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Hannah Szymanski

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## **Hurricanes: Climate Change & Social Inequality**

*Hannah Szymanski*

One of the most pressing issues in the global community is climate change. It is a threat that looms over nearly every issue, whether it be the subjects taught to kindergarteners, the kinds of cars being produced, or the material straws are made out of. As an impending issue that already has applicable problems, it already has a deadline that scientists warn we need to fix before it is irreversible and the planet is unable to recover and climate change affects every aspect of our lives. For many groups of people, however, climate change is already affecting them day to day and is a problem that was knocking down their doors yesterday. For the people living in coastal areas, hurricanes and tropical storms have always been a danger that they have grown accustomed to living with, and have accepted as part of living in the region. But with the escalation of climate change, the average temperature of the oceans has only increased more with every passing year, and the height of sea levels is higher than ever before. As a result, hurricanes have only become more and more dangerous to these communities as storm surges, floods, and winds continue to wreak more and more havoc on their homes and communities. The communities in coastal communities are more and more vulnerable to hurricanes because of climate change and are disproportionately affected by climate change, with people within the low socioeconomic class being the most drastically impacted.

### ***The Science Behind Climate Change and Hurricanes***

Hurricanes are formed when warm, moist air rises and creates a low-pressure area below itself, which allows for the creation of new warm air in its place. As this air rises higher into the atmosphere and more and more water is introduced, clouds form with the water, cooling the temperature of the air and water. The cool water and air meet the new, warmer air, and it circulates into swirls, creating a hurricane that feeds off warm water as it travels (NOAA). These conditions are only able to occur near the equator because the water further north is not warm enough to continue feeding the hurricane to maintain enough speed and strength to be considered a hurricane.

All of these storms begin as tropical storms, which have wind speeds between 36-73 mph, with 74 mph being the benchmark to classify a tropical storm as a category 1 tropical cyclone or hurricane (NASA). Many small storms and tropical hurricanes occur without ever reaching land, but as the water's temperature increases, it allows more storms to escalate into hurricanes. Records of the changing climate show that as the atmosphere is getting warmer due to the trapping of greenhouse gasses, the average temperature of ocean water has been increasing. This increased temperature adds to the fuel for hurricanes, and over the last four decades the amount of category 3-5 hurricanes has increased exponentially, and with every additional degree of temperature increase, rain is expected to increase by 7% (Ramirez). The increased number of hurricanes in total is a concerning figure, but the increased number of category 3, 4, and 5 hurricanes is something that presents a much clearer danger to people living near the equator. Category 3 hurricanes have wind speeds between 111-129 mph with a 9-12-foot storm surge, category 4's have wind speeds between 130-156 mph with storm surges between 13-18 feet, and category 5's have wind speeds over 157 mph and storm surges over 19 feet (NASA).

The greatest risks to property and human life in a hurricane are caused by extreme wind speeds and storm surges. Climate change has severely impacted the strength of both. Wind speeds in hurricanes are increased by the amount of pressure under the storm, which increases as the temperature of the water increases (Miller). Wind is a particularly dangerous force in a hurricane because of the power of destruction it can cause. Category 3 hurricanes mark the beginning level that most mobile homes will be completely destroyed, and most well-built infrastructure will also experience heavy damage. A category 5 hurricane's wind speeds mean that nearly all buildings will experience major damage, and many will be destroyed (Abrams). Flying debris also poses a risk to people, animals, or buildings because the force of the debris could cause serious injury, damage, or even death. Wind, however, is still less dangerous than storm surges. Storm surges happen when the intense winds from the hurricane push water from the oceans, lakes, or rivers in and around a city onto dry land, creating an extremely powerful and forceful flood aided by the extreme power from high-speed winds. Due to the high height of the water and the

forcefulness of the water, storm surges account for nearly half of all hurricane-related deaths (Ramirez).

