthropogenic manipulation of New Orleans's floodplain via levee construction has altered the ecological functions of the Deltaic plain. Thus, it is necessary to understand how levee construction disrupts the natural ecological balance of the Mississippi River Delta.

As the preceding sections have shown, New Orleans is a wet city; its flooding is not unusual. What is uncommon is how humans have continuously altered the delta's natural ecology for agricultural usage and urban settlements. Manipulation of the delta's ecology resulted from imperial colonization, not from the Indigenous peoples that lived in the region before European encroachment; this will be expanded more in Chapter Two, but it is important to note here. Altering the Mississippi's deltaic plain via levee construction has drastically reconstructed how the lower valley's natural ecological processes function. Levees along the Mississippi River, specifically in and around New Orleans, block the river's natural sediment dispersal process (Coleman et al. 1998, 714). By separating land from the Mississippi River, levees transformed the delta's natural floodplain into dry land (Morris 2012, 3). Time and time again, however, heavy storm rainfall would breach the levees, reverting the valley into a floodplain.

Oil and gas production is largely responsible for many of the canals that have been dredged and levees that have been built amid Louisiana's wetlands. Offshore and coastal oil and gas plants from Louisiana make up 11% of the total production in the United States (Bass and Turner 1997, 895). This is important because there is a direct relationship between levees and land loss rates along the Mississippi River Delta (Scaife et al. 1983, 440). Furthermore, the impacts of oil on the ecological structure of New Orleans's wetland ecosystems have the ability to alter the ecosystem services benefits to humans (Mendelssohn et al. 2012, 571). The construction of levees also causes a reduction in primary production in the Deltaic Plain. Turner

and Cahoon (1987) found that decreased mineral sediment in marshlands altered plant growth and organic sedimentation (27). This is perhaps due to the *indirect* influence of canals. Scaife et al. concluded that "canal surface area accounts for less than 10% of the actual land loss, yet canal density may account for 48% to 97% of the statistical variation in regional land loss rates" (440). As such, levees constantly influence coastal erosion even decades after their construction (Scaife et al. 1983, 440). The influence of levees in New Orleans's wetlands "clearly disrupt the movements of water into and out of a marsh and therefore affect the marsh salinity regime" (Turner and Cahoon 1987, 15).

As evidenced by this section, it is clear that levees disrupt the ecosystem services provided by the Mississippi River and the Deltaic Plain. This chapter has explored the relevant data concerning New Orleans's dire environmental issues to discover a plausible solution to these issues. Although levees have been a consistent issue in New Orleans since the eighteenth century, with combined SLR increase, higher likelihoods of intense hurricanes due to climate change, and loss of barrier wetlands, the city faces a host of potential catastrophes that it has not yet adequately prepared for.

Chapter 2: Catastrophe's Threshold in the Cotton Kingdom

On August 29, 2005, Hurricane Katrina made landfall in southeast Louisiana; its impacts were, in every sense of the word, catastrophic. As disastrous as it was, the Category 3 hurricane was nothing unusual for the coastal city of New Orleans. Like the numerous hurricanes and tropical storms that preceded it, Hurricane Katrina formed over the ocean and made landfall during the Atlantic hurricane season. It was not an anomalous event. Once Katrina inundated the city with rain, the levees and floodwalls surrounding New Orleans failed. However, this was also

nothing new; they had a reputation for failing since their implementation in the early eighteenth century. The levees' failure during Katrina greatly exacerbated flood conditions, and yet, when the water receded, the city reconstructed its levee systems. The roots of New Orleans's dedication to faulty levee systems, however, began much earlier than Katrina; they began with enslaved African labor in the eighteenth century but became a staple of the city's flood mitigation plans during the Antebellum Period.

At first glance, disasters may seem acute. The scale of a natural disaster is unpredictable; however, the factors that impact the severity of disasters brew over a long period of time, and their effects last for a long time. This chapter will examine the accumulation of environmental knowledge of New Orleans's environment from the region's colonization in the eighteenth century to the proliferation of the oil and gas industry in the Louisiana marshes in the mid-twentieth century. From this, it will become clear that the city's historical dependence on levee systems has resulted in minimal efforts to adequately adapt the city to disasters, whether in the form of hurricanes or levee breaches.

Cape of Mud. In 1541, when Hernando de Soto led a group of Spanish explorers through the lower Mississippi Valley, they stumbled upon a lot of mud. At some points during the exploration of Cabo de Lodo (Cape of Mud), the term Spaniards would use to describe the region; the mud was too deep for their horses (Morris 2012, 12, 27). Though it was a nuisance, the mud did not stop the Spanish from marveling at the region's abundant biodiversity, mainly the fish living in the numerous ponds and marshes (Morris 2012, 12-13). There was perhaps something more shocking to the Spanish besides the muddy terrain; there were Indigenous Peoples thriving in the valley of mud. According to historian Christopher Morris, Soto and his group would have likely encountered two distinct cultural zones of Native Americans living

along the Mississippi River. The Middle Mississippian settlements between the Missouri and Arkansas rivers were a network of chiefdoms, corn cultivation, and, most notably, their iconic large earthen mounds (Morris 2012, 15). In every respect, the Mississippians operated under an agricultural-based economy. However, the Plaquemines living in the lower valley lived differently than the Mississippians.

While the Spanish were discouraged by the lower valley's muddy prospects, the Plaquemine people relished it. The Plaquemine did not mimic the Mississipians' agricultural economy; instead, they thrived off the lower valley's fish, fruits, other wetland animals, and wild grains (Hudson 1997, 341). Rather than manipulating their wet environment to a dry one, the Plaquemine embraced Louisiana's wetlands; they even incorporated the wetlands into their religious lives. Floods were integral to how the lower valley peoples understood their relationship to the land, and when floods happened, the Plaquemine believed they were spiritually regenerative (Morris 2012, 17). For the Plaquemine, receding flood waters signaled that the land would replenish its natural plant and animal food. For the hunter-fisher-gatherer society, this meant reliance on an agricultural-based society was unnecessary (Morris 2012, 17, 20). But for Soto, the Plaquemines' way of life was frightening. Because the Spanish linked agricultural societies with wealth, the hunter-fisher-gatherer lifestyle of the lower valley people was, for Soto, equivalent to complacency with poverty (Morris 2012, 13). Despite the lack of intensive agriculture in the lower Mississippi Valley, the Spanish tried but failed to transform the floodplain into a potential agricultural site (Morris 2012, 21). Underwhelmed by the prospects of the lower Mississippi Valley, Soto, on his deathbed, wanted to make one more attempt at establishing Spanish control over the Plaquemines. His death in 1542, however, prevented such an assault. Worried that the Natives would desecrate Soto's corpse, the remaining Spanish

explorers sneakily threw their former leader's body into the Mississippi River (Hudson 1997, 349). After Soto's death, the Spanish quickly left the lower Mississippi Valley. There would not be another European expedition of the region until 1682 when René-Robert Cavelier, Sieur de La Salle, came to the Cape of Mud. Even though Soto's exploration of the lower Mississippi Valley failed to establish an agricultural settlement, it set a precedent for future colonial endeavors to transform the wet and muddy marshes into dry land suitable for intensive agriculture.

When La Salle ventured into the lower Mississippi Valley, he did not have the same ambitions as his Spanish predecessors. For the French, establishing small settlements near the mouth of the Mississippi would secure a new passage to the sea, expanding their fur trading empire (Morris 2012, 24). In 1682, La Salle traversed the delta's vast wetlands, and yet, when his boats approached the Louisiana coast in 1684, La Salle had no idea where he was (Morris 2012, 27-32). Because La Salle and his crew could not comprehend the scale or mechanics of the Mississippi River's deltaic plain, they sailed past it and went to Texas (Morris 2012, 31-32). The 1684 expedition was an utter failure, ending with La Salle's death at the hands of his crew. Despite the lower Mississippi Valley's grim prospects, French colonists, under the guidance of brothers Pierre Le Moyne d'Iberville and Jean-Baptiste Le Moyne de Bienville, managed to establish a few forts, but floods often inundated these settlements. Although the French wanted to abandon their settlements in the Mississippi River delta, reported English encroachment facilitated the need for the French to establish a permanent settlement in the deltaic plain. Therefore, under the assumption he had found a dry enough spot, Bienville founded the city of New Orleans in 1718 (Morris 2012, 47). Shortly thereafter, French colonists introduced aggressive plans for levee construction along the Mississippi to Lake Pontchartrain because, just like Soto had thought a century ago, complacency with a wet landscape was not an option for the

French. However, the French believed that to safeguard their new city from flooding, the grueling labor necessary for levee construction could only be accomplished by enslaved African labor (Silkenat 2022, 92). Thus, the quest to transform New Orleans into a dry city had begun.

The Lands can be Drained. The construction of levees along the Mississippi River and using enslaved labor grew in tandem. French colonists knew that economic success in New Orleans depended on their ability to reduce flooding. One French planter, Joseph Villars Du Breuil, led the charge for levee construction via enslaved labor. Du Breuil is credited with establishing the first plantation levee; his slaves were charged with leveeing 10 miles of canals and draining 400 acres of marshes (Morris 2012, 57-58; Silkenat 2022, 91). The manpower needed to replicate Du Breuil's success, however, was far and few between in eighteenth-century Louisiana. Frustrated by labor scarcity, the eager would-be planter class demanded that the French crown provide New Orleans with ample enslaved African labor (Berlin 1998, 80-81). And deliver they did. The Company of the West and Company of the Indies was responsible for the forced migration of roughly 6,000 enslaved people from Africa into Louisiana from 1719 through 1731 (Berlin 1998, 81). Although the initial success of Du Breuil's earthen levees was isolated to his plantation, his efforts would be mimicked throughout Louisiana, creating a paradigm shift between plantation owners' relationship with the lower Mississippi Valley's wetlands.

For the plantocracy, levees indicated something more than a barrier separating water and land; they were emblematic of man's subjugation over the Mississippi River (Morris 2012, 59). Furthermore, the use of enslaved African labor to construct levees instilled in plantation owners that the herculean tasks of clearing land, digging ditches, and shoring up levees were tasks only suitable for slaves. When new slaves arrived in the early years of colonial New Orleans, they

were more likely to be working on the levee than on plantations, indicating that the maintenance of the region's levee systems was foundational to its survival (Berlin 1998, 85; Morris 2012, 60-61; Silkenat 2022, 91). The levee systems created, however, were far from foolproof. Although the first municipal levee systems were established in 1724, the river quickly overtopped these embankments (Silkenat 2022, 91). The overflowing of embankments would be a recurring trend throughout the colonial period, and every time the levees failed, the solution was always to reconstruct higher, wider, and longer levee systems (Morris 2012, 61). This "solution," however, most likely made flood control issues worse over time.

While the French colonial era of New Orleans gave the plantocracy confidence that they had conquered the lower Mississippi Valley's floodplain, the region was far from becoming the plantation regime planters had hoped for. With the levees in place and a consistent supply of its enslaved labor force, planters were ready to reap the benefits of their burgeoning plantation economy. Still, conflict with the Natchez Native American people threatened Louisiana's budding prospects. In 1729, the Natchez revolt dismantled the developing plantation economy and ended the importation of new African slaves (Berlin 1998, 195). Though the lower Mississippi Valley had all the makings for a profitable slave society, the impact of the Natchez revolt resulted in the lack of infrastructure needed to cultivate a mass export crop, devolving Louisiana into a society *with* slaves (Berlin 1998, 199-202). From the mid-eighteenth century until the century's end, there was a lull in the growth of Louisiana as a powerful economic player in the larger realm of Atlantic commerce. While the French plantocracy struggled in this period, many enslaved people began to thrive. Without a stable export crop, the arduous labor required for plantations faltered, meaning many enslaved Africans could invest in their own economic endeavors with the possibility of buying their freedom (Berlin 1998, 210-211). Though

post-Natchez Louisiana only benefited its enslaved population, the French were not thrilled by the region's prospects. Eventually, Louisiana's economy became too troublesome for the French, and after 1763, they transferred the territory to the Spanish. Still, even with new imperial ownership, Louisiana was far from turning into a wealthy plantation-based society, but its Black population had even more opportunities to flourish. In Spanish Louisiana, it was easier for the enslaved population to gain their freedom; however, Black militiamen's labor was used to work on the levees, even though they had more than likely gained their freedom (Berlin 1998, 212). While the middle of the eighteenth century was less agriculturally intensive, and its enslaved population had a brief respite from large-scale plantation labor, it would not last into the nineteenth century. In the 1790s, the growth of cotton and sugar plantations would revert Louisiana into a slave society, making levees crucial for maintaining the new plantation economy.

