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## **Distributing Risks and Responsibilities: Flood Hazard Mitigation in New Orleans**

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Coordinated responses to flooding in the New Orleans area date back to at least the early 18<sup>th</sup> century when the Company of the Indies built a mile long bulwark on a natural levee.<sup>1</sup> Since that early project, corporations, NGOs, and local, state, and federal governments have taken numerous steps to limit the risk of flooding including building extensive levee systems, redirecting rivers, and developing evacuation plans. Like many risks that have been perceived and dealt with for centuries – including crime, disease, and other natural disasters – modern science, engineering, and institutions have worked in concert with one another to address the problem through the development of large socio-technical systems.

As with most large socio-technical systems, there was no single group or organization charged with overseeing all facets of the system to limit the risks of flooding in New Orleans. While some parts of the strategy to address the risks were meticulously planned, tightly coupled, and carefully coordinated, other components and institutions were only loosely connected. There was a general sense of who was responsible for what and even a few systems set up to assess whether the specific tasks were being adequately carried out. But the very nature of enormous and complex socio-technical systems is that they are too big to be centrally coordinated in any specific manner. The components of these systems are often developed for a myriad of reasons and their role in any particular mitigation system or strategy may be quite ancillary to their primary purpose. Thus the methods by which responsibilities were distributed amongst the various components were negotiated in an unsystematic and often unspoken way.

Despite the fact that the mitigation efforts were not meticulously coordinated, there was certainly some general agreement over what the overall strategy for New Orleans looked like. By tracing the ways in which tasks were distributed around it one can begin to see the ways in which ideas of responsibility hold together complex systems and perhaps why these systems sometimes fail in their mission.<sup>2</sup>

### **A System of Mitigation**

To begin this inquiry, it is important to first define the objective of flood hazard mitigation in the United States. While there are often competing views over defining the specific problems that any large system is meant to solve, as the name “flood hazard mitigation” implies, the field is not explicitly dedicated to flood prevention or even flood hazard prevention. Instead it presumes that there will always be an inherent risk in flooding and is organized with the goal of reducing the losses of life and property. Thus floodplains are ‘managed,’ not eliminated; and the damage caused by floods is ‘mitigated,’ not entirely prevented.<sup>3</sup>

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To manage these risks, a complex system has been built comprised of numerous artifacts and organizations and responsibilities are distributed to a large number of people for a number of different tasks. The system can be broken down into three component subsystems that require constant preparation, but which are ultimately focused on different time periods.

First there is the physical infrastructure that is built for the long haul. Communities and structures can be built with an eye to minimizing the damage that comes with flooding. This includes designing buildings that are able to resist damage from floodwaters; building levees and reservoirs to control floodwaters; and not building important structures in vulnerable areas. But those involved generally acknowledge that these measures will never eliminate the dangers of flooding so there is a second component of the system to get people out of harm’s way prior to a potential flooding situation. This immediate pre-flood preparation system includes weather forecasting that monitors the threat of rising rivers, hurricanes, and other sources of flooding; a political system of issuing warnings to residents; and evacuation and emergency response plans. And third, there is a post flood response system that deals with cleaning up, repairing, and rebuilding the flooded area.<sup>4</sup> Using these three subsystems as a framework I will briefly analyze what happened in New Orleans.

### **The New Orleans System**

The first subsystem is the extensive physical infrastructure that has been built over the past several hundred years. The city of New Orleans was settled and developed at the mouth of one of North America’s most commercially important rivers because of its strategic location. The oldest part of the city – the French Quarter – was (and is) on some of the highest land in the area. But even this high ground has not alone provided significant protection from flooding. To make matters worse, as the city grew it expanded well beyond this small patch of land and into areas that experienced habitual flooding. In an effort to keep floodwaters out of inhabited areas, the U.S. Army Corps of Engineers and the Federal Emergency Management Agency (FEMA) have developed models based on experience and forecasting as to the likelihood of a particular area of flooding. These models are used by state and local governments to determine where public works projects should be built and to set flood protection levels for new development.

