

THE VANISHING WETLANDS AND THE WRATH OF KATRINA

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The wetlands along the Louisiana coastline have long served as nature's first line of defense against rising seas and violent storms. However, over the past century the federal government has endorsed the construction of dikes and levees for better shipping access and flood control. While these measures have provided many benefits for local industries and the United States economy, they have come at a fairly high cost. As the coastline recedes and the wetlands are destroyed, the residents of Louisiana lose an important buffer against powerful storm surges. This nightmare scenario became reality with the events of Hurricane Katrina, which created fierce surges that breached levees and resulted in the massive flooding of New Orleans, the loss of over 1,600 lives and \$75 billion in damages ("Nameless Katrina"). Although the Bush Administration has been criticized for its lack of preparation prior to the storm and its slow response afterwards, many critics do not adequately acknowledge the government's failure to reverse much of the wetland loss experienced over the past 100 years. By funding projects aimed at reversing coastal erosion, the U.S. government could have tremendously reduced much of the flooding that caused so much devastation and shattered countless lives.

The U.S. Army Corps of Engineers, under the direction of the U.S. federal government, has been erecting flood control measures along the Mississippi River without accounting for any of the possible environmental consequences that could occur. While straightening the river offers many economic benefits, the construction of levees and dikes has left millions of people living in cities such as New Orleans defenseless against intense storms like Hurricane Katrina. In his essay, "Lessons to Learn from Nature's Fury," author Larry Schweiger writes that "wetlands and barrier islands that would have protected the delta from storms [have shrunk] or vanished [all together]" (Schweiger). As author Dominic Izzo in his essay "Reengineering the Mississippi," prophetically observed in 2004,

the coastal [regions of Louisiana] provide a buffer from hurricane storm effects to approximately 2 million residents who live within the 19 coastal parishes. The loss of coastal area means that this population, which includes the City of New Orleans, will experience the full force

of the hurricanes, including storm surges that top levee systems and cause severe flooding as well as high winds. (Izzo)

This ignorance on the part of the U.S. federal government has had disastrous results and led to the ruination of a shared natural resource as a result of human exploitation, that Garrett Hardin, in his influential essay, calls a “tragedy of the commons.”

The effects of Hurricane Katrina have been etched into the minds of many Americans, and the chances of another catastrophic event occurring in that region are high. As global warming progresses, there is a high probability that the intensity of hurricanes striking Louisiana will be greater because with the increasing water temperatures of the Gulf of Mexico. As the coastline vanishes, more and more residents will be left vulnerable to these killer hurricanes. Without the wetland protection, they will also be defenseless against rising sea levels. Cities such as New Orleans that sit below sea-level would be submerged if the sea rose 1.5 feet, as it is predicted to do by the year 2050. To make matters worse, the amount of subsidence occurring in the city of New Orleans is increasing, “as the weight of deposited sediment gradually depresses the Earth’s crust” (Izzo). This subsidence can be attributed to the “construction of Louisiana’s levee system, which has kept the Mississippi River from flooding [the city but has caused] the city of New Orleans [to sink] two to three feet in the past century” (“Sinking Feeling”).

The Mississippi River is the second longest in North America, flowing 2,300 miles from Lake Itasca in Minnesota, through the Midwest portion of the United States, to the Gulf of Mexico. As the river meanders through the mid-continental United States, it picks up tons of sediment, which eventually is deposited along the Mississippi River Delta before the river empties into the Gulf of Mexico. The accumulating sediment was an important contributing factor in building up the delta region, which includes much of the Louisiana coastline. However, during the post-Civil War period there was an explosion of levees, wing-dams, dikes, jetties, and other constructions along the full length of the river. As a result, the sediment that used to regularly replenish the delta during the flood season is carried directly out into the Gulf. Consequently, Louisiana is losing vast amounts of coastline in the form of wetlands and barrier islands. As these coastal areas recede, Louisiana loses an important buffer against strong storm surges and flooding.

Throughout human history, attempts have been made to control nature and benefit from its resources. For example, dams are created along many rivers around

the world, which impede their natural flow in order to provide people with electricity. However, ignorance and arrogance have blinded too many to recognizing the negative consequences that result from their attempts to control the environment. In his essay, author Larry Schweiger emphasizes the damaging results of installing levees on the Mississippi. "Before streams in the delta were lined with levees," he writes, "the rivers brought in silt that continuously replenished the land. After levees were constructed, however, the rivers stopped depositing new soil, which instead flowed out into the Gulf of Mexico" (Schweiger). As a result of "human ingenuity," the average amount of sediment that the river carries and deposits into the delta has significantly declined. The Mississippi National River and Recreation Area reported that the sediment load has diminished from 1,576,000 tons per day in 1951 to 219,000 in 1988 (National Park Service). This is producing serious harm to the downstream areas along the river, especially the delta region, which is receding at a high rate.