Coastal cities like New Orleans are the most vulnerable to hurricanes because of their proximity to large bodies of water that expose them to storm surges. New Orleans's location makes it particularly at risk with more than half of the city below sea level, and others only about three feet above (Sneath). The marshlands make the city prone to flooding as is, but their proximity to the tropics and the large bodies of water make it a hot spot for hurricanes. When Hurricane Katrina hit the city in 2005, it was only category three, but it was the storm surge that made it as destructive as it was. It knocked down power lines, destroyed homes, and because of the height of the city, the water was difficult to drain away and was inhabitable for many weeks. It was only a category three, and yet it was one of the worst hurricanes in the history of the city. Climate change was very quickly pointed out to be at fault for how devastated the city had been. Research conducted by the United States Army Corps of Engineers and Virginia Tech University compared many details about the environment in 2005 to New Orleans in 1900 focusing on a recognition of the erosion of the wetlands surrounding the city to compare the damage caused by Katrina in 2005 to what would have happened if Katrina had occurred in 1900. The study found that given the sea level rise and the wetlands erosion, flooding in 2005 was 15-60% higher in various places than it would have been in 1900 (Irish ET. Al). The study pointed out that because of the climate change-induced sea level rise, the wetlands that used to be crucial in protecting the city were sparse and unable to be effective in protecting the city. In addition to this, because of the way that the city was constructed, the sinking of the city allowed for flood damage to spread more quickly because so much of the city was lower than it used to be.

Katrina was only the first in a series of hurricanes that continue to batter New Orleans. Because of the devastation in the wake of Katrina, the city was more cautious in its attitude regarding future hurricanes, implementing more safety precautions for residents and building stronger and better infrastructure, such as levees, to protect the city in the event of another hurricane. While it may be unlikely that another hurricane will cause as much devastation to New Orleans soon, the strength and destruction of hurricanes in New Orleans have only worsened. Before 2020, it was

uncommon for hurricanes to reach the mainland at a category four, even rarer for a category 5. But since Katrina, New Orleans has been hit by several category four's including Hurricanes Laura and Ida in 2020 and 2021, and Florida was hit by only the fourth category 5 hurricane in recorded American history, Hurricane Michael (Neuman). The significance of Laura and Ida in the city cannot be overstated despite not causing as much devastation as Katrina and only being Category 4's. Both are tied as being the biggest storms to have ever hit the state of Louisiana (Vera). Ida and Laura have both continued to have an effect on the city as the damage from the storms has still yet to be fixed in many areas of the city. While hurricanes are naturally occurring, the phenomenon of having the two biggest hurricanes in the history of the state of Louisiana is not something that could have been normal. The climate-changed ocean and geography of Louisiana have continued to create apt conditions for historic hurricanes, and unless something is changed, history and the city will continue to be under constant threat of change.

### ***How This Impacts Communities***

Living in a coastal community carries with it an expectation that hurricanes will be inevitable, but the amount of destruction from hurricanes is very difficult to predict and prepare for. In cities that deal with hurricanes frequently, some safeguards and protocols are standard, such as distributing sandbags and ensuring residents are frequently updated with the forecast. FEMA states that it is important to prepare your house in the event of flooding by turning off the electrical breaker, the water line, and elevating furniture. It is also important that if you plan to leave before the hurricane to have gas in your car should there be traffic while leaving the city. Staying through a hurricane means needing to have food, water, and a source of light should the power be shut off by the storm.

New Orleans' protection is its levees. A levee is a structure, either manufactured or natural, that is designed to be much higher than the water level and the dry land to act as a barrier to reduce the amount of water that can flood the dry land (FEMA). While not always effective because of the high amounts of water, lack of maintenance, or poor structural integrity, they have been useful at limiting certain amounts of water from destroying a city. Hurricanes and the flooding/storm surge that accompanies them are

responsible for damaging both public and private property and ending life because of the risk of drowning and flying debris. Property damage comes mainly from the high-speed winds that can tear roofs off of houses, and the storm surge that when standing can weaken the strength of the wood, things that are very difficult to repair when the structure is weakened (Gillen).

