When The Levee Breaks:
The Robustness of Water Governance Structures in the Netherlands and Louisiana

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Abstract

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Comparisons between the water management and flood security systems of the Netherlands and Louisiana often undervalue the role of governance structures in helping preparedness and response to catastrophes. This thesis utilizes Hooghe and Marks’ typologies of multilevel governance and the design principles of Ostrom’s social-ecological systems to evaluate the relative robustness of both the Louisiana and Dutch water governance structures.

Following the Hurricane Katrina disaster in Louisiana and the massive flooding of 1953 in the Netherlands, there was a large-scale restructuring of those water resource regimes to increase the efficiency. However, in either case there were trade-offs between centralization and local control of water management. In looking towards the future of Louisiana, and the Dutch system, it seems that the most crucial aspect of efficiency is coordination across levels of governance and between uses of the resource.
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INTRODUCTION

Much attention has been paid to the rebuilding of the New Orleans Levee system. In the process of reconstruction, scholars have compared the Dutch system to Louisiana (Disco: 2006; Lindeman: 2008). The Dutch water regime has been portrayed as a pillar of social and political organization that is both efficient and enduring (Diamond: 2005; Disco: 2006). Up until recently, however, little has been discussed about the type of governance structure that supports this example of environmentally conscious political organization. Louisiana, on the other hand, has been described as a great failure of modern governance structures in the fallout from Hurricane Katrina. After the hurricane broke the levees and flood walls protecting New Orleans and surrounding areas, failures occurred at every level of governance. There are certainly a variety of differences between the two resource regimes, but this paper seeks to focus on the major similarities and differences in governance structures and how two of the worst flooding disasters affected them.

The importance of organizational factors and governance structures are often undervalued in their impact on the efficiency of a resource regime. With the growing threat of climate change on different resource regimes, a greater understanding of governance structure impact is fast becoming more important. Especially in developing countries, the focus in water management practices seems to be on technology transfer and assistance in engineering levees and canals. However, “[organizational] factors are relatively more important than preventing population overshoot and resource degradation than technological factors,” (Anderies 2003: 239).
Therefore, the focus on preparedness for climate change, sea level rise, and natural disasters needs to include ideas on best practices for governance structures as well as implementing new technologies.

This thesis seeks to unlock the similarities and differences in the governance structures and how they relate to the efficiency, or robustness, of the system as a whole. The water regime of the Netherlands seems to embody a mixture of Type II governance structure nested in a Type I external structure and the Louisiana system seems to be a more disorganized Type II governance structure models, as described by Hooghe and Marks (2003). This paper will explain how these structures develop over time, and what affects the structures’ robustness in the specific context of flood security. Ostrom’s “design principles for long-enduring institutions for governing sustainable resources” will be used as signposts to evaluate the overall robustness of the respective water regimes (1990; 2003). Finally, the robustness of the two regimes will be analyzed and the relative strengths and areas in need of improvement will become clear. Particularly in the case of Louisiana, where less time has passed since the respective disaster, the future will hold more information about the overall strength of the system, but the comparison and the measures of robustness might help us navigate the current rebuilding process.
THEORETICAL FRAMEWORK

Multilevel governance theory has provided insight into the changing institutional structure of the EU for quite some time (Zurn: 2010). Additionally, its typologies and categorization of governance structures have further reaching implications, specifically in more task specific organizations and resource regimes (Ostrom: 2008). For this paper, I will discuss how the ideas of Type I and Type II governance theory relate to the water management governance structures of the Netherlands and Louisiana. In limiting the scope of the institutions by selecting a specific issue, the similarities and differences between the two types will become clearer. Using these examples might also help to identify the causes of development of either type of governance structure, bearing in mind that all systems are prone to change over time and that neither case represents a perfect Type I or II governance structure. The typologies serve as a more precise descriptor for the two cases and an easier way to compare the two governance structures, given the time difference between the floods and differences in external political structures. How the two different governance structures emerged and why either case was relatively robust will be the focus of the analysis.

Multilevel governance and polycentricity have been heralded as tools in the push for new climate change governance, but in the case of water security there is little discussion of what is an effective institutional organization to promote efficiency (Andersson and Ostrom: 2008; Asmundsen, et. al.: 2007; Ostrom: 2008). By categorizing the types of governance, the important aspects of our case studies will be easier to compare and evaluate. The shortcomings
of the water regimes are often caused by the interactions between the levels of governance and the introduction of new actors. The changes in the governance structures following the disaster represent moves towards increased efficiency in the institutional structure. Measuring the robustness of those changes will help us to glean even more about the overall robustness of polycentric or multilevel governance structures- in the context of water management.

TYPES OF WATER GOVERNANCE STRUCTURES

Type I and II governance structures are characterized by the number of actors involved, or the number of tiers of the structure (Hooghe and Marks: 2003). Others prefer to differentiate types of governance structures by defining them as either centralized or decentralized social-ecological systems (Ostrom: 1990), or by describing multilevel approaches as polycentric (Andersson and Ostrom: 2008). Any designation represents a similar definition, but on a different scale. Social ecological systems typically refer to smaller systems, a smaller number of appropriators of a common good, and seek to incorporate all aspects of the environment within the system. Type I and type II governances structures refer primarily to political structures and how they relate to one another. This paper will utilize these typologies to analyze the major differences and similarities of the two case studies, and the institutional origins of either system.

Type I governance is categorized as a quasi-federalist system (Hooghe and Marks: 2003). It represents a more stable system that implies some sense of continuity in terms of the boundaries of the regions it governs. Type I also implies a limited number of actors, or levels of governance, and mutually exclusive jurisdictions. The most extreme Type I governance structure would have a clearly defined territorial jurisdiction that addresses all issues in that defined region with a primary formal institution. Type I governance does not preclude the
influence of informal institutions, public-private partnerships, or NGOs, but rather emphasizes the continued role of the primary institution, which in the case of a federal system would be the state. Type I governance does not necessarily imply a centralization of authority to the national level, but can predict a devolution of powers to the regional level so long as “there are few rather than many tiers,” (Hooghe and Marks 2003:18).