Since most New Orleans flooding problems had been with the Mississippi, the local government sought levees to protect against what the Corps of Engineers defined as an ‘800-year’ Mississippi flood (Suhayda, 2005; Grunwald & Glasser, 2005). These were designed to protect against all floods except those deemed so rare that the probability was they would only occur once every 800-years. Since flooding due to hurricanes had not been a major problem (at least compared to river flooding), the local government agencies did not demand such a high level of protection in the levees built to hold back water from Lake Pontchartrain. The U.S. Army Corps of Engineers estimated that the Lake Pontchartrain levees could deal with a category 1 or 2 hurricane as well as a category 3 hurricane provided that it did not settle over New Orleans and continuously dump water on the lake (U.S. Army Corps of Engineers 2000). The levees were built to resist somewhere between a 200- and 300-year flood (Suhayda 2005; Grunwald & Glasser 2005; Schleifstein & McQuaid 2002).

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Once the local government decided upon the basic specifications of the levees, local contractors were hired to build them. Of course huge earthen, concrete, and metal structures like levees deteriorate over time. In New Orleans, therefore, they are maintained by the Orleans Levee District, a special local government organization which has authority over levee-related issues in a geographic area that includes parts of several parishes.<sup>5</sup> And finally, to ensure that the levees are built and continue to offer their stated levels of protection, the Army Corps of Engineers is charged by federal regulation with monitoring the status of the levees built with federal monies and reporting problems to the local communities and levee districts.

Exactly what happened to this component of the flood mitigation system in the wake of Hurricane Katrina is still not fully known. Many of the levees held, but others did not and the resulting breaches allowed large sections of New Orleans to be submerged under several feet of water. There is speculation that some of these levees were overtopped and eroded from the backside and at least a few levees failed because they were built on soil that weakened when it was saturated with water, undermined the walls, and caused them to collapse (Seed 2005; Warrick & Grunwald 2005).

Who should be blamed for this has been a matter of significant debate. Fingers have been pointed in numerous directions. The original contractors have been criticized for lousy workmanship. The levee board has been blamed for poor maintenance. The Corps of Engineers has been denounced for not advocating designs that adequately addressed the underlying sandy soils. The local government has been denounced for not building the levees high enough and/or diverting funds needed for levees to other programs. And the national government has been blamed for not fulfilling the requests made by the Corps of Engineers and others for funding levee building and maintenance.

The second major subsystem of the New Orleans approach to mitigation was the pre-catastrophe response – the system set up to warn residents and evacuate them from the city.<sup>6</sup> In the week leading up to landfall, the National Hurricane Center tracked Katrina as it developed into a threatening storm. The warnings generated by the Hurricane Center compelled Louisiana Governor Blanco to declare a state of emergency on Friday, August 26<sup>th</sup> which should have mobilized emergency management workers (Blanco 2005). On Saturday, August 27<sup>th</sup>, President Bush declared a state of emergency which initiated the opening of a joint field office which would give local officials the ability to request resources from the federal government (Bush 2005). Later that same day, Governor Blanco initiated the area’s evacuation plan by advising people to evacuate the city and reversing the major highway lanes going into New Orleans to make it easier for people to get out. On Sunday morning, New Orleans Mayor Nagin upgraded the request and called for a mandatory evacuation. The strategy developed by the city to deal with those who did not have access to vehicles was also put into action – the doors of the Superdome were opened to people not able to evacuate.

As with those involved in building and maintaining the levees, there has been a lot of criticism about the timeliness of these announcements, and the plans in place for those not able to evacuate themselves. But despite the small amount of time available, statistically the evacuation was a remarkable success. After reviewing the statistics, Gov. Blanco and the FEMA coordinators for Louisiana estimate that over 1.2 million people (or 90% of the New Orleans area’s residents) evacuated to safer ground (Wells 2005).<sup>7</sup> For comparison, three weeks later

when Rita threatened Key West (an island with practically no hurricane protection) only 50% of the residents evacuated (Tan & Johnson 2005).<sup>8</sup> And while the plan to use the Superdome as housing rather than provide city buses was rightfully criticized long before Katrina hit (McQuaid & Schleifstein 2002), the stadium did provide protection from the hurricane winds.