The financial aspects of hurricane damage are the most long-lasting damage that hurricanes can cause. While buildings can be repaired with enough time, the damage caused to a person's finances is not as easily repairable. Following hurricane flooding, the estimated minimum cost for flood water damage is around \$4,000, around \$10,000 for moderate roof, window, or porch damage, and a minimum estimate of around \$8,000 for replacing a roof in New Orleans (New Orleans Legal LLC). Considering the demand for labor after a hurricane, prices can become even higher with the supply and demand of everyone trying to repair their homes so that they can continue living their lives. Following Hurricane Ida, the solution for many people awaiting their roof repairs were given blue tarps to be used as a way to restrict water from getting into the houses, with the thought that it would be a cheaper solution for families while they waited for roof repairs. When visiting New Orleans, myself, I witnessed that most of the houses going into the city still had those blue tarps as roofs, more than a year after Hurricane Ida had occurred.

While many residents are impacted by the extensive damage from hurricanes, certain communities are unable to recover. One aspect of aid for hurricane victims is flood insurance. But it is only beneficial to those who use it, and those who use it are those who can afford it. A study done into the likelihood of New Orleans residents having insurance found that the two of the biggest factors were race and economic status, something that is very intertwined in the city (Cannon). Insurance is supposed to cover most, if not all, of the costs associated with hurricane damage, freeing the residents' thousands of dollars that they would have to otherwise pay out of pocket. But for the people who do not have this insurance, the predominantly low-income and black New Orleanians, these costs fall to them, and they are forced to pay out of pocket to the companies to try and fix their homes. In an area where 21% of people were living at or below the poverty line according to the United States Census and an additional 32.6% below middle-class

status, the cost of both hurricane insurance and hurricane damages are extreme financial gambles to make (Data Research Center). If they have insurance and a hurricane does not occur, then the residents are out a significant amount of money that when living paycheck to paycheck, is an expense that could be the difference between having food and car payments made. If they don't have insurance and it happens, then they might not be able to afford to live in their home anymore, leaving them destitute.

In the media, *Beasts of the Southern Wild* presents a very accurate depiction of what life is and could be like for low-income Americans living in coastal communities that have been affected by hurricanes. In the movie, Hushpuppy's community, the Bathtub, is a community of extreme poverty in a swamp area close to the ocean that is hit by an extremely strong hurricane that floods their community because of the levees protecting the mainland residents. The community is then forced to live on floating habitats and boats until they blow up the levee, leading them to then be taken to a shelter (Zeitlin). Hushpuppy's extreme poverty is evident throughout the film, seen through her only having one outfit and living in worn down, broken housing and having no utilities. The hurricane they experience pushes many of the residents out of the community, and those that remain have access only to the resources that they can find within their land. They are left mostly homeless and without many of the few resources that they did have, showing just how destructive the hurricane was to their ability to live.

Hurricane Katrina, regarded as one of the worst natural disasters in recent American History, is a powerful example of poverty and hurricane destruction in the modern world. While classified as only a category three, the extreme storm surge and sheer size of the hurricane were 90 miles from the eye of the hurricane to the moment it made landfall (Vera and Croft). The extreme flooding caused by the failure of the levees damaged thousands of homes and caused 21 billion dollars worth of damage to private property, and 6.7 billion dollars of damage to public infrastructure (Andersen et. al.). As a result of the hurricane, 1,392 people died from a myriad of causes, mostly due to drowning. As previously stated, the two options for residents are to try and wait out the storm or leave. The financial situation for most low-income families prevents them from leaving their homes because they cannot afford the gas to travel far enough outside of the city to be safe and they cannot afford a hotel.