Type II governance structures are defined by a more fluid system of jurisdictions with a variety of independent actors that are organized by specific tasks. They are characterized by a seemingly endless number of actors and institutions of all varieties. What distinguishes Type II governance from a private-led corporate form of network governance is the centrality of a common good or a common pool resource in the development of the governance structures (Zurn: 2010; Ostrom: 1990). Type II governance structures are more dynamic forms of governance structures that allow for changes as needed. Among other places, Type II governance is expected to emerge where local governments interact with community associations (Hooghe and Marks: 2003). This tends to hold true for our case studies on water management governance structures.

ASSESSING ROBUSTNESS

The robustness of the relative governance structures is determined by the “maintenance of some desired system characteristics despite fluctuations in the behavior of its component parts or its environment,” (Carlson and Doyle 2002: 2538). More generally, measures of robustness of social-ecological systems often involve a tension between the stability of the system and its ability to adapt to changes. Gundersen attempts to bridge the gap by describing an “adaptive capacity” of a social-ecological system to provide for “ecological surprises” that can include
technological advances, discontinuities in long term trends, and other unexpected events (2002: 36-7). These types of feedback loops among demographic systems are key for allowing greater innovation both in incorporating advanced technology and political restructuring (Anderies: 2003). Water regimes must be able to handle all of these types of surprises. Technological advances in levee fortification are adapting to include green infrastructure solutions. Climate change is creating changes in sea level rise and seasonal river fluctuations. Storm surge and other relatively unpredictable disasters can also increase the overall uncertainty of the system.¹ The “acknowledgement and confrontation of uncertainty add resilience to managed systems,” (Gundersen 1990a, 2002: 38).

For the purposes of this paper, I will utilize the measures of robustness from Ostrom (1990) in judging the Netherlands and Louisiana. I chose these particular measures because they are particularly well suited to evaluate the ability of a governance structure to adjust to external shocks, both ecological and anthropological. They also capture more than relative cost effectiveness, which is difficult to calculate when discussing the idea of flood management and security. There are eight “design principles” that Ostrom discusses to define robust social ecological systems or governance structures (1990: 90; Ostrom, et. al. 2003: 54):

1. *Clearly defined boundaries:* Defining the boundaries of the system involves not only marking the territorial jurisdictions, but also by defining the number of appropriators that will be using that resource for whatever purpose (1990: 185-6).

¹ Integrated flood management practices have called for technology integration of storm, wind, flood, rainfall, and other natural disaster prediction to allow for increased lead time. Proponents of this technology integration also say that the greatest challenge is designing technology “within an administrative context conducive to its use,” Fratelli, et. al.: 1995).
2. *Equivalence between costs and benefits*: Rules for use must include equality for all users, namely those that use the most, pay the most (2003: 54; 1990: 90-1). The increased cost of exclusion, as determined by the definition of boundaries, proportionally lowers the equivalence between cost and benefits (1990: 91).

3. *Collective-choice arrangements*: Rules must be designed, at least in part, by those that are using the common pool resource. However, the fact that the appropriators make the rules, does not guarantee their compliance once the rules are set (1990).

4. *Monitoring*: Those who monitor the system must be accountable to appropriators of the common pool resource, or be the appropriators themselves. Also, those that are being monitored must be aware of the other appropriator’s actions and infractions, to help make decisions about their own rule following (1990).

5. *Graduated sanctions*: The rules need to stipulate moderate sanctions for minor offenses because it allows for mistakes on the side of the appropriators and allows for contingency plans in the face of disaster. Having a smaller sanction also increases awareness and commitment to sanctions, while increasing the sanctions for repeat offenders creates more deterrence (1990: 99-100; 186).

6. *Conflict-resolution mechanisms*: Institutions or rules that allow for arbitration between rule followers and/or rule enforcers. They do not continue to guarantee against free riders or other infractions, but they are required for long term systems (1990).

7. *Right to organize*: Smaller scale organizations are particularly adept at developing social capital. Once those institutions become nested in external structures, there needs be a forum through which the appropriators of the resource can organize and bargain (1990).
8. *Nested enterprises:* “All of the more complex, enduring [common pool resources] meet this last design principle,” (1990: 101). Rules must be followed on all uses of the common pool resource and fit into other systems of institutional design if they are to work.

These design principles were identified during a study of smaller social ecological systems that focused on governance structures surrounding a common pool resource problem. Ostrom defines a common pool resource by two characteristics. The first is that it is costly to exclude potential beneficiaries. The other is that the supply of the public good is finite (Ostrom, et. al.: 2003). Our study of water management is a typical common pool resource problem. The cost of exclusion is especially difficult since everyone enjoys the benefits of regulated water levels and the building of levees and dikes. Flood security is also a finite resource because the users are limited by both the amount of land and resources needed to create flood security and by the level of predictability of storms and sea level rise. Water regimes also imply a multitude of uses, and therefore different types of resource units taken from the common pool resource are dependent on the user. For example, a farmer might require greater resource units because he needs flood security, water sanitation, and a large of amount of fresh water for agriculture. These are all aspects of the water regime.