The final component of the hazard mitigation system was the post flood response. Government officials at the local, state, and national level, with the help of NGOs like the American Red Cross, were expected to deal with the immediate aftermath of the catastrophe. They were charged with the task of quickly and safely returning New Orleans to a state of normalcy and safety.<sup>9</sup>

This, as we now know, was the weakest part of the overall system. It is a monumental task to run a city (even if it is only 60,000 people) when the technologies that form the backbone of any community – including phone lines, cell phone towers, an electric grid, potable water, drivable roads, a coherent police force, etc. – are suddenly gone (Sims 2006). The plans that were in place to deal with the aftermath of the catastrophe were simply inadequate.<sup>10</sup> The emergency management workers mobilized by the state and the joint field office opened by the federal government during the pre-landfall preparations were not very effective in the immediate aftermath. They could not operate without the infrastructure that usually makes coordination and order possible.

### **A Problem of Communication**

The failure to adequately contain the problems generated by Hurricane Katrina sparked an international debate over who should be blamed for the tragedy. Fingers were pointed by nearly everyone involved at nearly everyone else involved in the process of constructing and implementing New Orleans’ mitigation projects. Officials at all levels of government were implicated as key parts, if not the primary cause, of the problem. The media criticized many of the groups and individuals involved as being incompetent and lacking leadership.

But while many of these criticisms likely have some validity, there were some more systemic problems that would not have been solved if only a few more officials had been a little less corrupt. Despite their size and importance, large unplanned socio-technical systems can be very fragile. Communication between all the constituent parts is vital if they are to work in concert with one another.<sup>11</sup> Without a system of centralized planning or monitoring, this only happens if all the groups involved actively engage with one another.

Certainly in the New Orleans’ system of flood hazard mitigation there were multiple ways in which the different groups communicated. But of course few systems of communication are perfect. The gravity of the potential situation may not have been realized by everyone involved. This can result from even small misinterpretations.

For instance, problems may have arisen simply because the focus on the levee and evacuation system distracted people from spending a considerable amount of time studying and preparing for what would happen if the city actually filled with water. The physical presence of levees – which could be seen all over the New Orleans landscape – may have offered a false sense of security that compelled those involved in preparing for the aftermath of a flood to be a

bit more relaxed than perhaps they should have been.<sup>12</sup> When one is looking at details like these it can be difficult to imagine the whole system and the various ways in which it may fail.

In a similar vein, FEMA’s mapping standards may have generated some misunderstandings. FEMA flood maps use lines and shading to demarcate whether a property is either in or out of the 100-year floodplain; a determination which is based on the levee system behaving as it was designed. This black and white delineation does not provide for shades of gray. Thus when homeowners (or potential homeowners) on one side of the line want a mortgage or home improvement loan, the bank will warn them of the potential for flooding in the area and that they are required to purchase flood insurance first. Homeowners on the other side are not required to purchase such insurance and will likely not be notified. Of course if the levee fails or they are hit with a flood that is more severe than a 100-year flood, both houses will have a significant problem. Communicating the subtleties of any situation can be very difficult. There are great pressures to simplify so that one can simply get a message across to people with different backgrounds and expertise. But at times such simplification can obscure what are later revealed to be very important ideas.

To further complicate matters, even if communication within the system of flood hazard mitigation had gone smoothly, the various individuals and institutions that comprised it had a difficult task because they were struggling with a moving target. The risk of New Orleans flooding was continually increasing because of a variety of systems that impacted the city and its natural systems of protection. For instance, the construction of the levees along the Mississippi prevented the river from replenishing the ground with sediment. This, coupled with the constant pumping necessary to keep the levee-protected lands dry meant that much of New Orleans is actually sinking. Other traditional flood barriers – like the surrounding wetlands – were indirectly eroded and deliberately cut up to put in canals, pipeline, etc. (Fischetti 2006). Projects like these weakened the city’s defenses. Thus to comprehensively address the risks of flooding, those involved in the system of flood hazard mitigation had to not only coordinate effectively with one another, they also needed to reach out to the various groups and projects that impacted and reshaped the city’s protection.

## **Conclusion**

When a system is successfully addressing the problem it is meant to handle, the loose system of distributed responsibilities that is often associated with large socio-technical systems can work well. It allows different groups with different visions to engage for the reasons they see fit without forcing them to strictly adhere to predefined roles that they may not be suitable for. These differences may lead to conflicts which must be negotiated between the groups. But it is also often the case that the flexibility allows differing opinions of what the system should look like to coexist. Thus different groups may end up attacking the same problem from multiple directions, making the system more robust and ultimately increasing its effectiveness.

In the case of the New Orleans system of flood hazard mitigation, this was certainly the case. There were not one, but at least three overlapping systems which sought to address potential problems at different phases of a catastrophe. If one failed there was a chance that

another component designed by another group of people might be able to take up some of the slack.