Human modifications of the Earth's natural systems have resulted in what author Garrett Hardin calls "the tragedy of the commons." A "commons" represents any resource that a group of people share, such as air, land, grass, fish, or in this case, a river. In his essay "The Tragedy of the Commons," Hardin describes how a group of people sharing a resource tend to utilize it to satisfy their own needs, but ultimately this logic produces the demise of that resource and with it, the sustenance it provides to all users (243). The straightening of the Mississippi River using manmade levees, dikes, and other flood control measures, is a case in point. In a recent Washington Post article, "Shrinking Louisiana Coastline Contributes to Flooding," Juliet Eilperin states that "[since the 1920s] lawmakers have pushed to create a straighter Mississippi River that provides easier passage for ships and better flood control" (Eilperin). As one can plainly see, this would definitely benefit the shipping and farming industries; however, creating a straighter river has negative consequences for millions of people residing along the Gulf Coast. Industries and individuals are exploiting common resources, such as the Mississippi River, for their own benefit without realizing downstream costs, both to themselves and to the larger society.

The creation of flood control measures along the river is an example of how humans tend to abuse shared resources without recognizing how their actions affect the natural systems that maintain the Earth's biosphere. Through this ignorance, we systematically fail to take into account the Second Law of Thermodynamics, which

states that entropy, the measure of chaos, always increases with time. The Second Law of Thermodynamics is analogous to the pulley system. In this system, a rope, which has a heavy and a light weight attached to each end, is wrapped around a pulley. As the heavy weight falls, it pulls the lighter weight up. Thus, the rising weight represents the useful order that is being created. However, since overall entropy must always increase, the falling weight represents the compensating amount of chaos being generated. In his book, *The Second Law: Energy, Chaos, and Form*, author P.W. Atkins gives a more detailed explanation of this principle. Atkins states:

The unnatural may be contrived at the expense of the natural. So long as we can drive one change by another, one change may be constructive and lead to a local reduction of entropy. But elsewhere, and coupled to the first, there must be a process that generates at least a compensating amount of entropy. There may be *local abatements* of chaos, which appear to us as the emergence of structure, but elsewhere there must be generated at least a compensating amount of chaos (Atkins 157).

This illustration can be applied to the negative environmental impact that is resulting from the straightening of the Mississippi River. Engineers' attempts to control the river's flow represent desired order, and the declining sediment being deposited along the river delta, causing the Louisiana coastline to recede, is the compensating chaos. The creation of useful, but shortsighted, order results in environmental chaos as an unwanted side effect, a tragedy of the commons.

Since the late nineteenth century, many of the levees that regulate the flow of the Mississippi River were federally mandated, and were constructed by the U.S. Army Corps of Engineers. While the goal of the engineers was to provide better flood management and create easier navigation channels, the unintended consequence of this engineering feat was the reduction of sediment being carried by the river watershed by sixty-seven percent (Izzo). In the July 2004 edition of *Engineering Magazine*, Dominic Izzo emphasized the impact human engineering along the river is having on the coastal regions:

Coastal Louisiana is one of the world's most significant wetland areas. It has lost over 900,000 acres . . . since the 1930s. As recently as the 1970s, the loss rate for Louisiana's coastal wetlands was as high as 25,600 acres . . . per year. The current rate of loss is about 16,000 acres . . .

per year. It is estimated that coastal Louisiana will experience [an additional] 320,000 acre . . . net loss by the year 2050. (Izzo)

The loss of wetland regions along the Louisiana coastline is the result of over “a century of engineering in the Mississippi basin to prevent floods and aid navigation” (Izzo). Not only has human activity, either direct or indirect, contributed to approximately seventy percent of the land loss in the delta region, but it has also had other effects such as subsidence and saltwater intrusion (Izzo). The combination of a reduced sediment load, and the flow of the remaining sediment directly into the Gulf of Mexico via channels, has contributed to the widespread loss of Louisiana coastline. As the coastline recedes, saltwater from the Gulf of Mexico enters the remaining wetland area. According to Izzo, “such erosion has been magnified by saltwater intrusion that kills native plants and bares the soil” (Izzo). This intrusion of saltwater further contributes to the erosion of the coastline, as the bare soil is carried out into the Gulf of Mexico. The high rate of erosion of wetland regions along the coastline leaves the residents of Louisiana vulnerable to powerful hurricanes.