In developing these design principles, Ostrom’s case studies had at most 15,000 appropriators of a given resource (1990: 185). The cases of Louisiana and the Netherlands are much larger, but the same principles apply. Given the size of the case studies, the governance structures might seem inherently less robust, but it might also be easier to highlight some of the critical factors in successful and robust governance structures. The relative robustness of either case study does not reflect a preference for either Type I or Type II governance structures, but
rather the critical aspects of multilevel governance structures that make them suitable for water management.
Post-Katrina Louisiana (2005) and post-flood Holland (1953) are two important and representative cases. Recently, the Netherlands has made it a priority to help to spread technology and information concerning flood management techniques. While case specific scenarios often include ecologically unique designs, policy and governance structures tend to be overlooked and many are fearful to compare different cases. If flood management practices are to be better understood, then the infrastructure has to include a complete picture of the polities and actors involved in developing and improving dikes and levee fortification. Two developed and stable democracies, such as the United States and Holland, have similar tools at their disposal, and yet have two different governance structures. Therefore, it seems appropriate to ask how they developed before using either as an example for future flood management best practices.

The Netherlands represents a historical case of flood management. They have long been recognized as an authority on the issue of flood management due to their position in Europe at the end of three major rivers as they meet the North Sea. They have successfully managed their water resources to accommodate transport, agriculture, sanitation, and limit water quantity for centuries. Louisiana has a much shorter history of flood management, but has developed a system to tame the Mississippi as it passes through New Orleans and other vibrant commercial hubs. Both water resource regimes and governance structures protect valuable cultural and
economic centers, and at the same time attempt to provide for basic water needs as well as improve agricultural conditions.

Despite being relatively similar in the basic goals of the water regimes, the governance structures of Louisiana and Holland are quite different. The external political structures represent different types of multilevel governance. Louisiana is nested in a federal, presidentialist system. The Netherlands consists of twelve provinces that are part of a national parliamentary system, which is also under an EU level of governance. In terms of size, the Netherlands has about four times the population of Louisiana and three times the land area.

Both systems were hit by a major external shock – the 1953 floods of the Dutch system and the Hurricane Katrina disaster of 2005 in Louisiana. Both shocks imposed huge costs on the system and triggered a massive reorganization of the governance structures of either case. By examining time periods closely before and after major disasters, I can evaluate the change in governance structure and assess to what extent those changes affect the robustness of the system against future shocks. The governance structure of either case will be assessed immediately before the major floods and approximately five years after. The efforts of this study are not meant to provide a universal solution to water governance issues, but rather to highlight key factors to relative successes and failures.
When discussing land reclamation and flood protection it is hard not to discuss the Netherlands. It is seen as the most successful case of organized flood security in the world and has been a leading advocate for change across the globe. Their historical and continued commitment to collective flood security has been a beacon of hope for troubled nations with important regions below sea level. However, Holland’s successful organization has not made it immune to the rising waters of its three rivers and extensive coastline. They also continue to have problems with groundwater contamination, quantity management, and brackish water systems (Kuks: 2002; Roth and Wagner: 2007). Perhaps the most recent catastrophic disaster was the massive flooding of Zeeland in 1953 where upwards of 1800 people lost their lives. This section will discuss the governance structures in place directly before the disaster and several years afterwards which culminated in the passing and implementation of Delta Law in 1958. This massive reinvestment in infrastructure and planning also incorporated a commitment to changes in governance structures from a disconnected Type II into a more hierarchical system nested in a centralized Type I governance structure.

Prior to the massive flooding in 1953, the Waterschappen, or the water boards of the Netherlands, held most of the authority concerning the issue of flood control. In 1940, there were over 2700 different water boards throughout the Netherlands. Waterschappen were traditional public institutions that existed even before the local governments, and they date back
as early as the 11th and 12th century (Graeff: 1996; Kuks: 2002). The process of building democratic institutions is said to have begun with these water boards and their commitment to the public good through the election of representatives (VanKoningsfeld, et. al.: 2008).

Historically, the Waterschappen’s sole responsibility was flood protection, primarily through the fortification of levees and dikes. They were also the primary builders of sea walls to protect the coastlines. They were financed solely by those who received protection within their jurisdiction and remained relatively autonomous from each other and from the central government. This form of organization seems remarkably similar to Type II governance structures because they were task specific, autonomous and remained relatively fluid as they adapted to the changing populations.

The other major player in the water regime of the Netherlands prior to 1953 was the Rijkswaterstaat, which later became part of the Ministry of Transport and Public Works. The Rijkswaterstaat was officially given authority in 1798 to help harmonize and coordinate between the water boards. The centralization of water management began with the birth of this institution (Kuks: 2002; Disco: 2006). As early as the 1800, the Dutch made efforts to harmonize local and federal authority. However, the Waterschappen were still constitutionally protected and remained relatively autonomous. It was not until J.A. Ringers first restructured in 1930, that the Rijkswaterstaat became a more substantial government body that began to centralize the water regime at the national level. However, the demand for that centralization sprung more out of a need for greater navigability during WWII, rather than from a desire for greater flood security. For instance, the hydrodynamic laboratory was established on the Neder Rijn to promote increased transportation in and out of Rotterdam (Linsten: 2002).
The credibility and significance of the Rijkswaterstaat soared following the 1953 flood, because the organization had predicted an imminent breach of the levees in the years leading up to the disaster (Linsten: 2002). After the flood, Dutch citizens demanded a more unified flood security plan, and centralization of the water regime began quickly. By the late 1950s, the “Rijkswaterstaat enjoyed thorough control over water management in the Netherlands,” (Lintsen 2002: 565). The Rijkswaterstaat even began enacting changes even without legal basis, which was often later given after the fact. They began to establish massive research and development plants and started to work on a more unified and national level plan to help organize a national level flood security plan. The Waterschappen had been widely discredited by the 1953 flood, due to its failure to anticipate major flooding and its relatively slow reaction to the problem. The reorganization reflected the frustration with the Waterschappen (Linsten: 2002).