At Work on the Levee. When architect Benjamin Henry Latrobe arrived in New Orleans in 1819, he "saw an overseer directed the repair of the Levee with a long whip in his hand," noting in his journal that plantation managers in Louisiana "have the reputation of working their slaves very hard" (Latrobe 1980, 165). From the 1790s into the Antebellum Period, the levees in Louisiana needed not to fail. In 1803, at the time of the Louisiana Purchase, Louisiana produced 4,500,000 million pounds of sugar and exported over 18,000 bales of cotton (Berlin 1998, 343). Breaches in the levee jeopardized Louisiana's plantation-based economy; thus, many planters in the lower Mississippi Valley forced their slaves to manage the upkeep of the surrounding levees with the threat of physical violence (Silkenat 2022, 95). Because the mid-eighteenth century was a time when a great deal of Louisiana's enslaved population could gain their freedom, it would be difficult to force the remaining slaves on plantations. Therefore, the beginning of the

nineteenth century marked increased violence to force enslaved people into doing the taxing labor that required levee maintenance and plantation work (Berlin 1998, 345-356).

The levee was a formidable feature of antebellum New Orleans, and enslaved labor was necessary for ensuring the safety of the lower Mississippi Valley's plantation economy. Scottish geologist Charles Lyell noted when he visited the Cotton Kingdom that "the greater part of New Orleans would be annually overflowed by the river, but for the 'levee'" (Lyell 1849, 142-143). To hold back the waters of the Mississippi River, a great deal of enslaved labor was allocated to such tasks. Though he was born a free man in New York, Solomon Northrup, after being kidnapped in Washington D.C. and sold into slavery, was brought to New Orleans and, on his arrival, saw the work needed to protect the city from flooding. As the ship brought Northrup into New Orleans, he "observed the chain-gang at work on the levee" (Northrup 2011, 60). The levee was so crucial to life in New Orleans that even though Latrobe reported that "the slaves are by no means obliged to work, anywhere in this state on Sunday" (Latrobe 1980, 201). However, as Latrobe noted, enslaved laborers had no option when it came to "the Sugar boiling season, and when the river rises on the Levee to prevent danger from innundation" (Latrobe 1980, 201). Because control over the lower Mississippi Valley's deltaic plain depended on levees, enslaved African labor, propagated by violence, was deemed necessary to keep the city dry.

Violent forms of coercive labor on the levees were not limited to the era of slavery in New Orleans. Amid the Great Mississippi Flood of 1927, dangerous and reckless work conditions were thrust upon a majority of the city's Black population. In order to understand the parallels between levee labor during slavery and in the early twentieth century, it is necessary to offer a brief history of the 1849 Swamp Land Act leading to the impacts of the Great Mississippi Flood of 1927 on New Orleans.

Historically, wetlands in New Orleans have been seen as lacking value (Horowitz 2020, 24). The only people who have found worth in the region's wetlands were Louisiana's enslaved population. Since the first enslaved people arrived in the colony in 1719, the marshlands of Louisiana served as a refuge for runaway slaves and burgeoning maroon settlers (Silkenat 2023, 132-138). However, because Louisiana's wetlands were deemed worthless to its white land-owning residents, Congress passed the Swamp Land Act in 1849, transferring ownership of 10 million acres of federal wetlands to the state (Horowitz 2020, 24). The aim of this act was to encourage the state to continue to drain and levee wetlands, but the state only began consolidating marshes into levee districts in the 1890s (Horowitz 2020, 25). Despite establishing the levee districts, the state was not eager to allocate resources to the projects required. This changed in the 1920s when officials decided that the wetlands could be sacrificed in the event of a major flood or hurricane (Horowitz 2020, 26). Starting in 1885, under the leadership of Andrew Atkinson Humphreys, the Army Corps of Engineers embraced a "levees-only" approach to flood control (Horowitz 2020, 26; Morris 2012, 147). However, the Great Mississippi Flood of 1927 made this approach's limitations apparent.

On April 15, 1927, Good Friday, 15 inches of rain fell on New Orleans. In less than a day, the total rainfall amassed one-quarter of the city's average annual precipitation of 55 inches (Barry 1997, 189). Due to heavy rainfall in the summer of 1926 across the Mississippi River's central basin, flooding peaked near Mounds Landing, Mississippi, with over 145 breaches in the levee threatening to bring flooding to New Orleans. In response, Lieutenant E. C. Sanders, in charge of the National Guard contingent at Mounds Landing, forced local Black residents to fill and throw sandbags on the levee breaches, threatening workers with guns (Barry 1997, 200). Thus, we can glean from the historical record that state-sanctioned violent and coercive labor

conditions were deemed appropriate in the early twentieth century as long as they safeguarded the city of New Orleans and its wealthier residents. Despite these efforts by forced Black laborers, the upriver flooding resulted in major stress for the levees surrounding New Orleans, leading officials to vote to dynamite the St. Bernard levee to flood the St. Bernard and Plaquemine parishes in order to save New Orleans from flooding (Barry 1997, 248). As the people of St. Bernard and Plaquemine parishes accepted defeat, the National Guard sent trucks to evacuate around 10,000 residents (Barry 1997, 255). The Great Mississippi Flood of 1927 prompted the reconstruction of a more extensive levee system along the Mississippi River, known as the Flood Control Act of 1928 (U.S. Congress 1928, 1-3). Until 1965, the state was tasked with controlling the city's flood control system. However, after Hurricane Betsy destroyed the flood walls around New Orleans's Industrial Canal, Congress passed the Flood Control Act of 1965. As a result, the Army Corps of Engineers assumed sole responsibility for New Orleans's levee construction and maintenance (Horowitz 2020, 132). Though such Acts of Congress were quick to address the need to rebuild and reinforce levee systems, they failed to account for the violence and injustice associated with the labor necessary to uphold such infrastructures.

There's Oil Under the Louisiana Swamp. As discussed in Chapter 1, oil and gas production have played a major role in levee construction throughout New Orleans's wetlands. The histories of industrial levee construction and the oil industry's rise in Louisiana are inseparable. As such, it is important to understand the relationship between Louisiana's oil industry and levee construction. In 1901 oil was first discovered underneath Louisiana marshes (Horowitz 2020, 132). The discovery of oil in Louisiana transformed the previously worthless marshes into liquid riches. A consequence of this discovery was that, in May 1928, the Louisiana State Legislature allowed public entities to capitalize on the discoveries of oil and gas; they

authorized parish school boards and levee boards to execute oil, gas, and mineral leases (Banta 1981, 469). By 1927, the state produced up to five million barrels of oil (Horowitz 2020, 31).

Economically speaking, the discovery of oil in New Orleans was a godsend for the residents who only ever understood the wetlands as futile. While the oil and gas industry shaped the state's economy, it was simultaneously reshaping its wetlands. Prior to the oil boom, New Orleans already had two major shipping canals: the Industrial Canal and the Gulf Intracoastal Waterway (Alperin 1983, 16). The Industrial Canal was dredged through the Ninth Ward in 1923 by the Port of New Orleans (Horowitz 2020, 33). Then, in 1933, the Gulf Intracoastal Waterway was built to provide a 9-by-100-foot channel from Lake Pontchartrain to the end of the Delta, linking to the Industrial Canal (Alperin 1983, 16). It became standard, then, that oil and gas infrastructure took priority over the well-being of the surrounding marshlands. While this was the general consensus in the 1930s, it was not until studies in the 1950s confirmed what many Louisianans had already concluded: canals had consequences (Horowitz 2020, 34). Because Louisiana's wetlands purify water, their waters had always been fresh; however, the construction of oil and gas canals allowed for the Gulf's salt water to intrude into the state's freshwater marshes (Horowitz 2020, 34; Penland et al. 2005, 37). The problem posed by saltwater intrusion would only worsen. Though the canals initially constructed by oil and gas companies tended to be on the narrower side, over time, they would grow wider (Horowitz 2020, 34). By that time, studies revealed that, in large part due to oil and gas infrastructure, the average rate of shoreline erosion between 2855 and 2002 was 19.9 ft/y (Penland et al. 2005, 37). Recall that, geologically speaking, floods and coastal subsidence are ancient processes that build and reshape New Orleans. However, prior to the authorization of the oil and gas industry's exploitation of marshlands, coastal subsidence was only measured on geological timescales. Though increased

coastal subsidence was concerning for the marshlands directly impacted by oil exploration, the effects of saltwater intrusion began eroding other regions of New Orleans's wetlands that were not extraction sites. For example, the Chandeleur Island barrier is the first defense line for New Orleans against hurricanes; however, increased development of oil and gas structures resulted in a 44.5 ft/y loss of gulf shoreline (Penland et al. 2005, 36). Still, the economic benefits of oil and gas continued to usurp the value of wetlands until Hurricane Katrina.

What can be gleaned from the historicization of New Orleans's levee systems within the broader context of the overall accumulation of environmental knowledge? Before establishing capitalism in eighteenth-century New Orleans, the Plaquemine understood that if man could not control the Deltaic plain's floods, then man must adapt their living practices with respect to the Delta. However, with the introduction of slavery and the opening of New Orleans's doors to a capitalist economy, we can identify a distinct pattern of capitalist interests driving levee construction. Whether it was sugar, cotton, or oil, levees were the primary flood control mechanism constructed to protect capital goods. Therefore, it is important to understand levees as symbols for the state's historical record of sanctioning private interests, which came to control the coast and had little to no regard for the safety of New Orleanians.

Chapter 3: The Politics of Staying Dry

On August 31, 2005, two days after Hurricane Katrina made landfall over southeast Louisiana, the White House released a photo of then-President George W. Bush flying over the flooded city (White House Archive 2005). Though it was meant to convey the President's concern and proximity to the crisis, the photograph would symbolize the government's failure to adequately respond to the storm's aftermath. While the sympathetic Bush viewed the horrors of

Katrina from the safety of Air Force One, there were approximately 150,000 to 200,000 people trapped in the flooded city beneath him (Goldman and Christine Coussens 2007, 16). The inept handling of Hurricane Katrina's response from the government – at the federal, state, and local levels – remains one of the most defining characteristics of the disaster. The photograph of President Bush overlooking a flooded New Orleans can be reduced to one constant about the U.S. government's role in natural disasters: those with the power to decide the preparations for and responses to disasters are seldom the ones most affected by their decisions. Because of this well-established bureaucratic constancy, this chapter will first examine the local, state, and federal government's role in their failure to provide New Orleans with an appropriate flood defense system or proper relief during Hurricane Katrina.

Though New Orleans has yet to face another Katrina-like hurricane and subsequent levee breaches have not transpired, many of the city's residents are worried that the government will fail to properly help the city prepare as well as mismanage relief efforts as they did in 2005. Therefore, with an understanding of the political decisions that transformed Hurricane Katrina from a disaster to a catastrophe, this chapter will elucidate how governmental policies preceding and following Katrina have shaped current levee infrastructure, flood control policies, and disaster relief plans. In order to analyze the political decisions of government officials during and after Katrina, this chapter will employ theories from political scientist Saundra Schneider's book, *Flirting with Disaster: Public Management in Crisis Situations*, to analyze the government's role in responding to Hurricane Katrina.

In Anticipation of Hurricane Katrina. In the 2006 congressional report, *A Failure of Initiative*, The Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina "identified failures at all levels of government," concluding that "response

plans at all levels of government lacked flexibility and adaptability" (U.S. Congress 2006, 1). Typically, governmental responses to natural disasters work effectively and efficiently in the United States (Schneider 1995, 5). The mobilization of the government's response to natural disasters follows the sequential order from the bottom up; it begins at the local level, then to the state, and, if necessary, to the federal government (Schneider 1995, 6). If this is traditionally the case, why was the government's response in anticipation of Katrina so inefficient?