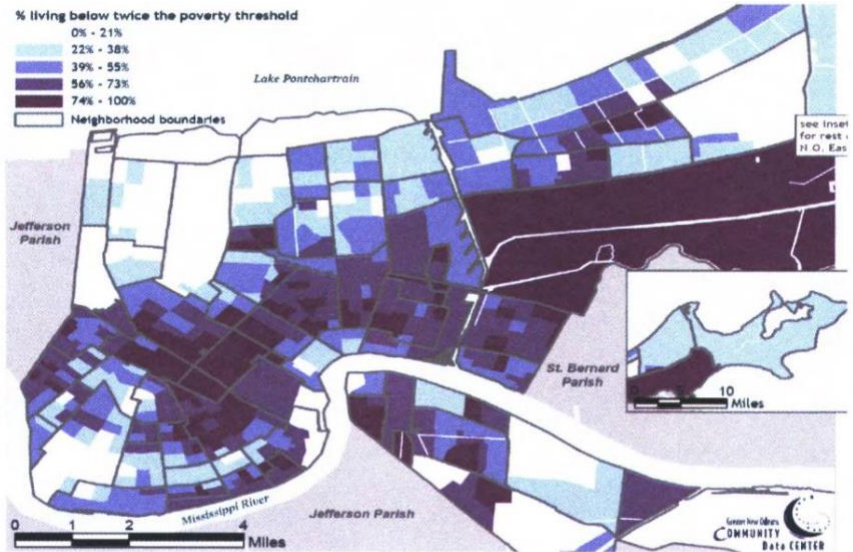
This leaves them in a much more disproportionately vulnerable position to hurricanes because, unlike middle-class families, they are simply unable to escape a hurricane even if they wanted to.

Post-hurricane, many thousands of people were left homeless and displaced from the city, with the decrease in residents numbering around 134,000 people who left the city and did not come back (Census.gov). Of the returning residents, the racial and economic differences began to shift in even greater favor of the upper and middle classes. In 2005, 67% of New Orleanians were black, with only 26.5% white residents. 10 years later, only 59.8% of residents were black, and 31.2% white, with a small increase in Asian and Hispanic populations as well (Census.gov). The number of businesses, housing, and establishments consisting of stores and restaurants decreased as well. This is due to the role that race, and economics played in the migration back to the city. In the 14 months following Katrina, 51% of black residents returned, and 71% of white residents returned, which when broken down further, is due in part to the economic statuses of the residents who returned. The 71% percent of white residents were made up of predominantly college graduates with high-earning incomes, with the same being reflected in the returning black population (Fussell et. al). The higher economic statuses that allowed for residents to be able to return was observed at a much higher rate in white residents, despite white residents making up only 26.5% of the population of New Orleans, showing a direct correlation to the ability of high-income residents to be able to recover from the hurricane at a much better rate compared to people living with lower incomes. This return rate impacted the gentrification of the city in places where flooding was at much lower levels. In areas where the flooding was minimal, more and more white, high-income residents moved, displacing black, low-income residents to more flooding-vulnerable locations (Aune et.al). The higher-class residents displayed the power that comes with having a higher income because their economic status allowed them to be able to disproportionately occupy low-flood zones, making the already at-risk population even more at risk.

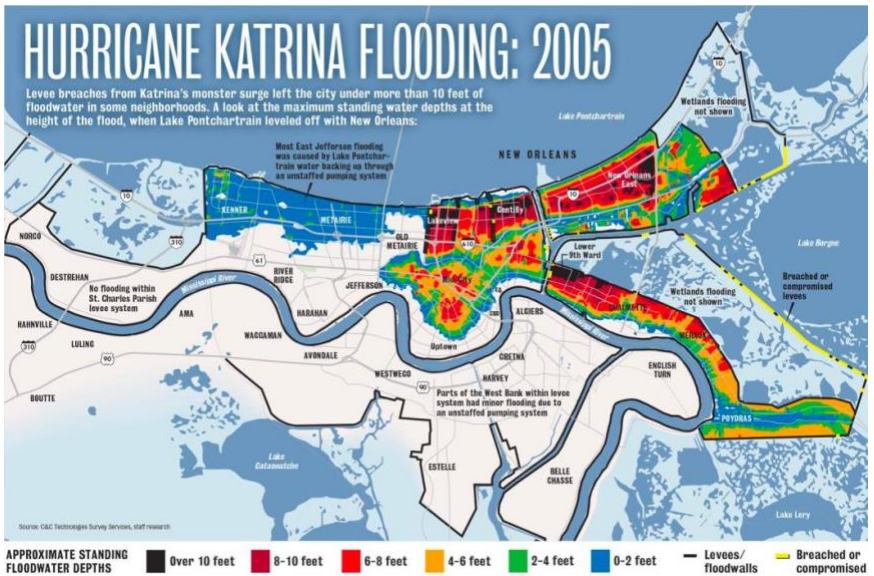
This gentrification, while more noticeable in post-Katrina New Orleans, was not new. In the map below, the economic statistics of what percentage of the area is living below the poverty level are visible, with the darker areas representing a higher density of poverty (Simo). In the next map, the depth of flooding in different



areas of the city is shown with darker/red colors reflecting the higher water levels (Swenson).