The Rijkswaterstaat, along with the support of the federal government, established the Delta Commission 20 days after the flood. The Delta Commission created the Delta Plan which consisted of four major recommendations for the improved coordination of national flood security. The first two recommendations involved initial reactions to flooding such as drainage and preventing irrigation and farming water from becoming too brackish. These recommendations appealed to agribusiness, fishermen and transport. The biggest task of the four was the drastic shortening of the coastline by closing inlets, which was physical and politically more feasible than just rebuilding the dikes. The final piece of advice represents the long term vision of the Delta Plan, which involved cost estimates between 700-900 million Euros over 25 years, and a way to institutionalize flood security by creating a annual review of the Delta Plan to ensure its effectiveness. The process of creating the Delta Commission, conducting research, creating an action plan with its final cost evaluations and passing through the national legislature
took just over five years, and was finally signed into action by the Queen on May 8, 1958.\(^2\) Despite having had a jumpstart on creating local institutions, centralizing authority, and generating public support, it still took the Dutch governance structure five years to create a plan and another thirty to execute.

In spite of the general discrediting of the Waterschappen, their usefulness was not overlooked. During those first five years following the flood and for some time after that, the Waterschappen faced a similar restructuring as the Rijkswaterstaat became a more prominent player. “People started to realize that perhaps many of these water boards were too small to have capacity- also financially- to upkeep and improve their dikes,” (Graeff 1996: 123). Despite their inability to deal with large-scale disasters, the Waterschappen were given more responsibilities following the 1953 flood, while embedding them further into an overarching regional and national governance structure. They had authority on local flood control issues and quantitative water management. Added post-flood, was the responsibility of water quality. The Groundwater Act of 1954 was a national policy that aimed to localize the efforts at reducing discharge and contamination of water resources (Kuks: 2002). This led to increased significance of the Waterschappen and increased financing schemes through taxation. In the field of flood control and quantitative water management, the Rijkswaterstaat centralized that planning through the release of annual reports detailing the overall mission of the Netherlands to respond to changes in sea level and population growth. In response the Waterschappen were to publish a detailed plan of how they were going to handle those goals established by the Rijkswaterstaat in the coming year.

\(^2\) All of the information concerning the development and rationale behind the Delta Works was taken from their website: <www.deltawerken.org>.

The number of Waterschappen was also reduced. Originally, this was the suggestion of the Rijkswaterstaat following the flood, as well as a general understanding amongst the Waterschappen. In 1940, there were upwards of 2700 water boards, and that number has slowly dwindled down to 55 in recent years. In limiting the number of Waterschappen the Dutch water regime was not reducing the tiers of governance, but consolidating units into larger territories to make a more manageable system. This allowed them to cut back on coordination costs and reap economies of scale. Despite being constantly in-flux, these jurisdictions can also be described as a quasi-permanent because the number of tiers of governance did not change. The reduction of the number of Waterschappen begins the transition of the water regime from a disorganized Type II to a more hierarchical structure, whereby Type II units (Waterschappen) are nested in a Type I institution (Rijkswaterstaat).

The Waterschappen remained fully funded through their own tax system and did not receive any federal subsidies. The Waterschappen set up a tax system that covered five basic groups: industry, households, owners of agricultural land, owners of buildings, and the Board of the Waterschappen. These five tax brackets may overlap, but they represent both types of usage and quantity. The two major taxes, as defined by the Waterschappen, are for pollution control and flood security. Fines for over use or misuse, however, are set at the national level by the Rijkswaterstaat. Recently, there has been talk of integrating the Waterschappen taxes into the national taxation system, but they remain an independent organization. Financial independence allowed the Waterschappen to maintain a higher level of autonomy and entrench a Type II structure into an external Type I governance structure.

The relationship between the Waterschappen and the Rijkswaterstaat remains fixed and has clearly designated boundaries, both territorially and politically. And, despite the more recent
changes in territorial jurisdictions of the Waterschappen, the original plan developed by the Delta Commission following the 1953 flood has been realized. A more centralized system has emerged in the form of an organized Type II governance structure which is the water regime of the Netherlands. The flood of 1953 seems to have been a catalyst for change from a historical, disjointed Type II governance structure to a more hierarchical Type II governance structure that was well incorporated into the external Type I governance structures of the federal government. This particular water regime, though well incorporated into a Type I structure, can still be classified as a Type II multilevel governance structure because the tiers of governance remained constant and the Waterschappen continued to fund themselves and act relatively independently. Other actors concerned about the Delta system, such as the EU, can also influence the water management regime, but the Netherlands has made it a national priority. The two key players are still the Waterschappen and the Rijkswaterstaat.

**ROBUSTNESS OF THE DUTCH WATER REGIME**

Water regime and governance structure robustness in the case of flood security is a measure of the inherent efficiency of the governance structure itself. Clearly defined boundaries are the first measure of robustness. In the case of the Netherlands, and other water regimes, boundaries are attached to land ownership and the type of usage. Since the number of Waterschappen was in flux during and just following the flood, some of the boundaries might have been in question. The entire water regime is clearly bounded by the delta region itself, which also aligns well with the territorial jurisdiction of the state of the Netherlands. The historical development of Dutch society surrounding the water resources helps to entrench the boundaries of both individuals and the system as a whole (Vankoningsfeld, et. al.: 2008). Therefore, the Dutch system was relatively robust in the years leading up to the flood. However,
after the flood, it was the process of redistricting the Water Boards and consolidating the jurisdictions that made the boundaries unclear. During its first five years after the flood, the Dutch system did not have well defined boundaries, but over the course of its redistricting, that robustness increased.

Proportional equivalence of costs and benefits is and was a strength of the Dutch system. The Waterschappen’s system of collecting taxes at the local level in a graduated system creates an equitable distribution of the costs among the resource users. The percentage of land in need of flood security also makes it easier for the federal government to justify expropriating lands and having more influence on the Waterschappen. Having such a large resource system makes it easier to create cost sharing among the whole nation, because everyone is affected, or in need of the resource of flood security. Cost and benefit equivalence is also closely related to the fourth measurement of robustness: monitoring. Without effective monitoring of usage of resource units, cost and benefit relationships are meaningless. In Holland, those that monitor are accountable to the appropriators of the resource. Therefore, monitoring and cost-benefit equivalence is high thanks to the level of autonomy that the Waterschappen exercise.