It was August 24 when the World Meteorological Organization identified a tropical storm headed toward the Gulf of Mexico named "Katrina;" however, it was not until August 27, two days before Katrina made landfall, that Mayor Ray Nagin declared a state of emergency (Horowitz 2020, 116). The same day he declared a state of emergency, Nagin issued the first *voluntary evacuation* notice rather than implementing a mandatory evacuation (Comfort 2005, 3). Per the City of New Orleans Comprehensive Emergency Master Plan, Mayor Nagin initiated, executed, and directed operations during a national disaster (U.S. Congress 2006, 1). Yet, Mayor Ray Nagin only issued a *voluntary evacuation* notice two days before Katrina made landfall (Comfort 2005, 3). Having gone through the experience of Hurricane Ivan one year before Katrina, it is fair to assert that Nagin should have had the foresight to prepare for Katrina. Although Governor Kathleen Blanco declared a state of emergency one day earlier than Nagin, she did not issue a mandatory evacuation order either.

It was not until the National Weather Service (NWS) issued a dire notice on August 28 that warned state and local officials that, as Katrina encroached upon the Mississippi River's Delta, "most of the area will be uninhabitable for weeks…perhaps longer" (National Weather Service 2005). After this message, Nagin and Blanco declared a mandatory evacuation in New Orleans with only 19 hours until Katrina made landfall.

Though much of the blame for Katrina has been cast on the local and state governments, it is necessary to try to comprehend why Governor Blanco and Mayor Nagin were reluctant to issue a mandatory evacuation. At the time of Katrina, Louisiana was a relatively small and poor state; it lacked the resources to handle a disaster of this scale, which led state and local officials to rely on help from the federal government, albeit more than they should have (Roberts 2005, 3-4). That said, Louisiana's limited resources posed major challenges concerning evacuation measures. Evacuations are expensive, and, at the time, it was widely known to state and local officials that between 112,000 and 132,000 New Orleanians did not have access to a vehicle (Horowitz 2020, 127-128; Wolshon 2006, 32). Although it has been reported that 1-1.2 million New Orleanians evacuated the metropolitan area in over 430,000 vehicles in the 48 hours before the hurricane made landfall, traffic engineer Brian Wolshon has estimated that between 100,000 and 300,000 people either did not or could not be evacuated (Wolshon 2006, 31-32). For those who could not evacuate, Nagin opened the Superdome and Convention Center; however, images of the 25,000 people packed into both refuges raised concerns about the city's ability to coordinate actions in such an extreme event (Comfort 2005, 1; Horowitz 2020, 117). Because of Louisiana's limited resources, it is clear that state and local officials anticipated the federal government intervening in their initiative, resulting in the delayed employment of a mandatory evacuation of metropolitan New Orleans.

The federal government is supposed to support states and localities in extreme events, such as Katrina, but they must prepare to provide sufficient aid for the 2005 hurricane. The federal government was more than aware of the danger hurricanes posed to New Orleans, so much so that the Department of Homeland Security required the city to submit emergency preparedness plans to which the city complied (Roberts 2005, 4). The plan, however, needed to

be audited appropriately; thus, the federal government, particularly the Federal Emergency Management Agency (FEMA), was wildly caught off guard when Katrina made landfall (Roberts 2005, 4). This was a major oversight on FEMA's part, as emergency preparedness agencies' fundamental priority is ensuring that local communities are equipped to handle, or at least manage until federal emergency agencies arrive at natural disaster scenarios (Schneider 1995, 29). Furthermore, because New Orleans's emergency response plan was never thoroughly analyzed, it lacked vital information concerning external failures that might occur in the event of an intense hurricane, most notably levee failures, communication breakdowns, and lawlessness (Roberts 2005, 4). As political scientist Patrick S. Roberts has claimed: "A plan cannot ensure a perfect response, but it can prompt serious thought about how to cope with the unexpected contingencies that accompany a major catastrophe" (Roberts 2005, 4). Therefore, while Mayor Nagin and Governor Blanco are often criticized for putting off the mandatory evacuation, it is fair to say that the unique circumstances of Katrina should have prompted federal intervention amid preparations for and responses to Hurricane Katrina.

From Disaster to Catastrophe. The incomplete pre-landfall evacuations from the local and state governments significantly worsened post-landfall evacuation and support from the federal government. Hurricane Katrina attained Category 5 status but weakened to Category 3 before it made landfall in Louisiana; it was weaker than predicted, leading people to believe the worst was over (National Weather Service 2022). But, over the next two days, 50 major levee breaches would inundate 80 percent of New Orleans, resulting in approximately 1,440 deaths (US Army Corps of Engineers 2009, 3). However, given the scale of the catastrophe, there will never be a definite death toll (Horowitz 2020, 119). A demographic breakdown of

Katrina-related deaths will be discussed in Chapter 4, as the majority of deaths were African American residents.

Both Governor Blanco and Mayor Nagin were aware of the levees' potential for failure, but it is unclear how local officials understood the risks the current levee systems posed. Still, in a joint news conference with the two on the morning of August 28, Nagin warned that "the storm surge most likely will topple our levee system" (quoted in U.S. Congress 2006, 110). As previously mentioned in Chapter 2, the Flood Control Act of 1928 prompted the construction of flood-control structures, such as levees and floodwalls, along the Mississippi River Valley, authorizing the U.S. Army Corps of Engineers (USACE) with the herculean feat (U.S. Congress 1928, 1-3). Hence, the security of New Orleans's flood control systems was and continues to be, managed at the federal level. Because the USACE, a federal public engineering agency, was tasked with the management and repairs of the city's levees, it begs the question: should fault for the devastation wrought by Hurricane Katrina lie with the state and local governments for delaying mandatory evacuations, or, because of their negligence of the levees, with the federal government?

There is no denying that, given the information provided by the NWS, Governor Blanco and Mayor Nagin should have issued a mandatory evacuation sooner. Still, their ability to evacuate between 80 to 90 percent of the New Orleans metropolitan area, without a doubt, saved thousands of lives (Wolshon 2006, 31). While both leaders are faulted for not heeding the warnings from the NWS sooner, it is necessary to examine the USACE's role in maintaining the levee systems before the storm.

Prior to Katrina, the USACE had been working on the Lake Pontchartrain and Vicinity Hurricane Protection Project (LPVHPP) since 1965's Hurricane Betsy (Horowitz 2020, 85-6).

However, as Katrina formed over the Atlantic, the LPVHPP was only 80 percent complete (Horowitz 2020, 90). Despite the fact that the LPVHPP was incomplete, flood control measures in place were still inadequate. According to computational simulations done prior to Katrina, it was well-known, at least to the USACE, that the city's levees were not able to withstand even a Category 3 hurricane (Comfort 2005, 3). By the end of the 20th century, the majority of New Orleans's residents lived below sea level; therefore, failure to properly maintain flood control structures was a substantial oversight on the federal government's part (Campanella 2006, 46; Burkett et al. 2003, 63-70). In the event of unprecedented natural disasters, governments can stray from the traditional bottom-up response pattern to a top-down one, where the federal government is the first to intervene (Schneider 1995, 70). Given that the USACE was aware that their levee systems could not withstand Katrina, it can be argued that the top-down response pattern should have been invoked, as information pertaining to the reliability of New Orleans's flood-control structures was held at the federal level.

While the federal government failed to manage the city's levee structures properly, one of the more significant elements of the political turmoil that transformed Hurricane Katrina from a natural disaster to a man-made catastrophe was the varying degrees to which political officials acquired knowledge of the emergency as it unfolded. According to political scientist Saundra Schneider, communication is vital after the immediate disaster recedes, and "breakdowns in communication…prevent authorities from establishing and maintaining social order" (Schneider 1995, 51). In the midst of Katrina, communication between political officials was convoluted, to say the least. As discussed in the above section, the federal government's failure to scrutinize New Orleans's emergency response plan resulted in the failure to adequately prepare alternative forms of communication. When the levees were breached, and 80 percent of New Orleans was

underwater, all avenues of communication were disrupted to some degree, resulting in poor situational awareness that hindered response efforts (Comfort 2005, 4). Even the 2006 congressional report, *A Failure of Initiative*, cited that "the loss of power and the failure of multiple levels of government to take the initiative to prepare for its effects on communication adequately hindered the response effort" (U.S. Congress 2006, 163). Limited communication avenues between federal and state governments were especially detrimental to FEMA's ability to bring resources to victims who could not evacuate. For example, then-FEMA director Michael Brown was not notified of the thousands of people in the Convention Center until September 1. In an interview with CNN anchor Soledad O'Brien, Brown articulated that FEMA relied "upon the state to give us that information" and that he learned about the New Orleanians in the Convention Center from news reports (CNN Transcripts 2005). This is only one example of inadequate communication between government officials, but it is emblematic of how poor communication hindered response efforts.

Rebuilding Quicker, Not Better. The previous two sections, in brief, provided the context of federal, state, and local politics within which the debate about the government's mismanagement of the preparations for and responses unfolded during Hurricane Katrina. Debates over who is responsible continue to this day. However, for the purposes of this section, the rudimentary analysis of the government's poor handling of Katrina provides the context necessary to understand how national scrutiny affected the state's policies concerning disaster preparedness, disaster relief, wetland conservation, and rebuilding the flooded city.

At its core, Katrina presented a rather simple problem that New Orleanians had dealt with since the eighteenth century: how to rebuild a flooded city. Political leaders at all levels of governance had the opportunity to reorder metropolitan New Orleans; however, post-storm

policymaking would not create flood protection systems that would actually protect the city. Therefore, this section will examine how political decisions during New Orleans's "recovery" were framed by the government's inept response to Katrina, but also how such policies were reiterations of long-standing political decisions that have continued to make New Orleanians worse off and extremely vulnerable for the next time the levees breach.

The geological situation and the geomorphological implication of New Orleans make the occurrence of hurricanes and flooding more probable than at other points along the Atlantic Coast. And yet, each time the levee systems fail as a result of these more or less predictable weather events, political officials insist upon rebuilding the entire city. Hurricane Katrina, however, allowed the US disaster policy to do the right thing. At first, things were off to a good start, with Mayor Ray Gain announcing the Bring New Orleans Back Commission (BNOBC) (Horowitz 2020, 140-141). The seventeen-person panel hired the Urban Land Institute (ULI) as its consultant. For the ULI, as reported by the BNOBC member who hired the group, Joe Canizaro, "I think we have a clean sheet to start again. And with that clean sheet, we have some very big opportunities" (Rivlin 2005). The way forward, then, for many urban planners, seemed like an obvious opportunity to shrink the city. To them, Katrina revealed that "the sprawling metropolitan region was not sustainable or safe" (Horowitz 2020, 141). Katrina had shown urban planners that rebuilding the same levee systems and buildings on top of the flood-prone Delta was no longer a rational option. Instead of repopulating and rebuilding parts of the city's hardest-hit areas soon, the ULI suggested these zones be used as open spaces for wetlands, recreational parks, or water retention systems (Ydstie 2005). Based on our knowledge from Chapter 1, we must understand that ULI's proposal was the first in New Orleans' history to have a reconstruction plan centered around sustainable design. The issue for residents, however, was

that the ULI "proposed that the city privilege neighborhoods that had not flooded" (Horowitz 2020, 142). In response, "African American political leaders rejected the idea of depopulating black neighborhoods so they could serve as flood control infrastructure for rebuilt white neighborhoods" (Horowitz 2020, 142). Naturally, opposition to the ULI spread amongst New Orleanians, who insisted on rebuilding the entire city and levee structure as before. The BNOBC proposed they should have the power of eminent domain to buy damaged homes in flooded neighborhoods (Horowitz 2020, 144; Ydstie 2005). However, Opposition from residents pushed Mayor Nagin to abandon the BNOBC's plan and commit to rebuilding the city exactly as it stood before Katrina (Horowitz 2020, 146). As a result, City Hall issued building permits across the city without any respect to a home's potential flood vulnerability. What can be gathered from this episode in New Orleans post-Katrina reconstruction, then, is that the influence of New Orleans directly influenced rebuilding policies and plans.