The ecological consequences of attempts to control Earth’s natural systems can be attributed to the human need to perform tasks easier and faster. George Kingsley Zipf, the late Harvard professor of linguistics and psychology, described this concept as the principle of least effort. Zipf believed that:

[b]ehaviors that are "useful" are performed frequently, and frequent behaviors become quicker and easier to perform. The very existence of these quick, easy behavior patterns then cause individuals to choose them, even when they aren't necessarily the best behavior from a functional point of view. (“Human Behavior”)

Since the late 1800s, engineers have been consumed with improving the river channel for shipping. By changing the natural structure of the river, engineers have made it easier and faster for large barges to transport goods upstream. As Greg O’Brien explains in his essay, “Making the Mississippi over Again: The Development of River Control in Mississippi,” “Engineers made shipping safer and faster by the removal of natural obstacles, such as fallen trees, boulders, and sandbars; the deepening of certain river channels; construction of navigation aids; and straightening of the river (O’Brien). This is a notable illustration of how humans have a tendency to take the easy route. Instead of developing a method to navigate through meandering waterways, engineers have disturbed the natural order of the

river in order to give ships easier and faster access. While industries have benefited in the form of reduced transportation costs, people living along the coastal regions are suffering from the consequences.

In the wake of Hurricane Katrina, the United States federal government must contribute more effort and money in order to restore the coastal regions of Louisiana. Dominic Izzo explains how the United States has attempted to develop a renovation plan in the past:

In 1998 the State of Louisiana and the federal agencies involved in the reclamation and preservation of Louisiana's coastal wetlands developed a new coastal restoration plan, Coast 2050: Toward a Sustainable Coastal Louisiana. The goal of the plan [was] to restore or mimic the natural processes that formed and sustained the Mississippi River Delta... Coast 2050 named some 500 potential projects and estimated the total cost at \$14 billion. (Izzo)

While Coast 2050 was a step in the right direction towards rehabilitating the coastline, the plan never received adequate funding. However, after Hurricane Katrina ravaged much of the Gulf Coast, the federal government has become more involved in the restoration efforts of Louisiana's wetland regions. Congress recently "approved a massive energy bill providing one billion dollars for Louisiana and other states to shore up their coastlines" (Eilperin). While only half of that money will go to the state of Louisiana (with the rest divided amongst Texas, Mississippi, Alabama, and Alaska), federal officials are backing another coastal renovation plan estimated at \$14 billion. The proposed plan will "restore more meandering waterways, which in turn would deposit new silt on the state's shrinking coastal wetlands" (Eilperin).

It seems as though it is in the nature of the Federal Government to wait for a disaster such as Hurricane Katrina to occur before it acts. Though several restoration plans, such as Coast 2050, and bills were presented to Congress, it took the loss of over a thousand lives in order for the government to emphasize reversing coastal erosion. Government officials have known about the ecological consequences of human engineering along the Mississippi River for quite some time. However, the federal government allowed the problem to escalate, and the result is that the Gulf Coast is more vulnerable to powerful storms than ever. In his essay, "Protecting Against the Next Katrina," Mark Fischetti interviewed Jeffress Williams of the U.S. Geological Survey, who has studied the coast for twenty years. Williams reported

that he “raised the issue [of whether the United States government has waited too long for traditional restoration techniques to suffice] at a Corps meeting several years ago, [but] it was not well received. But considering the rate of wetland loss, land subsidence, sea-level rise, and increasing frequency and severity of storms, the question should be on the table” (Fischetti). Since the government failed to address the problem sooner, more resources must be allocated to restore the wetlands and barrier islands of the Gulf Coast in order to protect millions of people from another destructive hurricane.

Several countries have employed successful coastal restoration plans, which the United States may want to imitate in order to solve its own coastal erosion problems. In his essay, Fischetti illustrates how “a continuous rim around the delta region can be created by connect[ing] the barrier islands and outer marshes with large levees, dams and floodgates” (Fischetti). This same type of network was created in the Netherlands after a 1953 North Sea storm sent a surge inland and killed two thousand people (Fischetti). While “a [solid] front wall against the Gulf could condemn to death the wetlands behind it, by changing the tidal mixing patterns of saltwater and freshwater,” the Dutch government “erected a long series of sluices whose huge doors remain open year round, allowing the sea in [and] close only when storms approach” (Fischetti). In addition to the network utilized by the Netherlands, the United States may also want to consider successful rehabilitation techniques established in other areas of the world. In his essay, Fischetti describes the method used by the Italian government in order to protect the city of Venice from storm surges. He explains how “the venerable city [relies] on mobile floodgates in its lagoon that lie flat on the seabed under normal conditions and rise only during extremely high tides” (Fischetti). The construction of these floodgates around cities such as New Orleans could be very beneficial in preventing another Hurricane Katrina disaster. By employing these various methods, the United States can protect Gulf Coast residents from storm surges and prevent further damage to the wetlands region. The Bush Administration must develop these types of long-term strategies in order to mitigate and reverse the rapid loss of the coast. Though these techniques may cost U.S. taxpayers \$15-\$16 billion (Fischetti), imagine the number of lives that can be saved and the economic consequences that can be abated from their utilization.