Collective choice arrangements in the Netherlands water regime are somewhat robust as well, because they incorporate those affected by regulations in the decision-making process. The Waterschappen are primarily made up of elected officials from the districts that they represent, and those offices change hands every four years. The increased oversight of the Rijkswaterstaat and supremacy of their national level planning limits the input of the actual resource users by centralizing some aspects of authority. Also, as the Waterschappen were redistricted following the flood, the larger sized territories limited input from individual appropriators. Therefore, the
robustness of collective choice arrangements remains limited but still impressive for a water regime of this size.

Graduated sanctions are inherently robust in flood security regimes, because there are relatively few ways to overuse the resource. However, there are ways to misuse the land or damage the overall system by failing to manage a certain part. The Netherlands faces serious problems in the way of water pollution and groundwater contamination from runoff and overuse. The Waterschappen have the responsibility to monitor and fine offenders. Because the fines are set at the national level there is a continued threat from national officials if there continues to be a problem. Also, the incorporation of water quality allows for a greater adaptive capacity, especially in the case of integrated flood management, and the monitoring of an integrated system. This means that the Dutch system is robust in its enforcement of sanctions.

Conflict resolution mechanisms and the recognition of the right to organize are the next two measures of robustness. In the Netherlands, these two seem to work together. Since the centralization of authority and the weakening of the robustness of collective choice arrangements, many citizens have become frustrated with the damage to culturally significant property and land in the name of national flood security. Primarily, this comes from the taking of land for dike improvement and limiting the natural splendor of the Dutch landscape. This trade off was originally made by the state without much consultation and people began to organize. In response, the Rijkswaterstaat began to incorporate “natural and cultural values,” or LNCs into their planning strategies for the future (Walker, et. al.: 1994). This situation shows that the appropriators do have a limited right to organize, so that measure is somewhat robust, but does exemplify a trade-off of centralization and embedding the Waterschappen in the national level of governance. However, because the land was taken for so long with little
consultation, and because the citizens did need to organize reflects on a weakness in the conflict resolution mechanism. That mechanism is therefore less robust.

Perhaps the most important factor in evaluating the Dutch system is the concept of nested enterprises. The concept of nested enterprises describes the relationship of a multi-layered system which is inherent in the Dutch and Louisiana water regimes. How well the levels of governance and variety of actors work together is important when evaluating larger systems. The relationship between the Rijkswaterstaat and the Waterschappen changed in the aftermath of the 1953 flood, and the coordination costs between the two major players was lowered after that restructuring. The coordination costs of a Type I governance structure is inherently low, because there are fewer jurisdictions and fewer actors involved. Type II governance structures well nested in Type I helps to minimize coordination costs and increase overall efficiency.
Due to missteps in the immediate aftermath of Katrina, New Orleans, the State of Louisiana and the federal government have made some changes in the past five years to improve their reaction and responsibilities towards disaster relief and to the overall water regime. Due to the overwhelming criticism of the response efforts, that is where the bulk of the changes in governance structures have begun. Rebuilding the levee system has also been a major priority of the federal government, and there have been some changes to the overall governance structure surrounding the management, upkeep and review of the levees. There have been changes at all levels of governance in the New Orleans area, but the overall coordination between those levels remains questionable.

The levee system in New Orleans is divided between those that protect against river floods and those that protect against hurricanes and storm surge. The Mississippi River Levee System (MRL) is in federal jurisdiction and is a multi-state project to protect against river flooding and seasonal changes. With a slightly more predictable water system, and the clear delineation of jurisdiction, these levees were a secondary consideration in the face of major hurricanes. The MRL is run by the Mississippi River Commission, established in 1879. The officers in the commission are appointed by the President and are members of the Army Corps of Engineers. They also hire and consult through private firms to help build research on the improved fortification against river flooding (ASCE: 2005). The slightly more predictable nature of the river, the national mandate, the higher level of flood security and focus of research
and levee improvement makes the MRL a more natural counterpart to the Rijkswaterstaat. They are a relatively streamlined and hierarchical commission. However, the coordination between the MRL and the Louisiana governance is limited to the detriment of the entire system.

The Lake Pontchartrain and Vicinity Hurricane Protection Levees (LPV) were the major levees that failed the city of New Orleans during Katrina. The LPV was established by the federal government in the Louisiana Project in Flood Control Act of 1965. It was designed as a joint project between federal, state and local governments (GAO: 2005). The federal government was to build the original levees, and after completion, local parishes took control of operations, management, repair, replacement and rehabilitation (GAO: 2005). These levees were designed to handle a hurricane that by today’s standards would withstand around a Category 3 hurricane. The nature of hurricanes creates a more complicated cost-benefit calculation because of the sporadic and violent nature of hurricanes, as compared to the periodic rise of river flooding. After the last levee was handed over in 1987, the LPV was officially subject to “a multitude of local levee boards,” (ASCE 2005: 4). Following the Hurricane, the American Society of Civil Engineers testified to Congress that “everyone – and no one- is in charge of the New Orleans Levee System” (ASCE 2005: ).

After the US Army Corps of Engineers officially put the parishes in control of the levees, the federal government still had some responsibility to the region. Every federally funded levee system had to appoint a permanent committee with a superintendent as the head. This superintendent was in charge of submitting a report to the Army Corps of Engineers who also had branches throughout the country and in the Lake Pontchartrain lowlands. The local officials

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3 The category system was not in place at the time of creation. The levees were capable of handling a storm with category 2 winds, category 3 storm surge, and category 4 barometric pressure. This equals the probability of this type of storm in 1/200 years. Compared to the Netherlands levees which protect against flooding in 1/1250 years.
in charge of parishes are generally composed of state-appointed officials. Some have argued that the federal devolution of authority created coordination problems and put too much burden on an already fragmented local system (Burns and Thomas: 2008).