While we have looked at the local politics of New Orleans's post-Katrina rebuilding efforts, it is necessary to examine the federal government's understanding of its role in rebuilding. Looking at Katrina through Schneider's concepts, it is clear that Mayor Nagin and Governor Blanco were slow to mobilize. Though they were late in appealing to the federal government for aid, it is also fair to counter this point because there's not much power the federal government has when it comes to natural disasters. The Disaster Relief Act of 1974, later amended by the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988, specified that "the national government cannot step into a natural disaster situation on its own" (U.S. Congress 1988, PL 93-288; PL 100-707). Though that was very much the case, it is necessary to emphasize the federal government's important role in appropriating aid (Schneider 1995, 31). In fact, by November 2005, the Congressional Black Caucus introduced the Hurricane

Katrina Recovery, Reclamation, Restoration, and Reconstruction and Reunion Act, yet the bill never came up for a vote (Horowitz 2020, 148). It should be noted that the appropriations Congress made were unprecedented. However, they were only a portion of what Louisiana's Congressional delegation thought they would need. Furthermore, it should also be noted that most bills concerning disaster aid were taking into account the damages wrought by Hurricane Rita. Consequently, Congress appropriated $120.5 billion in response to Hurricane Katrina (Lindsay and Nagel 2013, 11). Of that $120.5 billion, approximately $75 billion was dedicated to emergency relief rather than rebuilding (Lindsay and Nagel 2013, 11). The downside was that this total was split among Texas, Louisiana, Mississippi, Alabama, and Florida (Lindsay and Nagel 2013, 1). The distribution, however, proved unsuccessful in the long run. For example, major corporations secured government contracts for emergency relief tasks. Still, due to hiring second-tier subcontractors, about five or six corporate layers took shares of this federal money (Horowitz 2020, 149). The issues between public efficiency and private profits were irreconcilable.

The dissonance between public efficiency and private profits was best pronounced through the state's housing assistance program, the Louisiana Road Home. In the months following Katrina, Congress allocated $13.4 billion for *long-term* rebuilding projects in southeast Louisiana (U.S. Congress 2005, PL 109-148). The Louisiana Road Home plan promised homeowners more or less $150,000 in grants to cover uninsured losses (Louisiana Recovery Authority 2006, 6-7). Interestingly, the program was based on the idea of compensating homeowners for the failure of the federally run Army Corps levee systems, given that "many homeowners lived in places where flood insurance had not been required, and standard homeowner's insurance would not cover flood damage" (Horowitz 2020, 150). The catch,

however, was that "whatever other insurance payouts a person might receive, though, would be subtracted from his or her Road Home grant" (Horowitz 2020, 150).

The Road Home's policies were rather straightforward. First, it authorized and subsidized rebuilding the entire city, regardless of a zone's flood vulnerability (Louisiana Recovery Authority 2006, 5). This first policy decision shaped the Road Home's next major point: encouraging homeowners to stay in Louisiana (Louisiana Recovery Authority 2006, 7). Because the program was centered around supporting homeowners, renters were left out. The Road Home offered no subsidies for renters, even though they represented 51 percent of New Orleans's population (Horowitz 2020, 151). The racist policy's target of New Orleans's rental housing residents will be discussed more in the following chapter. However, things did not look good for the Road Home program. A year after Congress began appropriating the funds necessary for grant recipients, only 101 out of more than 91,500 homeowners applicants had received grants (Horowitz 2020, 151). Nonetheless, the Road Home program was a commitment to disaster relief funds on a historically unprecedented scale; it allowed people who most likely could not have afforded to build their homes. However, it did encourage people to rebuild in the Delta's flood-prone neighborhoods. Though the federal government's Road Home program had many problems, it allows us to understand that federal intervention in disaster relief aid is crucial, raising questions that will be looked at in Chapter 5 of whether or not disaster management should change from a bottom-up response pattern to a top-down one.

Chapter 4: Reckoning with Katrina's Injustices

In the months following Hurricane Katrina, Robert Bullard, known as the "father of environmental justice," wrote an article titled "Katrina and the Second Disaster: A Twenty-Point

Plan to Destroy Black New Orleans" (Bullard 2005). The plan called out the "unspoken" policies and practices that thwarted Black New Orleans' ability to recover and rebuild their neighborhoods. For Bullard, it was clear the "second disaster" was driven by racism (Bullard 2005). As the foremost scholar on issues of environmental justice (EJ) and environmental racism, Bullard was well aware of the likelihood of an inequitable recovery for the people of Black New Orleans. Though Bullard advocated for an equitable recovery right after Katrina, the "second disaster" still manifested.

In Chapter 3, I refrained from discussing how the government's lead-up and response to Hurricane Katrina disproportionately affected Black New Orleanians; this was intentional as instances of environmental injustices, especially in the case of African Americans impacted by flooding from Katrina and post-Katrina policies, require a different methodology. Therefore, to understand the breadth of environmental injustices incurred by the city's Black and poorer residents, this chapter will engage with EJ concepts to study how racialized policies doomed these groups prior to the flood and how reconstruction efforts magnified pre-Katrina racial inequalities.

Because this chapter employs EJ concepts, it is necessary to define relevant terms briefly. As put forth by American political theorist David Schlosberg, the fact that the EJ movement is a *movement* rather than solely a set of theories allows us to see that environmental justice "movements tend to offer a more expansive, plural, and pragmatic notion of justice" (Schlosberg 2007, 45). In short, the term environmental justice "focuses on environmental issues as they pertain to communities of color and the disproportionate rise those communities often face" (Schlosberg 2007, 47). Restorative environmental justice, known as "the approach of addressing harm or the risk of harm through engaging all those affected in coming to a common

understanding…on how the harm or wrongdoing can be repaired and justice achieved," often comes in the form of distribution of funds and resources after a natural disaster (Pali 2020, 1). But, because environmental justice is a movement, the issue of distribution "is almost always tied with some discussion of recognition, political participation, and/or capabilities at both the individual and community level (Schlosberg 2007, 45). At its core, the EJ framework centers around the equitable application of the law; thus, for EJ to succeed, the enforcement of environmental laws must be applied equally to all people regardless of socioeconomic status or race (Colten 2007, 174). This concept is also understood as distributive justice; however, when distributive justice does not prevail, restorative justice, in the form of disaster relief funds for the purposes of this thesis, is exercised. A key element of the EJ movement is to confront environmental racism. This chapter will utilize Bullard's definition of environmental racism, which refers to any policy, practice, or directive that differently affects or disadvantages (whether intended or unintended) individuals, groups, or communities based on race or color" (Bullard 2000, 98).

Therefore, by applying the EJ framework to interpret the plight Black and poorer residents experienced during Katrina, this chapter will illuminate how post-Katrina policies have failed to properly reckon with the city's racial and economic inequalities and, in turn, have left these groups rather defenseless in the event of another large-scale flood.

Race and Flood Vulnerability. It's been over a decade since Katrina. Still, it is an indisputable fact that Black New Orleans, people experiencing poverty, and other disempowered residents were victims of a myriad of injustices after the 2005 flood (Horowitz 2020, 138). Such injustices were clearly visible to Americans watching the disaster unfold on television. Even more so, EJ concerns took center stage in various news reports. One such example from the *New*

York Times insisted that “it is not a coincidence that many of those hard-hit, low-lying areas have had poor and predominantly African-American residents" (NYT 2006, A14). If Americans, media outlets, and EJ scholars could immediately recognize Katrina as a case of environmental racism, it would be necessary to examine what decisions led to the injustices that resulted in Katrina’s disproportionate impact on Black New Orleans.

As will be discussed later in this chapter, evacuation efforts and post-Katrina rebuilding policies can be cited as clear instances of environmental racism. Even though the media stressed that predominantly African American populated areas were hit the hardest by levee breaches, this does not necessarily explain the connection between race and flood vulnerability in New Orleans. EJ scholarship regarding race and flood vulnerability during Katrina has stressed that poorer African American communities experienced the brunt of flooding (Dyson 2006, 6). This is a rather lofty claim that has permeated discussions concerning Katrina’s flooding impact; however, arguments such as this are not supported by statistical analysis of flood-damaged areas of New Orleans. Therefore, it is important to contextualize the circumstances that determined which areas of New Orleans were more prone to flooding prior to Katrina.

Racism played a key role in dictating which areas were susceptible to flooding, but in a rather non-traditional manner. The rise of suburbanization in the American South throughout the twentieth century gave rise to residential segregation, with white families relocating to suburban areas (Lassiter and Kruse 2009, 704). The Federal Housing Administration supported racial discrimination, as they subsidized the construction of all-white residential developments (Lassiter and Kruse 2009, 695). Black southerners, then, primarily remained in the older parts of their respective cities; however, towards the end of the century, the numbers of African Americans moving into suburbia increased (Lassiter and Kruse 2009, 704). By the time

suburbanization grew momentum in New Orleans, the only places available for white residential developments were low-lying areas (Horowitz 2020, 72). In the lead-up to Katrina, then, it was most often the case that white residents lived in lower-lying areas that were more prone to flooding. Whereas the majority of Black residents, as a result of racial discrimination during the twentieth-century suburbanization boom, remained in the older parts of New Orleans, which happened to be situated on higher ground.

In a statistical analysis of the flood-damaged neighborhoods of the larger New Orleans metropolitan region, it was found that almost the exact same number of non-Hispanic whites as Black residents' properties flooded, 294,000 versus 295,000, respectively (Logan 2005, 7). Though racial inequality took the form of geographic segregation throughout the twentieth century, this statistic reveals that the racial discrimination that shaped metropolitan New Orleans did not necessarily relegate Black residents to more flood-prone areas. A comparison between a predominately white majority and Black majority parishes in the New Orleans's metropolitan area will further strengthen this point. According to the 2000 Louisiana Census, St. Bernard parish was 88.3 percent white and 7.6 percent Black or African American, whereas Orleans parish was 68.8 percent Black or African American and 26.6 percent white (U.S. Census Bureau 2000, 67, 70). According to FEMA Flood and Damage Assessments, 96.6 percent of residents in St. Bernard parish were impacted by flood damage, compared to the 76.8 percent impacted in Orleans parish (Gabe et al. 2005, 8). Per Bullard's straight-line theory of environmental racism, Orleans parish, because of its higher Black or African American population, should have flooded more. However, as shown by the data, this was not the case. While EJ scholarship is correct in arguing that instances of environmental racism occurred during evacuation efforts and rebuilding policies post-Katrina, it is necessary to clarify that higher concentrations of Black or African

Americans did not mean a higher likelihood of flood vulnerability, as the definition of environmental racism implies.

Evacuation Inequality. Although suburbanization trends throughout the twentieth century determined who would flood during Katrina, evacuation efforts were inherently discriminatory. In New Orleans, the racial divide in personal auto ownership was a major factor in who could evacuate the city. Despite this, it is not fair not to say that Governor Blanco and Mayor Nagin intended to leave Black residents behind; instead, it could be argued that their decision to hold off on issuing a mandatory evacuation was because they were concerned over members of the population who lacked access to personal automobiles. According to data from the 2000 Census, 27 percent of Black or African American residents in the New Orleans metropolitan area did not have access to a car, versus the 5 percent of non-Hispanic whites who lacked auto access (Berube and Katz 2005, 1). It was still more likely for poorer whites to have access to a car than Black New Orleanians (Berube and Katz 2005, 1). Even in more urban regions like Orleans Parish, where access to public transportation could narrow these disparities, 52 percent of poor African American residents lacked car access compared to 17 percent of poor whites (Berube and Katz 2005, 1-2). As mentioned in Chapter 3, local governments were aware that between 112,000 and 132,000 New Orleanians did not have access to personal vehicles (Horowitz 2020, 127-128; Wolshon 2006, 32). Because of this, when Mayor Nagin and Governor Blanco issued the mandatory evacuation, they decided that buses would be used to transport the remainder of the population who lacked access to private transportation. Despite officials' knowledge of the demographics of automobile ownership in New Orleans, the city only had one-quarter of the number of buses necessary to evacuate carless residents (Bullard 2009, 69). When Governor Blanco requested evacuation aid from President Bush on August 29, he assured her that FEMA

director Michael Brown would send 500 buses the following day (U.S. Senate 2006, 69). Buses did not arrive until Thursday, September 1, three days after the levees had been breached.