But despite these benefits, a loose system of distributed responsibility can create a great deal of confusion and miscommunication. As a socio-technical system slowly evolves, different groups develop different expectations of its various components and institutions. Some of these expectations are widely shared, but the precise ideas of what these responsibilities entail often vary. The constant threat of miscommunication can mean that certain areas are inadequately dealt with.

This loose structure of responsibilities opens up a space for debate over who should carry out what (Hilgartner 2006). There can be a great deal of pressure to look backwards and define what a proper system should have looked like and then claim that any variation from this ideal system was an ethical violation or breach of responsibility. The media, and to a lesser extent the law, tend to create the idea that the problem can be solved if only the single perpetrator or handful of morally suspect individuals who form the center of the system’s collapse can be found and punished. This has the effect of an attempt to impose precise ideas of responsibility that did not exist prior to the event.

But while the media and others certainly deserve some blame for their witch-hunt mentality, they are perhaps only an indicator of a more systemic problem. Western capitalist societies have not developed a good sense of how to deal with distributed responsibilities that are a necessary part of any complex system. Systems of responsibility are not always clearly marked and they are not always clearly understood by their participants. In the case of Katrina, while some systems worked reasonably well, many groups simply were not prepared.

When systems fail as spectacularly as did the one built to deal with events like Hurricane Katrina, it is rarely ever the result of just one person. This does not mean that people should not be held responsible for the failures that occurred in New Orleans’ flood hazard mitigation strategy. At their core, all systems are developed by and consist of individual people. The danger is that individuals who work within large socio-technical systems can be very tempted to think that their role is not critical because if they fail, their mistakes will be remedied by the actions of others or perhaps never even noticed. This is an urge that must be resisted, especially when failures can have such devastating consequences. An understanding and respect of the other components of a system can facilitate the communication necessary to strengthen the weaknesses inherent in systems of distributed responsibility.

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## Notes

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<sup>1</sup> For a detailed history of the public and private works projects to control the Mississippi over the past several hundred years see Colten (2005).

<sup>2</sup> I offer a more detailed explanation of the important role ideas of responsibility play in the construction, maintenance, and revision of socio-technical systems in Wetmore (2004).

<sup>3</sup> See Bijker (2006) for additional explanation of the U.S. “mitigation” approach as well as an alternative approach taken by the Dutch.

<sup>4</sup> The assumption that flooding will never be completely eliminated in the United States has also led to a nationwide effort to alleviate the difficulties of those directly affected by distributing the costs of flood recovery through insurance programs. See the Federal Emergency Management Agency’s National Flood Insurance Program: <http://www.fema.gov/nfip/>

<sup>5</sup> For more details of the Orleans Levee District see: <http://www.orleanslevee.com/>

<sup>6</sup> The White House (2006) gives a detailed explanation of the various steps that were taken in the few days leading up to landfall.

<sup>7</sup> A survey taken during the summer of 2005 predicted that as many as 60% of southeast Louisiana residents would not evacuate if a category 3 storm approached (Schleifstein 2005). Shirley Laska, Sociologist and Director of the Center for Hazards Assessment, Response and Technology at the University of New Orleans argues that the resistance to evacuate was overcome in large part because Hurricane Katrina was classified as a category 5 storm as it approached (Laska 2005).

<sup>8</sup> Tan and Johnson note that the normal percentage of Key West residents that evacuate in response to hurricane warnings is between 20 and 30 percent. The especially high evacuation rate is likely attributable to the increased fears generated by Hurricane Katrina.

<sup>9</sup> For just two of the many reasonably accurate pre-Hurricane Katrina predictions of what this would entail, see: (Schleifstein & McQuaid 2002; Laska 2004)

<sup>10</sup> For an explanation of how the White House later conceptualized the role that numerous organizations would play in the initial response see: (White House 2006, Chapter Two)

<sup>11</sup> Diane Vaughan’s work on the Challenger disaster demonstrates how this can occur even between people with the same professional training (Vaughan 1996).

<sup>12</sup> This argument is similar to MacKenzie’s idea of a “certainty trough” – that those committed to a program, but not actively engaged in it, tend to be more certain of the knowledge it produces than those who actually produce the knowledge. (Mackenzie 1990, 370-372).

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