Financing the levee system in and around New Orleans is also relatively complicated. The Louisiana Constitution originally granted the rights of parishes to levy taxes on its citizens in order to provide flood protection and levee fortification. The LPV project allowed federal funding to help initiate a more unified system for New Orleans. Funding for the original building of the levees (as designed in the Louisiana Project in Flood Control of 1965) was 70% from the federal government and 30% from the State and local government. After the construction was complete, all federal funding stopped. However, as long as the levees were managed according to the manual left by the federal government, then in the event of a disaster all levees were available for 100% reimbursement by the federal government (GAO: 2005; Mittal: 2005).

Following the Katrina disaster, a shaky organization of governance at all levels sought to rebuild the infrastructure of New Orleans and surrounding areas. In the immediate aftermath, a handful of federal organizations rushed in. Secretary of Defense Rumsfeld created an independent panel of experts under the National Academies of Science. They also formed a panel to review information from the Intra-agency Performance Evaluation Task Force (IPET). IPET was peer reviewed by the American Society of Civil Engineers (ASCE) who also reported to the National Research Council. The newly established Department of Homeland Security, which had little experience with natural disasters, published a manual on how to handle the situation. DHS was also in charge of FEMA (Waugh: 2009).
At the state and local level, existing conflict and changing jurisdictions only exacerbated an already complicated emergency response plan. In the years leading up to the Katrina disaster, local officials in and around New Orleans had been charged with corruption which led to a general mistrust of the local government. This level of distrust was said to have caused hesitation from the Governor in the dispersal of federal money following Katrina. Due to the hostilities and general distrust between levels of governance, the allocation of federal funds got disrupted. Both Mayor Nagin of New Orleans and Governor Blanco set up competing disbursement agencies for federal funds. Mitch Landrieu, the Lt. Governor, also attempted to set up a third, though it quickly failed (Burns and Thomas: 2008). Governor Blanco then set up the Road Home project to try to funnel federal funds into highway and transport infrastructure rebuilding. Road Home was then both planned and run by the same outside consulting firm, ICF International which failed to deliver even a small fraction of its planned projects, and had difficulty working with parish officials.

Due to some complications of utilizing local disbursement mechanisms, the federal government, FEMA and others, turned to NGOs. In response to the outpouring of nonprofit work, FEMA utilized their Voluntary Agency Liaison (VAL) to help initiate and maintain relationships between the public and private sector. Currently, there are ten permanent VALs domestically based out of regional FEMA offices. Despite the VALs coordination efforts, the President still recognized a deficiency in coordination between nonprofits and created the position of the Office of Federal Coordinator for Gulf Coast Rebuilding (OFC) in November 2005. Three of the four major responsibilities involved coordination and allocation of funds.

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4 The State governor was reluctant to give money to local school in the face of two major corruption and bribery charges against the local, public school board. The state had also recently voted to take over several local failing schools, and put them under direct state control. Local officials became fearful of too much state government oversight in all aspects of public policy (Burns and Thomas: 2008).
from nonprofits. With all of these new coordinators, the nonprofit sector was able to distribute millions of dollars and begin several productive organizations aimed at rebuilding. The Katrina Aid Today (KAT) was able to aid 73,000 households in rebuilding and refinancing in the course of just three years. FEMA channeled money into KAT and other nonprofits, as well as allocating foreign aid money into NGOs and nonprofits.5

When it came to restructuring the actual water regime, all parties involved, which at this point was a huge number, had become exhausted by the coordination costs. The only major changes that the state and local governance structures were able to restructure were during the second special session of the state legislature. With overwhelming majority, amendments were passed to eliminate the New Orleans Levee Board and consolidate the number of assessors from seven to one. Burns claims that reorganization did not come from a popular demand for a more coordinated (Type I) governance structure, but rather they “stemmed from a lack of trust in the way New Orleans managed its public policies,” (2008: 269).

The New Orleans Levee district, which contained most of the vulnerable areas and the LPV levee system, also underwent some drastic changes. Originally, the four major parishes that managed the LPV levees were consolidated into two major districts, divided by the Mississippi: the Southeast Louisiana Flood Protection – East and the Southeast Louisiana Flood Protection-West. The parish lines and levees districts were redrawn to reduce the number of levees and consolidate the New Orleans levee district under the control of the West Bank and Hurricane Projection Project. The state legislature created the Coastal Protection and Restoration Authority which was to represent the state in matters of hurricane protection. In general, the restructuring

5 All of this information came from a report from the GAO in 2010 which examined the overall impact of NGOs in Louisiana and found very positive results for a governance structure that is flexible enough to incorporate new actors (Czerwinski: 2010).
of the districts and responsibilities is still somewhat in flux, and will be reevaluated after the completion of the new flood security system in mid 2011.⁶

At the federal level of governance, there were greater attempts to restructure their response efforts, but they still changed little about management practices. The Post Katrina Emergency Management Reform Act of 2006 dealt primarily with the missteps of DHS and their handling of FEMA. The ASCE and the GAO also had several proposals for increased efficiency in the event of a disaster. Primarily these suggestions involved greater federal presence in local agencies surrounding the levees and improved understanding of each organization’s responsibilities and specific jurisdictions (GAO: 2005; ASCE: 2005; Mittal: 2005).