From this, it is clear that New Orleans's evacuation plan was based on the notion that the population would use private transportation. Such plans, however, are designed to privilege upper-class, able-bodied, and non-elderly households (Bullard 2009, 69-70). As we saw with the demographic breakdown of New Orleans's car ownership, the government's failure to provide enough public transportation to evacuate lower-income and communities of color was inherently racist. Furthermore, pre-Katrina emergency planners were well aware of the risks transit-dependent residents faced in the event of a mandatory evacuation (Bullard 2009, 72; Fischett 2001). It was apparent then that local, state, and federal authorities' inability to coordinate proper transportation for transit-dependent residents resulted in unnecessary loss of life (Johnson 2006, 13). Because the majority of Black residents did not have access to cars and because officials failed to employ a sufficient amount of mass transit, this led to a disparity between the death toll between white and Black residents. For example, in Orleans Parish, the mortality rate for Black or African Americans was four times higher than that among white residents (Brunkard et al. 2008, 218). Therefore, while lower-income and primarily Black or African American neighborhoods were less likely to experience flood damages due to the suburbanization trend of the twentieth century, transportation disparities between white and Black residents during Katrina's evacuation resulted in a stark contrast in the death toll. By looking at the mismanagement of emergency transportation under the EJ framework, it is clear that New Orleans's emergency evacuation was an indisputable instance of environmental racism that must be addressed before the next Katrina-like catastrophe hits the city.

Case Study: Katrina, Race, and the Media. (Separate short section on media). The ramifications of the city's failure to evacuate between 112,000 and 132,000 New Orleanians meant that, for the many African American residents left behind, they became the scrutiny of a post-Katrina racial media campaign. Interestingly, this serves as a case study that looks at the interaction between race and media amid a natural disaster, broadening the scope in which issues of environmental justice are studied. Following Katrina, media outlets were quick to imply racial stereotypes among the storm's victims. For example, the media argued that "white people faced the emergency as self-reliant, rugged individualists." Still, for the many poor and African Americans left behind, media outlets cast Black residents as "devolving into criminal, savage freeloaders" (Horowitz 2020, 121). Thus, the ways in which media outlets described survivors of color fall under the umbrella of racial injustices spurred by Katrina.

As discussed, the majority of individuals depicted on the roofs of their flooded home, the Superdome, and the Convention Center were primarily Black (Sommers et al. 2006, 39). This resulted in an emergence of race-related questions about Katrina, most notably: Why was race now being correlated with one's ability to evacuate before the storm? To answer this question, it is necessary to emphasize the media's ability to manipulate language in order to form a narrative of disaster events. In the days after Katrina, media outlets commonly described those left behind in New Orleans as "refugees," a term that is seldom applied to describe American citizens still on United States soil (Sommers et al. 2006, 40). It has been argued that the unprecedented circumstances posed by Katrina meant the crisis called for its victims to be deemed "refugees;" however, was the language used to describe Katrina's victims influenced by race? In a study examining American news networks' coverage of Katrina, new outlet Sommers et al. (2006) found that "race played some role in the use of 'refugee' in the coverage of Katrina (41). Still, it

is impossible to definitely argue that networks consciously associated Blackness with the term "refugee."

Nonetheless, one of the more concrete ways in which media networks racialized Katrina was the story angle pushed onto the survivors staying at the Superdome and the Convention Center. News stories were quick to emphasize the outbreak of violent crime after Katrina. In the competitive marketplace of information, it is interesting how news outlets focused to hone in on this aspect of Katrina's aftermath. Sommers et al. (2006) found that "'looting' comprised one aspect" of property crimes. Still, media attention was largely concentrated on "what was described as a 'violent crime wave' within the city of New Orleans, particularly among evacuees at the Superdome and Convention Center. As one NPR article put it, "much of the problem stems from a sudden flood of drug crimes, as dealers battle it out for territory vacated by the storm" (Sullivan 2006). Although media analyses can help us argue that race was at least a contributing factor in the media's attention to violence in post-Katrina New Orleans, it is impossible to prove if such a correlation exists. What can be gained from this brief examination of the intersection between media, race, and Katrina is that natural disasters provide various outlets, independent of the government, for environmentally related injustices to be brought about.

They Never Intended to Do Me Justice. As discussed in the previous chapter, the Road Home plan offered thousands of Louisiana residents the opportunity to finance, rebuild, and return to their homes. While this is true, it is necessary to discuss the implicit environmental racism embedded within the Road Home project's agenda.

For many poor and African American homeowners, groups largely concentrated in New Orleans's Lower Ninth Ward, eligibility for the Road Home program was already a barrier against these groups. First, the preliminary requirement for the Road Home program was that

homeowners needed to show a clear title to the properties destroyed during the flood (The Road Home 2012). However, this was particularly difficult for the city's poor and African American residents, as mainstream banking was less accessible to groups at this time; therefore, the result would be that these groups "were more likely to have obtained credit through lease-to-buy or other nontraditional mechanisms," meaning many never even possessed the required documents (Horowitz 2020, 153). Additionally, it was difficult for African Americans to receive the $150,000 maximum because grants were assigned according to a real estate market that had historically devalued African Americans' neighborhoods. The average grant would come out to be approximately $68,000 (Wolff 2012, 164). Homeowners were aware that the Road Home subtracted insurance payments from closing costs; however, residents soon realized that calculations for maximum payments were compared to a home's worth pre-flood to what it would cost to rebuild (Wolff 2012, 164). Unfortunately, this meant people in poorer neighborhoods, such as the Lower Ninth Ward, received less money and still had to pay inflated post-flood repair costs.

The poor and African American residents were taken advantage of by the Road Home program; however, they never stopped fighting. Nearly five years after Katrina made landfall, 124,000 homeowners received a total of $8 billion, but some 27,000 eligible homeowners were still waiting for their checks (Wolff 2012, 269). At this point, 4,000 homes were lost in the Lower Ninth Ward, yet residents waited longer than their white counterparts (Wolff 2012, 268). These eligible homeowners filed a suit against the federal government, saying "the program was prejudicial, that their payments couldn't cover repairs because they were based on the lower home values in Black neighborhoods (Wolff 2012, 269). Though homeowners made a valiant effort, data from the 2010 census revealed that St. Bernard Parish regained 60 percent of its

pre-flood population, and New Orleans only regained 34 percent (U.S. Census Bureau 2010, 34). Therefore, the implicit racist policies of the Road Home program meant many of its poor and African American homeowners could not come back to the city post-Katrina.

Perhaps the racism of post-storm policymaking can be illustrated best through the city's "attempt" to bring residents of public housing back. Evidence of racist policies of the Road Home program can be found in the city's deliberate attempt at eradicating its public housing. Before Katrina, public housing was already an important, albeit divisive, issue in New Orleans (Horowitz 2020, 158). In an ironic twist of fate, compared to the rest of the city, New Orleans's public housing complexes survived Katrina relatively unscathed. As such, inspections "found only limited damage to three of the so-called "Big Four" public housing developments (Horowitz 2020, 158). Post-storm rebuilding efforts, however, offered city officials the chance to slowly reduce the number of public housing residents (Greater New Orleans Fair Housing Action Center 2009, 7). As a result, even though New Orleans's major public housing units were safe to move back into after Mayor Nagin lifted the evacuation order, public housing remained closed, and residents were sent to FEMA trailers (Greater New Orleans Fair Housing Action Center 2009, 8). Because the valuation of houses in New Orleans could not escape from the history of racism, renters and residents of public housing were abandoned and preyed upon by city officials.

The decision to evict people from their homes reveals that New Orleans's "recovery" revealed that city officials did not aspire to build an equitable city. Through the concepts of environmental justice, this chapter was able to demonstrate the intricacies associated with race and post-disaster policy-making, revealing that environmental injustices still persist. As a result, the following chapter will recommend future post-storm policies that emphasize the nuances

surrounding race, renting, and public housing to make for more environmentally just post-disaster programs.

Chapter 5: Imagining the Future of New Orleans

A common thread throughout this thesis is that New Orleans is dedicated to its levee systems. From its founding in the eighteenth century to the present day, New Orleans has yet to rethink its relationship with the levee seriously. Because the city rebuilt its levee systems post-Katrina, scholars of its rebuilding policies often claim that such efforts were *laissez-faire*, highlighting the influence of profit-seeking firms (Horowitz 2020, 147). From this line of thinking, many believe that the reconstruction of levee systems post-Katrina was a case study of "disaster capitalism." For example, sociologists Kevin Fox Gotham and Miriam Greenburg contended in their monograph, *Crisis Cities: Disaster and Redevelopment in New York and New Orleans*, that New Orleans's post-Katrina reconstruction took the route of a "free-market-oriented approach to post-disaster redevelopment" (Gotham and Greenburg 2014, ix). Similarly, an American Studies scholar, George Lipsitz, argued that rebuilding policies in New Orleans were fundamentally neoliberal (Lipsitz 2006, 458). It may be tempting to fall into this line of thinking because post-Katrina rebuilding policies did appear to be heavily influenced by profit-seeking firms that, in turn, overthrew Black and lower-income residents' efforts to repopulate and thrive after the flood. However, as shown throughout this thesis, this was not the case.

Therefore, in order to recommend policies that will better prepare New Orleans for the possibility of another Katrina-like disaster, I find it necessary to problematize this neoliberal interpretation. In Chapter 2, I discussed at length the extent to which the construction and

maintenance of the city's original levee systems were foundational to New Orleans's growth. Capitalism, or rather slave-powered capitalism in the eighteenth and nineteenth centuries, determined where people lived in Louisiana and where the levees were constructed. Thus, I echo scholar Andy Horowitz's point that "Capitalism did not blow into the city with the storm" (Horowitz 2020, 147). This thesis, then, has shown that racial capitalism is the underlying concept that has shaped New Orleans since its founding and amid post-Katrina reconstruction. Thus, New Orleans's contemporary environmental challenges, namely those posed by climate change, cannot be extricated from the city's long history of racial capitalism. As I draw upon previous chapters to recommend policies for New Orleans, I will remain conscious of the fact that solutions to the city's environmental challenges are situated within this context. Also, it would be remiss to propose that New Orleans forgo its levee system because, without levees, New Orleans would not exist. Because New Orleans's levee systems are here to stay, my policy recommendations focus on adaptive practices that will reduce the potential for levee failures.

Bring Back Wetlands, Not Big Oil. As detailed in Chapter 1, threats posed by climate change, namely sea-level rise and the increased likelihood of more intense hurricanes, threaten the coastal city. Furthermore, even though Katrina prompted the *Louisiana Comprehensive Master Plan for a Sustainable Coast* (effective June 2, 2017) that would create 800 square miles of wetlands over the next half-century, there is still the likelihood that public entities (levee districts and port authorities), as well as development from industries (oil and gas operators, shipyards, and manufacturing facilities), could result in over 4,000 square miles of wetlands lost (Coastal Protection and Restoration Authority of Louisiana 2017, 74).

Coastal wetlands act as a natural buffer zone in the event of hurricanes. Therefore, if more policies are geared toward the creation of wetlands, this will shift a lot of the pressure put

on levee systems to hold flood waters to these marshlands. However, the oil industry stands in the way of efforts to restore wetlands. Chapter 3 made it clear that the post-Katrina reconstruction era prioritized the fast-tracked return for large oil companies. This was primarily done because, by 2015, the oil industry provided 65,000 Louisiana jobs and produced $1 billion per year in tax revenue for the state (Horowitz 2020, 192). As mentioned in the introduction of this chapter, Katrina did not usher in capitalism to New Orleans; as such, the oil industry has not traditionally had any roadblocks when it comes to dredging more than 9,000 miles of canals throughout the city's wetlands. Although Big Oil is required to pay Louisiana state taxes, they are not taxed for the destruction of wetlands or forced to pay for wetland restoration. Therefore, I propose that, in addition to the standard state tax, oil industries must face an additional tax for coastal wetland restoration.