These images show that two of the most densely low-income populated areas, the Lower Ninth Ward and New Orleans East, experienced some of the worst floods from the storm. The notable fact about the population of these areas, aside from their economic statistics, is that the majority of these residents are black (Fussell et.al.). The areas near Lake Pontchartrain are more sparsely populated because of the inherent risk of normal flooding. This area is also more prepared for flooding because of the frequent flooding from normal rainstorms, so many of the houses are family lake homes built on the stilt houses that protect the main areas of the house from being damaged in the flooding. But for New Orleans East and the Lower Ninth Ward, the racial and economic density displays the previously existing gentrification of the city that places low-income residents in the more vulnerable neighborhoods to flooding.



While Hurricane Katrina is far from the last time that a devastating hurricane has hit New Orleans or the continental United States, it is one of the most important to look at for the impact it had on the lower-income residents in the city in regard to the difference in how they were able to recover compared to middle and upper-class residents. Hurricane Maria, which hit Puerto Rico in 2017, had a death toll of an estimated 2,975 people killed as a result of the hurricane (Santiago et.al.). The average income of Puerto Rico from 2017-2021 was estimated to be around \$21,967 (Census.gov). The relatively low economic status of much of the country meant that any preparation or evacuation from the hurricane would have been taxing and improbable for many residents, and the climate change-induced hurricane meant that it would be stronger and more destructive than what the country could realistically prepare for. But because of the low economic status and influence that Puerto Rico has, it was a very slow recovery because of the lack of financial resources that were available to help the country rebuild. As Daniel Sherrell points out in his memoir *Warmth: Coming of Age at the End of our World*, other storms would come and would erase Maria from the public view, making it simply another tragic event that would garner sympathy at first, but be forgotten as the world moved on (102).

Katrina and Maria represent two of the highest losses of life as a result of a hurricane in modern times, and their victims show the desperate need for change in both the climate fight and the need for social change.

### ***What Can Be Done***

While institutional classism and climate change are not something that can be easily changed with one quick rule, the need for change is pressing, and some solutions represent a chance for improvement. Decreasing the cost of insurance, for example, offers an increased likelihood that low-income families would be able to afford to have it continue and would be better prepared in the event of a hurricane. Continuing to improve the quality of the pumps and levees in cities like New Orleans offers another improvement when flooding will inevitably occur. Gentrification is another problem that could be solved by improving the quality of housing and infrastructure in lower-income areas as well as building and maintaining affordable housing in already gentrified areas to encourage more diverse communities both racially and economically (Kriesberg).

On the climate front, the documentary *2040* offers one way of reducing carbon in the oceans, which would then reduce the temperature of the water, lowering the strength of the average hurricane. The documentary recommends marine permaculture of varied species of seaweed to encourage the drawing out of carbon dioxide, as well as providing a sustainable food source that would lessen the demand for agriculture on land, allowing for other avenues of climate solutions to be explored (Gameau). Particularly in the region where hurricanes occur, this would be a very viable option because of the ability to center the focus on lowering the temperature of the water where it would make the biggest impact. Another current solution being explored in New Orleans is being documented on TikTok by environmentalist Franziska Trautmann. She has opened the only glass recycling plant in the city of New Orleans which reduces the amount of glass going into landfills, lessening the amount of non-decomposing waste being put into the environment. The focus of this recycling plant is restoring the New Orleans wetlands which have become eroded by the rising sea levels. The glass is used in sandbags and put directly into the environment to encourage the regrowth of plants to keep the soil from being

washed away, providing another barrier for hurricane flooding. In the years she has been doing so, she has documented the increased land mass and how much the marshlands have improved with their biodiversity. While these are small steps towards fixing much larger problems, they offer a chance at turning the tide of hurricane damage to both the environment and the social climate of coastal communities to help protect the world for future generations.

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