In response to several of the GAO’s continued audits of their response to Hurricanes Katrina and Rita, FEMA came up with several targets to help improve their overall efficiency and storm surge preparedness. A major priority was staffing changes, which incorporated more long-term local staff members on site to help with monitoring and emergency response. They also instituted training and protocol in the event of major disasters to help with decision making and to clarify competencies for those in charge. Along those same lines, FEMA developed databases on disaster recovery plans for a variety of levels of storm surge and types of disasters. Transparency of FEMA and DHS operations was also made an issue, and the federal government now pays for several websites and organization to track spending of public funds and the development of new projects.⁷

The federal governance structure surrounding the New Orleans levee system before Hurricane Katrina can be classified as a dysfunctional Type II. The disorganization at the top

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⁶ Taken from the Southeast Louisiana Floor Protection Website: <http://www.slfpaw.org/history.aspx>
⁷ All of this information was published through FEMA on the DHS website. Websites that publish information about the projects are: <www.FEMARecovery.gov>; <www.fema.gov/hazard/hurricane/2005katrina/weekly.shtm>
level, due to the restructuring of the DHS and its relative lack of experience was only further exacerbated by local fragmentation and the inability of the state and local governments to work together. This also seems to have developed not because of a large number of actors and tiers of governance, but a lack of understanding by those actors as to their own jurisdictions and competencies in the event of a major disaster. These failures of its response to the Katrina disaster are not inherent in Type II governance structures. This type of structure seems to have developed because of the nature of geographical features of New Orleans and the Mississippi River, the relatively unpredictable nature of hurricanes, and changing hierarchy of competencies. Unfortunately, the crippled infrastructure of New Orleans was not served well by the public and private organizations that rushed in to save her. In the five years following the disaster, the restructuring was reminiscent of the changes we saw in the Netherlands and helped to clarify the responsibilities of each actor involved. Perhaps, the problems of the Louisiana governance structures can be best explained through the measures of robustness.

THE ROBUSTNESS OF THE NEW ORLEANS WATER REGIME

Before Katrina, the boundaries of usage for flood security and otherwise were not as clearly delineated as compared to the Waterschappen regions of the Netherlands. The areas that demand the greatest amount of flood security, namely the four parishes surrounding the city, had relatively robust levels of established boundaries and number of appropriators of the resource. Following the disaster, the redistricting of the Parishes and rebuilding of the levees has created a large shift in the designation of boundaries. The re-drawing of boundaries has created some confusion, especially as the rebuilding of the levees continues. Therefore, the clarity of boundaries has actually dropped following the disaster, but will likely be redefined following the completion of the levees and the re-institution of local authority over them.
The proportional equivalence between costs and benefits to the resource users was less robust. The parishes used to operate on a similar, self-sufficient basis as the Waterschappen. The parishes attempts to improve the federally built levees actually made them weaker against a storm surge, which cost the appropriators money and decreased their benefits.\(^8\) The introduction of federal funds also implies costs to those that would never benefit from water management and flood security measures. This is a problem of larger resource systems of all kinds, but in the case of an even larger nation, the problem becomes more exaggerated than in a smaller nation such as the Netherlands. Following Katrina, little was changed in terms of financing the building and maintenance of the levees. However, the inclusion of NGOs and non-profits seemed to increase the levels of robustness of proportional equivalence, by allowing cost sharing amongst those that wanted to assist and creating a more efficient distribution of those funds. This took some of the burden off of the federal government, whose tax money did not necessarily come from those that benefited from flood security.

Monitoring of the water management sector was relatively robust before the hurricane, but improvements post-Katrina have improved upon that design principle. Before the hurricane, the monitoring was all done at the parish level, which was run by local officials that were also appropriators of the resource. However, the federal government which invested in flood security did little to monitor their projects. This created problems of coordination between the two actors that were investing in the same resource of water management and flood security. Following the disaster, FEMA’s restructuring included hiring locals, who were appropriators of the resource, to full time monitoring of the system to increase federal monitoring of its projects. This represents

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\(^8\) Upon review of the storm surge damage in the four vulnerable parishes surrounding New Orleans, the ASCE found that ‘improvements’ made by local parishes actually weakened the levees structurally and led to even greater damage, (ASCE: 2005).
an increase in robustness for the monitoring measurement following the restructuring post-Katrina.

Before the storm, collective choice arrangements in the Louisiana parishes seem to have a robust measurement according to Ostrom’s definition. The parishes that control the relative levee districts are run by state appointed officials. This is less robust than in the Netherlands where they had rotating elected officials, which were elected by the appropriators of the resource. However, in the current restructuring of the levee districts it remains unclear how the authority will change in the coming years. Currently the construction and management is overseen by the Southeast Louisiana Flood Protection Authority (with commissioners appointed by the governor), the US Army Corps of Engineers, the Coastal Protection and Restoration Authority (appointed by the governor), the West Bank and Vicinity Hurricane Project (federal authority), and the Louisiana Division of Transportation and Development. Centralizing too much authority at the state level, especially in the hands of the governor, could create serious problems for collective choice arrangements and add to the general distrust between levels of governance. In passing legislation on the redistricting of parishes just after the storm, locals were fearful of losing influence by redistricting the parishes, which represents a fear of losing that robustness of collective choice arrangements (Andersen and Scott: 2005). Since the rebuilding of the levees is a federal undertaking, there would have been little input from the parishes regardless of the redistricting, so it is yet to be seen how robust the collective choice arrangements will be after the federal builders leave.

Sanctions against levee damage and misappropriation of water prior to the hurricane were not particularly robust. The parishes/Levee Boards had complete authority over the levees and water resource, and there was little increase in punishment for misuse of the resource. The
parishes had little support from the federal or even state authorities when it came to sanctions against offenders. There was also little integration of water pollution into the resource regime. The two issues work more efficiently under a single organization because the water pollution has shown to weaken the “green infrastructure” of the levee system (Wise: 2008). Louisiana and others need to incorporate natural buffers and promote the protection of the wetlands if it is to create a successful flood security system (McFalls, et. al.: 2010). Following the storm, there has yet to be any major changes to the sanctioning of offenders and the coordination between water pollution and flood security. The robustness of this measure, therefore, remains low. However, pushing some responsibility of flood security up to higher levels of governance might help to coordinate the policies on water pollution in the wetlands, and create a better environment for flood security through more natural buffers. This type of integration between resource systems would help in the integrated flood technology systems, and would help improve coordination costs and minimize externalities.