A tax would be a straightforward way to raise revenue for wetland restoration. Nonetheless, it is necessary to note the political and social difficulties of raising taxes, as they vary depending on the type of tax and fiscal needs (Herrera et al. 2019, 263). In place of a tax, this thesis proposes the implementation of an Environmental Impact Bond (EIB) to address the challenges of funding coastal wetland restorations. EIBs come in two forms of transactions: either a Pay-for-Performance (PFP) or Pay-for-Success (PFS) (Herrera et al. 2019, 261). Both transitions are "intended to finance environmental interventions whereby contracting parties pay for, or are paid for, services based on pre-specified outcomes" (Herrera et al. 2019, 261). Because there is no single financing mechanism for natural infrastructure restoration, options like municipal bonds, PFP contracts, and green bonds should be considered. By using a bond to provide capital now, accelerating the timetable of wetland restoration in Louisiana would avoid future higher restoration costs (Herrera et al. 2019, 262). As put by Herrera et al. (2019),

"bonding based on expected 15 years of spill restoration funds and other potential longer-term revenue could attract private capital to accelerate restoration and by doing so generate greater environmental reduction benefits sooner" (262). Transactions are grounded in demonstrating the value of wetlands for reducing land loss rates, leveraging outside capital, and providing a model for future coastal restoration investments (Herrera et al. 2019, 267). Establishing the value of bonding changing restoration costs is important, as subsidence and rising sea levels will continue to make wetland restoration projects more costly.

Perhaps the most advanced feature of implementing EIBs would be the benefits reaped from using machine learning. There are two channels of machine learning algorithms: supervised and unsupervised machine learning. As Herrera et al. (2019) worked out, supervised and unsupervised machine-learning approaches can evaluate wetland restoration (270). Therefore, "by aligning the time and location of historic readings from these data sources and satellite imagery, machine learning models can be trained to 'see' relationships between hyperspectral imagery and the measurements made in situ (Herrera et al. 2019, 270). With the technology capable of evaluating the value of wetlands, investors would be incentivized to invest and secure funding. This would greatly enhance the *Louisiana Comprehensive Master Plan for a Sustainable Coast* (2017), as their "funding for future projects is not guaranteed and unforeseen circumstances could complicate the process of implementing projects that are already funded" (36). Interestingly, funding for wetland restoration projects is primarily from the settlement related to the 2010 Deepwater Horizon oil spill (Herrera 2019, 265). Because this is precedent for wetland restoration funding in Louisiana, this thesis proposes that an additional fee against oil and gas companies can supplant the settlement funds related to the 2010 Deepwater Horizon oil spill once they run out. Nonetheless, Herrera et al. (2019) give Louisiana a template "to

pursue a pilot transaction and then develop larger performance-based bonds for wetland restoration projects across its vulnerable coast (Herrera et al. 2019, 271). With increased funding from the oil and gas industries, it is possible to restore wetlands while creating benefits and interest from different stakeholders.

Someone has to be Held Accountable. The USACE, as discussed in Chapters 2 and 3, has been tasked with constructing and maintaining New Orleans's levee systems since 1928. In Chapter 3, it was revealed that the USACE was well aware of the fact that New Orleans's flood-control systems could not withstand a Category 3 hurricane. Additionally, they knew that the LPVHPP was only 80% complete prior to Katrina. There was no denying that the USACE neglected its responsibility of overseeing the city's levee systems. Still, when residents tried to sue the USACE to seek compensation for their losses, district courts found they were immune to most lawsuits. It seems entirely paradoxical that those in charge of the city's levee systems face no retribution when said systems fail, especially in the case of Katrina when the USACE did not inform government officials sooner that the levees could not withstand Katrina.

The USACE's immunity can be traced back to the same 1928 Act that allocated them as the overseers of flood control along the Mississippi River's alluvial valley. Per the 1928 Flood Control Act, "no liability of any kind shall attach to or rest upon the United States for any damage from or by floods or flood waters at any place" (U.S. Congress 1928, 1). Even though more than 50 of the USACE's levees were breached during Katrina, they were not held accountable for their negligence, nor did they have to pay back most of their victims. Because the USACE was clearly at fault for failing to complete the LPVHPP and for ensuring the quality of New Orleans, it is rather confounding that the 1928 Flood Control Act has not been amended to try and find a way to attribute some form of liability to the USACE. Thus, I propose that the

1928 Act be amended in order to limit USACE's level of immunity. Such a proposal, however, is more difficult to implement than it seems. Because the USACE is a branch of the United States Army, they are granted sovereign immunity; thus, they can only be sued with the United States government's consent.

While the 1928 Flood Control Act has saved the United States government from having to pay for flood damages since its adoption, the June 2022 *Milton v. United States* case revealed that courts were beginning to take a more nuanced approach to the Act (Hite 2022, 1). In light of this, it is too late for New Orleanians to bring up their cases against USACE; however, Houstonians who flooded during the 2017 hurricane Harvey still have the option (Hite 2022, 4). Nonetheless, it is necessary to monitor the *Milton v. United States* case to see if it is at all possible to sue the United States for flood-related damages, as this will most likely be a necessity for New Orleanians in case future breaches of USACE's levees produce flood damages as they did during Katrina.

As it stands, a claim against USACEs "must be presented, in writing, within two years from the date that cause of action occurred" (USACE 2024). In essence, this effectively bans anyone, though it was a majority of New Orleanians who were flooded from the levees' breeches. However, as American civil rights lawyer Deborah Archer (2021) has argued, "the right to return has long been used internationally as a legal and conceptual framework to protect ethnic minorities who were the victims of ethnic cleansing" (343). From this, "the right to return framework can be used to advance reparations for slavery" (Archer 2021, 362). However, because the right-to-return concept was invoked by residents of New Orleans to advance justice, it is plausible to argue that reparations are due for Katrina victims, particularly those who never received grants for the Road Home program. As Chapter 2 revealed, the history of levees and

storm surges has been predicated on Black New Orleanians to bear the brunt, whether in the eighteenth century or in 2005. Therefore, this thesis proposes a moral framework grounded on the right to return as an important part of reigniting the fight for reparations for Katrina victims.

Prepare, Prepare, Prepare. As we saw in Chapters 3 and 4, the mismanagement of preparations for and responses to Katrina was catastrophic; it undoubtedly exacerbated the mortality rate among Black or African American residents who did not evacuate. However, I employed ideas from political scientist Saundra Schneider, namely her claim that bottom-up governmental mobilization is the standard approach in response to natural disasters (Schneider 1995, 6). However, with the increased threats posed by climate change, as explained in Chapter 1, the impacts of hurricanes and floods in New Orleans have the potential to be far worse than Katrina. Thus, given the higher risks posed by climate change in New Orleans, it is fair to assert that federal officials should be able to intervene in instances of New Orleans's natural disasters without state or local officials first having to request additional assistance.

Furthermore, Governor Blanco could have invoked martial law; however, she did not. If she had, the National Guard would have been able to speed the evacuation process of the metropolitan area of New Orleans. But, if the top-bottom approach had been employed, the federal government could have bypassed this grave mistake made by the then-Louisiana Governor. Even though Schneider had made a compelling argument that the bottom-up approach has been relatively effective in other cases of natural disasters, it is perhaps time to insist on a top-bottom system for New Orleans, especially in retrospect of the mishandling of Katrina.

Given that poorer, and primarily African American, residents who did not have cars faced inequities while evacuating, I propose that a law must be put in place that mandates government officials, at the start of the hurricane season, to ensure that there is an adequate supply of

transportation vehicles on standby, in the event that federal response teams cannot reach the city. The incomplete evacuation of the metropolitan New Orleans area also highlights the need for government officials to stop thinking about evacuation plans with the notion that everyone has access to private transportation. Thus, it is necessary to create a city-wide program in order to educate New Orleanians on the proper protocol in the event of a disaster. For example, when Mayor Nagin and Governor Blanco issued the mandatory evacuation, a fair amount of residents refused to leave, as they did not understand the severity of Katrina. Additionally, for the lower-income and primarily African American communities that did not have personal vehicles to evacuate, a good deal needed to be made aware of the fact that the Superdome and Convention Center were being used as a shelter amid the storm. Recall that, in Chapter 3, the federal government failed to audit the emergency preparedness plan New Orleans submitted before Katrina (Roberts 2005, 4). Had this been done, the city's government and residents would have prepared better for the disaster.

As of now, the National Risk Index (NRI) score has New Orleans rated as relatively high risk (NRI 2024). Given that disasters' distribution is uneven in space and time, it raises many interesting questions. For example, to what degree should a population be educated on natural disasters? Is there a positive outcome from increased education and mitigating natural damage disasters? For Cerulli et al. (2020), the answer leans toward yes. Therefore, it is necessary to look at the relationship between education and natural disaster preparedness in order to create a public learning program for New Orleans.

Naturally, populations are unevenly distributed throughout countries, states, and cities. Therefore, individuals have various hazard awareness levels (Cerulli et al. 2020, 1). Disasters may become more frequent and severe in New Orleans's future because of land subsidence,

increased hurricane activity, and climate change. Because of this, it is necessary to look at the role of education, particularly because it is the precursor to behavioral action (Cerulli et al. 2020, 2). Natural hazard awareness, however, changes over time. As Cerulli et al. (2020) explained, the "memory of a natural hazard event gradually fades with time unless significant investments in education and training are made to maintain heightened levels of natural-hazard awareness" (2). Interestingly, evidence has shown that "countries at low risk tend to be over-aware while countries at high risk are under-aware" (Cerulli et al. 2020, 1). This point is perhaps best illustrated by the fact that many residents were not aware that the Superdome and Convention Center were being used as a shelter.

Though this section is focused on educating the general New Orleans public about hazard awareness, it is important to emphasize the role early childhood education has in mitigating disasters. In a study done by Yasuda et al. (2018), it was discovered that "the desire to acquire knowledge of the mechanisms which cause disasters increased due to the disaster-prevention education program" (21). This is a very relevant point when discussing the implementation of more hurricane preparedness educational programs in New Orleans. Given that exposure to mechanisms causing disasters and disaster-prevention education appeared to work in tandem in this study, it is necessary to highlight the potential eagerness of children latching on to a program like this in New Orleans. Furthermore, even though the awareness of a natural disaster threat weakens over time with children, "it was found that the desire to obtain knowledge of the disasters remained, even after a month had passed" (Yasuda et al. 2018, 21). As such, this paper proposes that it would be extremely beneficial if New Orleans were to integrate disaster preparedness programs within their schools.

Adaptive Living Practices. Unfortunately, the next Katrina is inevitable. Though post-Katrina levees withstood the 2009 Hurricane Ida, they are not equipped for the risks posed by climate change. As we have seen, New Orleans has yet to give up the levee as its main source of flood control. The city is too dependent on the levee systems to rework them completely. However, if the levee systems cannot be overthrown entirely, it is essential that New Orleans stops people from building on land below sea level. It also requires builders to adhere to adaptive living practices to make homes better withstand future storms and floods. The best way to understand how adaptive living can operate in New Orleans this thesis proposes that the city mirror the adaptive living practices of the Netherlands. The two have many similarities, and both face the same threats posed by challenges. However, by looking at the Netherlands, it will become evident that it is possible to transform New Orleans into a climate-resilient city, but the Republican-led government is a major opposition.