The restoration of Louisiana’s coastal regions is vital, not only to protect human life, but also because “the continued shrinking of the delta will have

substantial economic repercussions” as the two million residents of coastal Louisiana “will face increasing exposure to floods and storm damage to their homes, businesses, and supporting infrastructure” (Izzo). Many local industries that contribute heavily to the nation’s economy, which Izzo enumerates, will experience severe losses.

Louisiana's coastal region yields fish and shellfish harvests worth \$300 million. The value of cattle production exceeds \$25 million and that of alligator hides and meat reaches \$16 million. With thousands of miles of navigable waterways, the state leads the nation in waterborne cargo, handling some 500 million tons a year. Oil and gas production facilities and pipelines in Louisiana supply about one-fourth of the country's

needs, and the U.S. strategic petroleum reserves are stored in this area

After viewing these figures, it is hard to imagine why it has taken so long for the federal government to begin the coastal renovation process.

For over a century, the construction of a levee system along the Mississippi River has provided better flood control and easier shipping channels. However, the Second Law of Thermodynamics explains that the creation of order in one part of a system generates a compensating amount of entropy, or chaos, in another part. The use of levees and dams to control the flow of the river is contributing to the rapid erosion of the delta region. As one can see, humans fail to recognize that altering the Earth to benefit their own interests creates future ecological consequences. We must realize that we are just a part of a larger biosphere, and that everything we do affects the natural order that the Earth has had in place for millions of years. In “What Do We Mean by the Global Commons?” A.R. Palmer observes that [s]ustaining human civilization on Earth at acceptable levels requires recognition of the place of human beings in the ‘web of life’ and the role human beings play in modifying the world on which we live and the natural systems which maintain the Biosphere of which human beings are just a part.” Instead of attempting to control nature, we must learn to work with it in order to reduce some of the adverse consequences that have resulted from human “ingenuity.” By doing so, we can ensure the survival of our common resources for future generations.

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COMMENTARY: Jessica Driscoll

In light of the Hurricane Katrina tragedy, Ankit Shah's essay provides insight into the ecological role of natural disasters as well as suggestions toward preventative measures the human race must take to avoid similar catastrophes in the future. While it has been excessively easy to place the burden of the situation on the government

and their delayed reaction time, the fact is that human development was an important precipitating factor and the consistent damage inflicted upon the wetlands made an occurrence such as this inevitable. It is only when we can accept responsibility and acknowledge that our advancements toward convenience and efficiency do have tangible consequences that our natural ecosystem may be remedied and the tragedy averted.

Two of the most important concepts explored by Shah were the “tragedy of the commons” and also the role of entropy in environmental reaction. He emphasizes that any shared resource can be over-utilized by the group in possession which thereby creates the destruction of the resource and eliminates the sustenance for the sharers. A common ecological resource must be respected and maintained by those who benefit from it, or those benefits will ultimately run out and irreversible devastation is likely to follow. The tendency toward entropy, or chaos, stems from the fact that, “the unnatural may be contrived at the expense of the natural.” If human developments, such as the implementation of dams and levees and their eventual effects on coastal erosion, continue to be implemented purely for the accommodation of the here and now without regard for future consequence, ecological consequences such as the destruction of the wetlands will occur, be irreparable, and will encourage future events of mass destruction and human loss such as we saw with Katrina. The overuse of a resource for immediate convenience spurs the creation and build-up of chaos that will ultimately result in environmental tragedy.

At the conclusion of “The Vanishing Wetlands and the Wrath of Katrina,” Shah provides a message of necessary modifications. The solution will be far from immediate considering that the damage of “human ingenuity” has been constant for hundreds of years, but the implementation of coastal reconstruction and rehabilitation projects certainly will not worsen the situation. The most important lesson to be learned from Hurricane Katrina is that humans must recognize their place in their environment and respect the natural protection that the ecosystem provides for itself and its inhabitants. We must learn to abide by the rules of the earth and work with the natural flow of nature to advance the race, or we must suffer the backlash from the injury to our resources.