Before and after the storm, the recognition of the right to organize is robust in New Orleans and Louisiana. Having so many actors and organizations involved in the region, there are consequently more forums for citizens and public officials to make claims and declare any grievances. Unfortunately, this also makes it harder for conflict resolution mechanisms. Due to the large number of actors involved, conflict resolution is dependent on the territory in question and who is the authority on that particular land. Similarly to the Dutch case, lands in and around New Orleans have been expropriated by the federal government for projects and resolving and

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9 The integration of water pollution into the management of water quantity is also promoted by the International Association of Hydrological Sciences (IAHS), particularly the committee on International Commission on Water Resource Systems (ICWRS) and the British organization Green Infrastructure: <www.greeninfrastructurenw.co.uk/>; <IAHS.info>. Improved integration would also imply better coordination between the MRL system and the Louisiana system to help improve sanctions against polluters.
paying off those that lose has been difficult without knowing the hierarchy of control. Therefore, the right to organize seems quite robust and important, but conflict resolution can be a slow and tedious process. The introduction of NGOs and non-profits through the VAL organization seems to have expedited the process following the storm, but claims are still difficult to process simply because of the volume of people affected.

Finally, the last measure of robustness and one that is important for larger ecological systems is nested enterprises. This is a key measure for Type II governance structures, such as the New Orleans and Louisiana system, because of the large number of actors involved and how they interact becomes important. As discussed earlier, coordination costs in the wake of Katrina were the greatest hindrance to the rebuilding process. Coordination costs are not inherent in territorially overlapping jurisdictions, only when those jurisdictions are unclear as to their own competencies and responsibilities. The obvious problems at the federal level led to the restructuring of the DHS and the creation of the OFC to handle the missteps of FEMA. At the state level, the creation of competing disbursement agencies and corruption at the local level led to an inefficient system. The efficiency of private actors and nonprofits in rebuilding New Orleans reflect the robustness of Type II governance in filling implementation gaps through the inclusion of task specific jurisdictions and private actors.
CONCLUSION

Using Ostrom’s design principles we have assessed our two case studies and come to a generalization about the robustness of each principle in each case study. Table 1 summarizes these generalizations about our two case studies to compare the two governance structures. The Louisiana case has two columns, one for a pre-Katrina structure and one to represent the changes, and expected changes after the hurricane. The levels of distinction are admittedly vague and open to some criticism and changes as the structures evolve. However, even with generalized measures, information about the basic trends in the changes and overall robustness of either system are visible.

Table 1. Robustness Measures: Netherlands vs. Louisiana

<table>
<thead>
<tr>
<th></th>
<th>Netherlands</th>
<th>Pre-Katrina Louisiana</th>
<th>Post-Katrina Louisiana</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boundaries</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>Cost-Benefit</td>
<td>High</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>Collective Choice</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Monitoring</td>
<td>High</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>Sanctions</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Conflict Resolution</td>
<td>Moderate</td>
<td>Moderates</td>
<td>Moderate</td>
</tr>
<tr>
<td>Right to Organize</td>
<td>Low</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Nested Enterprises</td>
<td>High</td>
<td>Low</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

Based on the information in the table, it seems that the Netherlands water regime has developed a robust flood security and water regime by maintaining levels of autonomy at the local level. By keeping aspects of the Type II governance structure, namely the Waterschappen, and nesting it more effectively into the external political structures, the Dutch enjoy many of the
efficiencies of a small, local governance structure but on a national scale. Part of the reason that they can politically justify these policies on a national level is the overall percentage of the country that is affected by the issue of flood security. The Netherlands water regime is not perfect and they face a growing demand for improved water quality and management, but the governance structure seems to be well equipped to face the challenges through its adaptive capacities and nested enterprises.

The changes made in the Netherlands reflect a coordination of water management into other systems that affect the overall flood security of the nation as a whole. They managed to create a governance structure that both preserved aspects of the Type II governance that makes it relatively robust like the smaller systems of Ostrom’s study, and allowed for greater integration between water quality, water management and flood security. This is the prescription for greater efficiency in the practice of flood security (Fratelli et. al.: 1996). The Netherlands system is by no means perfect, but it seems to have left room for some of the adaptive capacity to allow for newer, more efficient technology as well as the coordination both between levels of governance and between related systems.

In the case of Louisiana, it does seem to be moving in the right direction in terms of making its overall design principles becoming more robust. The restructuring seems to have only hurt one principle of collective choice arrangements, as the state gets more authority and the parishes merge. That same issue plagued the Netherlands as they redistricted the Waterschappen, but they managed to maintain some level of input through elected officials and maintaining local control. Based on the case of the Netherlands, the greatest success can be gleaned from the improvement in nested enterprises and how the levels of governance work together either in times of crisis or in the maintenance of the system. The federal government’s
permanent offices in the region, the increased state authority on water management, and the consolidation of the parish districts are all prominent first steps in that process. However, the entire water regime could benefit from the inclusion of water pollution into its regime along with better coordination among the levels of governance. In order to create successful policies to curb water pollution, organizations such as the MRL need to coordinate better with all levels of governance in Louisiana to help protect the wetlands and other natural buffers along the Louisiana delta.

In general, the relative success of a water management governance structure appears to stem from its coordination between levels of governance (nested enterprises) and its coordination between governance structures of related common pool resources.
REFERENCES