Like New Orleans, the Netherlands consists of a delta and former floodplains of the rivers Rhine, Meuse, and Schelde. Similarly, the Netherlands faces major challenges of sea level rise and wetland land subsidence. Adaptational challenges plague both regions; however, limited geographic space means the Netherlands has had to center its adaptive living practices on that principle. New Orleans, on the other hand, has the ability to relocate people more northern into Louisiana. That said, what the Netherlands has done successfully comes from its decision-making process, which puts the natural system as the starting point of all policy choices (Baptist et al. 2019, 7). For example, the Netherlands has overcome infrastructural challenges by implementing "sustainable solutions for permanent structures on soft (subsiding) soils…based on the principles that the ground pressure of structures should not exceed the bearing capacity of the soil (Ritzema 2008, 11). Interestingly, the Netherlands has also begun incorporating flood-proof

foundation and building techniques. Such techniques are framed around the notion of increasing sea level rise. For example, buildings with foundations on piles, floating buildings, and buildings on artificial mounds are some of the ways the Netherlands works around living in a wetland environment. With such measures in mind, the Netherlands expects that in 2120, “the river area provides space for floating homes,” and their levees along the rivers, which will be much wider, “provide locations for homes and sustainable energy generation (Baptist et al. 2019, 9). As such, this thesis proposes New Orleans adopt similar adaptive living practices to ensure the city’s future.

Bibliography

Al-Attabi, Zaid, Yicheng Xu, Georgette Tso, and Siddharth Narayan. 2023. "The impacts of tidal wetland loss and coastal development on storm surge damages to people and property: a Hurricane Ike case-study." *Scientific Reports*, 13(1): 1-14. https://doi.org/10.1038/s41598-023-31409-x

Alperin, Lynn M. 1983. *History of the Gulf Intracoastal Waterway*. National Waterways Study, US Army Engineer Water Resources Support Center, Institute for Water Resources.

Archer, Deborah N. 2021. "Reparations and the Right to Return." *New York University Review of Law & Social Change* 45(3): 343-369.

Banta, Brady Michael. 1981. "The Regulation and Conservation of Petroleum Resources in Louisiana, 1901-1940." *LSU Historical Dissertations and Theses*. 3669. https://repository.lsu.edu/gradschool_disstheses/3669/

Baptist, Martin, Tim van Hattum, Stijn Reinhard, Michaël van Buuren, Bertram de Rooij, Xiaolu Hu, Sabine van Rooij, Nico Polman, Sander van den Burg, Gerjan Piet, Tom Ysebaert, Brenda Walles, Jeroen Veraart, Wieger Wamelink, Bram Bregman, Bram Bos, Trond Selnes. 2019. *A nature-based future for the Netherlands in 2120.* Wageningen University & Research. https://doi.org/10.18174/512277

Barbier, Edward B., Ioannis Y. Georgiou, Brian Enchelmeyer, and Denise J. Reed. 2013. "The Value of Wetlands in Protecting Southeast Louisiana from Hurricane Storm Surges." Edited by Gil Bohrer. *PLoS ONE* 8 (3): e58715. https://doi.org/10.1371/journal.pone.0058715.

Barry, John M. 1998. *Rising Tide: The Great Mississippi Flood of 1927 and How It Changed America*. Touchstone.

Bass, Aaron S., and R. Eugene Turner. 1997. “Relationships between Salt Marsh Loss and Dredged Canals in Three Louisiana Estuaries.” *Journal of Coastal Research*, 13 (3): 895-903. https://www.jstor.org/stable/4298682

Berlin, Ira. 1998. *Many Thousands Gone: The First Two Centuries of Slavery in North America*. 4. print. Cambridge, Mass.: Belknap Press of Harvard Univ. Press.

Berube, Alan, and Steven Raphael. 2005. “Access to Cars in New Orleans.” Brookings Institution, 1–19. https://www.researchgate.net/publication/228514891_Access_to_cars_in_New_Orleans

Brunkard, Joan, Gonza Namulanda, and Raoult Ratard. 2008. "Hurricane Katrina Deaths, Louisiana, 2005." *Disaster Medicine and Public Health Preparedness* 2 (4): 215-23. https://doi.org/10.1097/DMP.0b013e31818aaf55

Bullard, Robert D. 2000. *Dumping in Dixie: Race, Class, and Environmental Quality*. 3rd ed. Boulder, Colo: Westview Press.

Bullard, Robert D. 2009. *Race, Place, and Environmental Justice after Hurricane Katrina: Struggles to Reclaim, Rebuild, and Revitalize New Orleans and the Gulf Coast*. Edited by Beverly Wright. Boulder, CO: Westview Press.

Bullard, Robert. 2011. “A 20-Point Plan to Destroy Black New Orleans After Katrina: Revisited 5 Years Later.” Dr. Robert Bullard: Father of Environmental Justice. May 30, 2011. https://drrobertbullard.com/a-20-point-plan-to-destroy-black-new-orleans-after-katrina-revisited-5-years-later/.

Burkett, Virginia R., David B. Zilkoski, and David A. Hart. 2003. “Sea-Level Rise and Subsidence: Implications for Flooding in New Orleans, Louisiana,” in *U.S. Geological Survey Subsidence Interest Group Conference: Proceedings of the Technical Meeting,*

Galveston, Texas, November 27–29, 2001. Austin, TX: 63–70. https://pubs.usgs.gov/of/2003/ofr03-308/pdf/OFR03-308.pdf

Campanella, Richard. 2006. *Geographies of New Orleans: Urban Fabrics before the Storm*. Center for Louisiana Studies.

Cerulli, David, Scott M, Aunap R, Kull A, Pärn J, Holbrook J, Mander Ü. 2020 "The Role of Education in Increasing Awareness and Reducing Impact of Natural Hazards." *Sustainability* 12(18): 7623. https://doi.org/10.3390/su12187623

CNN Transcripts. 2005. "City of New Orleans Falling Deeper into Chaos and Desperation." http://www.cnn.com/TRANSCRIPTS/0509/02/ltm.01.html

Coastal Protection and Restoration Authority of Louisiana, 2017. *Louisiana Comprehensive Master Plan for a Sustainable Coast* (effective June 2, 2017). https://coastal.la.gov/wp-content/uploads/2017/04/2017-Coastal-Master-Plan_Web-Book_CFinal-with-Effective-Date-06092017.pdf

Colten, Craig E. 2007. "Environmental Justice in a Landscape of Tragedy." *Technology in Society* 29 (2): 173–79. https://doi.org/10.1016/j.techsoc.2007.01.006.

Comfort, Louise K. 2005. "Fragility in Disaster Response: Hurricane Katrina, 29 August 2005." *The Forum* 3 (3): 000010220215408884 1090. https://doi.org/10.2202/1540-8884.1090.

Dyson, Michael Eric. 2006. *Come Hell or High Water: Hurricane Katrina and the Color of Disaster*. New York: Basic Civitas.

Fisk, Harold N.1944. *Geological Investigation of the Alluvial Valley of the Lower Mississippi River*. Vicksburg, MS: U.S. Army Corps of Engineers, Mississippi River Commission.

Gabe, Thomas, Gene Falk, and Maggie McCarty. 2005. *Hurricane Katrina: Social-Demographic*

Characteristics of Impacted Areas. Washington, D.C., CRS Report no. RL33141. https://www.everycrsreport.com/files/20051104_RL33141_dbe7aa622e3978035b86421c23de45598a0a1889.pdf

Gosselink, James G. and National Coastal Ecosystems Team (U.S.). 1984. *The Ecology of Delta Marshes of Coastal Louisiana : A Community Profile*. Washington, DC: National Coastal Ecosystems Team, Division of Biological Services, Research Development, Fish and Wildlife Service, U.S. Dept. of the Interior. https://doi.org/10.5962/bhl.title.4037.

Greater New Orleans Fair Housing Action Center. 2009. *Housing Choice Crisis: An Audit Report on Discrimination Against Housing Choice Voucher Holders in the Greater New Orleans Rental Housing Market*. https://storage.googleapis.com/wzukusers/user-33549461/documents/5b47887358f3cNIEd9KN/HousingChoiceInCrisis2009.pdf

Herrera, D, Cunniff, S., DuPont, C., Cohen, B., Gangi, D., Kar, D., Peyronnin Snider, N., Rojas, V., Wyerman, J., Norriss, J., & Mountenot, M. 2019. "Designing an environmental impact bond for wetland restoration in Louisiana." *Ecosystem Services*, 35(1): 260–276. https://doi.org/10.1016/j.ecoser.2018.12.008

Hite, Kristen. 2022. "Opening the Floodgates? Federal Circuit Lets Claims Proceed Against Corps of Engineers for Hurricane-Related Flooding." *Congressional Research Service*. https://crsreports.congress.gov/product/pdf/LSB/LSB10790

Horowitz, Andy. 2020. *Katrina: A History, 1915-2015*. Cambridge, Massachusetts: Harvard University Press.

Hudson, Charles M. 1997. *Knights of Spain, Warriors of the Sun: Hernando De Soto and the South's Ancient Chiefdoms*. Athens: University of Georgia Press.

Institute of Medicine, Board on Population Health and Public Health Practice, Research, and Medicine Roundtable on Environmental Health Sciences, Christine Coussens, and Lynn Goldman. 2007. *Environmental Public Health Impacts of Disasters : Hurricane Katrina: Workshop Summary*. Online Access: NCBI NCBI Bookshelf. Washington, D.C.: National Academies Press. https://search-ebscohost-com.avoserv2.library.fordham.edu/login.aspx?direct=true&db=e000xna&AN=991005&site=eds-live.

IPCC. 2021. *Climate Change 2021: The Physical Science Basis*. *Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, In press, doi:10.1017/9781009157896.

Jefferson, Thomas. 1803. "An Account of Louisiana : Being an Abstract of Documents in the Offices of the Departments of State and of the Treasury." Online text. Library of Congress, Washington, D.C. 20540 USA. 1803. https://www.loc.gov/item/06002118/.

Johnson, R. P., Jr. 2006. "Should the National Response Plan Be Changed to Divide the Transportation Responsibilities Under Emergency Support Function #1? Lessons Learned from Hurricane Katrina Show That Transportation Support for Emergency Response Needs Revision." Carlisle, PA: U.S. Army War College Strategy Research Project. https://apps.dtic.mil/sti/pdfs/ADA449680.pdf

Keim, Barry D., and Robert A. Muller. 2009. *Hurricanes of the Gulf of Mexico*. Baton Rouge, LA: Louisiana State University Press.

Kelman, Ari. 2007. "Boundary Issues: Clarifying New Orleans's Murkey Edges." *Journal of*

American History 94 (4): 695–703.

Lassiter, Matthew D., and Kevin M. Kruse. 2009. "The Bulldozer Revolution: Suburbs and Southern History since World War II." *The Journal of Southern History* 75 (3): 691–706. http://www.jstor.org/stable/27779033.

Latrobe, Benjamin Henry. 1980. *The Journals of Benjamin Henry Latrobe, 1799-1820: From Philadelphia to New Orleans*. Edited by Edward C. Carter, John C. Van Horne, and Lee W. Formwalt. The Papers of Benjamin Henry Latrobe : Series I, Journals ; v. 3. New Haven: Yale University Press.

Lindsay, Bruce R. and Jaden Conrad Nagel. 2013. *Federal Disaster Assistance after Hurricanes Katrina, Rita, Wilma, Gustav, and Ike*. Washington, DC: Congressional Research Service, https://digital.library.unt.edu/ark:/67531/metadc227881/m1/1/high_res_d/R43139_2013Jul05.pdf

Logan, John R. 2006. "The Impact of Katrina: Race and Class in Storm-Damaged Neighborhoods." Brown University, 1-16. https://s4.ad.brown.edu/Projects/Hurricane/report.pdf

Louisiana Recovery Authority. 2006. *South Louisiana Recovery Survey: Citizen and Civic Leader Research Summary of Findings*. Baton Rouge: Louisiana Recovery Authority Support Foundation. https://www.doa.la.gov/media/xtallctz/apa1_clarification_approved.pdf

Lyell, Charles. 1849. *A Second Visit to the United States of North America: In Two Volumes*. Vol. 02. London: J. Murray. https://doi.org/10.5962/bhl.title.50855.

Mendelssohn, Irving A., Gary L. Andersen, Donald M. Baltz, Rex H. Caffey, Kevin R. Carman,

John W. Fleeger, Samantha B. Joye, Qianxin Lin, Edward Maltby, Edward B. Overton, and Lawrence P. Rozas. 2012. "Oil Impacts on Coastal Wetlands: Implications for the Mississippi River Delta Ecosystem after the *Deepwater Horizon* Oil Spill." *BioScience*, 62 (6): 562-574. https://doi.org/10.1525/bio.2012.62.6.7

Millennium Ecosystem Assessment (Program), ed. 2005. *Ecosystems and Human Well-Being: Synthesis*. Washington, DC: Island Press.

Morris, Christopher Charles. 2012. *The Big Muddy: An Environmental History of the Mississippi and Its Peoples, from Hernando de Soto to Hurricane Katrina*. New York, NY: Oxford University Press.

National Weather Service. "Hurricane Katrina - August 2005." NOAA's National Weather Service. https://www.weather.gov/mob/katrina.

National Weather Service. "NWS New Orleans/Baton Rouge Sun Aug 28 2005 413 PM CDT Inland Hurricane Warning." NOAA's National Weather Service. https://www.weather.gov/lix/NPW_28_1613.

Northrup, Solomon. 2011. *Twelve Years a Slave Narrative of Solomon Northup, a Citizen of New-York, Kidnapped in Washington City in 1841, and Rescued in 1853*. Chapel Hill: The University of North Carolina Press.

Nyman, J. A., R. D. DeLaune, H. H. Roberts, W. H. Patrick Jr. 1993. "Relationship between vegetation and soil formation in a rapidly submerging coastal marsh." *Marine Ecology Progress Series*, 96(3): 269-279. https://www.jstor.org/stable/24833555

Pali, Brunilda. 2020. "Restorative Environmental Justice." *European Forum for Restorative*

Justice. https://www.euforumrj.org/sites/default/files/2020-05/EFRJ_Thematic_Brief_Restorative_Environmental_Justice.pdf

Penland, Shea, Paul F. Connor, Jr., Andrew Beall, Sarah Fearnley, and S. Jeffress Williams. 2005. "Changes in Louisiana's Shoreline: 1855-2002." *Journal of Coastal Research*. 44 (1): 7-39. https://login.avoserv2.library.fordham.edu/login?url=https://www.proquest.com/scholarly-journals/changes-louisianas-shoreline-1855-2002/docview/210890952/se-2?accountid=10932

Rees, Mark A. 2010. *Archaeology of Louisiana*. Baton Rouge, LA: Louisiana State University Press.

Ritzema, H. P. 2008. "Coastal Lowland development: coping with climate change: examples from the Netherlands." *Proceedings of the International Workshop on Sustainable paddy farming and healthy environment*. https://www.researchgate.net/profile/Henk-Ritzema/publication/37793061_Coastal_Lowland_development_coping_with_climate_change_examples_from_the_Netherlands/links/54cfdd710cf24601c095be62/Coastal-Lowland-development-coping-with-climate-change-examples-from-the-Netherlands.pdf

Rivlin, G. 2005. *A Mogul who would rebuild New Orleans*. The New York Times. https://www.nytimes.com/2005/09/29/business/a-mogul-who-would-rebuild-new-orleans.html

Roberts, Patrick S. 2005. "What Katrina Means for Emergency Management." *The Forum* 3 (3): 00001022021540888841094. https://doi.org/10.2202/1540-8884.1094.

Rohland, Eleonora. 2019. *Changes in the Air: Hurricanes in New Orleans from 1718 to the Present*. New York, NY: Berghahn Books.

Saucier, Roger T. 1994. *Geomorphology and Quaternary Geologic History of the Lower Mississippi Valley*. Vicksburg: Miss.: US Army Corps of Engineers, for the Mississippi River Commission, Waterways Experiment Station.

Scaife, William W., R Eugene Turner, and Robert Costanza. 1983. "Coastal Louisiana recent land loss and canal impacts." *Environmental Management*, 7(5): 433-442. https://repository.lsu.edu/cgi/viewcontent.cgi?article=1165&context=oceanography_coastal_pubs

Schlosberg, David. 2007. "Defining Environmental Justice in the USA." Ch. 3 from *Defining Environmental Justice: Theories, Movements, and Nature*. New York, NY: Oxford University Press.

Schneider, Saundra K. 1995. *Flirting with Disaster: Public Management in Crisis Situations*. Bureaucracies, Public Administration, and Public Policy. Armonk, NY: Sharpe.

Silkenat, David. 2022. *Scars on the Land: An Environmental History of Slavery in the American South*. New York: Oxford University Press.

Sommers, Samuel R., Evan P. Apfelbaum, Kristin N. Dukes, Negin Toosi, and Elsie J. Wang. 2006. "Race and Media Coverage of Hurricane Katrina: Analysis, Implications, and Future Research Questions." *Analyses of Social Issues and Public Policy* 6(1): 39-55. https://cretscmhd.psych.ucla.edu/nola/volunteer/EmpiricalStudies/Race%20and%20media%20coverage%20of%20hurricane%20katrina%20-%20analysis,%20implications,%20and%20future%20research%20questions.pdf

Stone, Gregory W., John M. Grymes Iii, John R. Dingler, and David A. Pepper. 1997. "Overview and Significance of Hurricanes on the Louisiana Coast, U.S.A." *Journal of Coastal Research* 13 (3): 656–69.

Sullivan, Lara. 2006. *Crime Wave Surfaces in Post-Katrina New Orleans*. NPR. https://www.proquest.com/docview/190109986/fulltext/E9E827E15B1F4266PQ/1?accountid=10932

The New York Times. 2006. "Opinion | Hard Decisions for New Orleans," January 14, 2006, sec. Opinion. https://www.nytimes.com/2006/01/14/opinion/hard-decisions-for-new-orleans.html.

The Road Home. 2012. "The Road Home Program Overview." https://www.road2la.org/HAP/Default.aspx

Turner, R. Eugene, and Donald R. Cahoon. 1988. *Causes of Wetland Loss in the Coastal Central Gulf of Mexico*. Volume I: Executive Summary. https://espis.boem.gov/final%20reports/3778.pdf

Twain, Mark. 2006. *Life on the Mississippi*. Online text. Project Gutenberg eBook. https://www.gutenberg.org/files/245/245-h/245-h.htm

United States Army Corps of Engineers. 2009. *Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System: Final Report of the Interagency Performance Evaluation Task Force*. 1 (1): https://biotech.law.lsu.edu/katrina/ipet/Volume%20I%20FINAL%2023Jun09%20mh.pdf

US Army Corps of Engineers. 2024. "Filing a Claim against the Army Corps of Engineers under

the Federal Tort Claims Act." *US Army Corps of Engineers: New Orleans District*, www.mvn.usace.army.mil/About/Offices/Office-of-Counsel/FTCA/#:~:text=A%20claim%20against%20the%20United,alleged%20negligent%20act%2Fdamage%20occurred.

United States Census Bureau. 2002. "Louisiana: 2000 Summary Population and Housing Characteristics." https://www2.census.gov/library/publications/2002/dec/phc-1-20.pdf

United States Census Bureau. 2012. "Louisiana: 2010 Summary Population and Housing Counts." https://www2.census.gov/library/publications/decennial/2010/cph-2/cph-2-20.pdf

U.S. Congress. House. 1928. *An Act For the control of floods on the Mississippi River and its tributaries, and for other purposes (The Flood Control Act)*. Ch. 596, 70th Cong., 1st Sess. Adopted 15 May 1928. https://www.mvd.usace.army.mil/Portals/52/docs/MRC/Appendix_E._1928_Flood_Control_Act.pdf

United States Congress. House. 1988. *Major Disaster Relief and Emergency Assistance Amendments of 1987*. Public Law 100-707, 100th Congress. Adopted 23 November 1988. https://www.congress.gov/bill/100th-congress/house-bill/2707

United States Congress. House. 2005. *Emergency Supplemental Appropriations to Address Hurricanes in the Gulf of Mexico, and Pandemic Influenza Act, 2006*. Public Law 109-148, 109th Congress. Adopted 30 December 2005. https://www.congress.gov/bill/93rd-congress/senate-bill/3062/all-info

United States Congress. 2006. *A Failure of Initiative : Final Report of the Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina*. Report / 109th Congress, 2nd Session, House of Representatives: 109-377. U.S. Government

Printing Office. https://search-ebscohost-com.avoserv2.library.fordham.edu/login.aspx?direct=true&db=cat00989a&AN=ford.1190364&site=eds-live.

United States Congress. Senate. 1974. *Disaster Relief Act Amendments*. Public Law 93-288, 93rd Congress. Adopted 22 May 1974. https://www.congress.gov/bill/93rd-congress/senate-bill/3062/all-info

United States Senate. 2006. *Hurricane Katrina: A Nation Still Unprepared, Special Report of the Committee on Homeland Security and Governmental Affairs*. Washington, D.C., S. Rept. 109-322. https://www.congress.gov/109/crpt/srpt322/CRPT-109srpt322.pdf

USGS. 2023. "Louisiana Coastal Wetlands: A Resource At Risk - USGS Fact Sheet." https://pubs.usgs.gov/fs/la-wetlands/.

Volkov, Denis L., Kate Zhang, William E. Johns, Joshua K. Willis, Will Hobbs, Marlos Goes, Hong Zhang, and Dimitris Menemenlis. 2023. "Atlantic Meridional Overturning Circulation Increases Flood Risk along the United States Southeast Coast." *Nature Communications* 14 (1): 5095. https://doi.org/10.1038/s41467-023-40848-z.

Walker, Jesse H., James M. Coleman, Harry H. Roberts, and Robert S. Tye. 1987. "Wetland Loss in Louisiana." *Geografiska Annaler. Series A, Physical Geography*, 69 (1): 189-200. https://www.jstor.org/stable/521377

Wang, Zhankun, Tim Boyer, James Reagan, and Patrick Hogan. 2023. "Upper-Oceanic Warming in the Gulf of Mexico between 1950 and 2020." *Journal of Climate* 36 (8): 2721–34. https://doi.org/10.1175/JCLI-D-22-0409.1.

White, David A., T. Edward Weiss, John M. Trapani, Leonard B. Thien. 1978. "Productivity and

Decomposition of the Dominant Salt Marsh Plants in Louisiana." *Ecology*, 59 (4): 751-759. https://www.jstor.org/stable/1938779

White House Archives. 2005. "President George W. Bush Looks out over the Devastation in New Orleans from Hurricane Katrina as He Heads Back to Washington D.C." August 31. https://georgewbush-whitehouse.archives.gov/news/releases/2005/08/images/20050831_p083105pm-0117jas-515h.html.

Wolff, D. J. (2012). *The Fight for Home How (Parts of) New Orleans Came Back*. Bloomsbury.

Wolshon, Brian. 2006. "Evacuation Planning and Engineering for Hurricane Katrina," *The Bridge* 36 (1): 27-34. https://www.nae.edu/File.aspx?id=7393&v=932df41

Yasuda, Mari, Toshiaki Muramoto, and Rui Nouchi. 2018. "Assessment of Educational Methods for Improving Children's Awareness of Tsunamis and Other Natural Disasters: Focusing on Changes in Awareness and Regional Characteristics in Japan" *Geosciences* 8, no. 2: 47. https://doi.org/10.3390/geosciences8020047

Yates, Kathrine E. 1999. "Wetlands Mitigation and Mitigation Banking in Louisiana." *Louisiana Law Review*, 59 (2): 591-622. HeinOnline.

Ydstie, J. 2005. *Group unveils plans to rebuild New Orleans*. NPR. https://www.npr.org/2005/11/18/5019103/group-unveils-plans-to-rebuild-new-orleans

Yin, Jianjun. 2023. "Rapid Decadal Acceleration of Sea Level Rise along the U.S. East and Gulf Coasts during 2010–22 and Its Impact on Hurricane-Induced Storm Surge." *Journal of Climate* 36 (13): 4511–29. https://doi.org/10.1175/JCLI-D-22-0670.1.

"Industry | Louisiana Seafood." 2023. 2023. https://www.louisianaseafood.com/industry.

"Orleans Parish, Louisiana." *Community Report - Orleans Parish, Louisiana | National Risk*

Index, 2024, hazards.fema.gov/nri/report/viewer?dataLOD=Counties&dataIDs=C22071.