

On-Line Dialogue

Post- Hurricane Katrina: Building frameworks for incorporating social-ecological resilience

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ABSTRACT Vulnerability of coastal areas is not just defined by natural perturbations but includes the degree of ecosystem degradation, community design and the socio-economic composition of the community. Increased degradation of coastal ecosystems and population growth has meant that hurricanes, tsunamis and other natural disasters have taken an increasing human and environmental toll worldwide. Hurricane Katrina dramatically exposed the lack of overall system resilience in Louisiana. Increasing resilience of the system necessitates an inclusive view of both socioeconomic and ecological factors. Alicia Hope Herron, David Neil and Marc Hockings highlight the importance of considering coastal management as a social-ecological system, using the situational analysis of Louisiana and Hurricane Katrina to show that resilience is inextricably tied to these linkages.

Introduction

Hurricane Katrina struck the city of New Orleans on August 29, 2005 as a Category 3 hurricane. It followed a path modeled 20 years earlier by the United States Army Corps of Engineers (USACE) as that most critical to the city (Van Heerden, 2006). Despite this prediction, which had been widely disseminated through scientific journals and the popular media (Bourne, 2004; Fischetti, 2001; McQuaid and Schleifstein, 2002), Hurricane Katrina devastated New Orleans and much of the Gulf Coast – killing approximately 1300 people and causing US\$ 200 billion in damages (NRC, 2006).

The majority of the damage in New Orleans resulted from the flooding of approximately 80 percent of the city. While there are many historical factors that contributed to the flooding, there are two that are particularly significant: the failure of the levees and a loss of the wetlands that had previously mitigated storm surge effects. The flooding exposed serious socioeconomic vulnerabilities, as much of the population unable to evacuate and impacted by the flood waters was low-income, minority citizens.

Vulnerability and adaptation

Approximately 50 percent of the world population lives within 200 km of the coast and the total number of people living in coastal areas is expected to double by 2025 (PRB, 2003).

Vulnerability of coastal areas is not only defined by natural perturbations such as tsunamis, hurricanes and coastal flooding, but also includes ecosystem degradation, community design, and the socioeconomic composition of the community. Population growth, economic development, rising sea levels and uncertain weather patterns exacerbate vulnerability.

The United States federal government has committed US\$ 114 billion to rebuilding the Gulf Coast, with a large share directed to New Orleans (DHS, 2007). The discussion is not whether New Orleans will be rebuilt, but how. The effort represents the largest reconstruction effort ever undertaken by the United States federal government and an opportunity to incorporate lessons learned from coastal zone management to build a more resilient city. Increasing the resilience of New Orleans will require a paradigm shift: away from the strict focus on flood control and towards a holistic water management framework. It will mean rethinking the relationship between people and water at many levels of interaction.

Flood control

The city of New Orleans was founded in 1718, on a strategic point along the natural levee of the Mississippi River. Population growth continued throughout the eighteenth and early nineteenth centuries but remained largely concentrated above sea level. The construction, in the late 1800's, of pump stations capable of dewatering wetlands allowed the population to expand into low-lying areas.

The USACE assumed levee building responsibilities in 1879 (Colten, 2006) and the United States government became involved in disaster response and legislated for structural flood control following the Great Mississippi River Flood of 1927 (Mason, 2006; Galloway, 2006). The levees along the Mississippi River were subsequently strengthened and extended to protect against flooding. In 1962, the USACE outlined a comprehensive plan for flood prevention in the greater New Orleans area resulting from the 'Standard Project Hurricane' (SPH).¹ Congressional authorization followed in 1965; however the project became mired in financial and political obstacles.

The New Orleans Corps reported progress with the project in August 2005, immediately before Katrina, as ranging from 65 percent complete in the New Orleans West Unit to 98 percent complete in St. Bernard Parish (Woolly and Shabman, 2007).

Further review of the failures of the flood control system during Hurricane Katrina begs questions of the management frameworks which assessed the risk acceptance, cost, and benefits of the protection system. Moving forward, value judgments must be made as to what to protect and at what cost.

Coastal development

Public access to the coast is recognized by the Coastal Management Act as an important goal. Some 40 federal programmes fund beachfront development, which includes federal monies for highway infrastructure (Heinz Center, 2002). Highways and roads allow for development in areas that would otherwise be unsuitable and impractical. Once development occurs, the federal government then subsidizes the building of water and sewerage works, which spurs more development. States and local governments often prioritize growth, which can lead to community design that does not adequately address the risks of coastal areas. The building of Interstate 10 in Louisiana provides one such example. Intensive urban development in previously unsettled wetlands in and around the New Orleans area followed its construction in the 1970s (Brookings Institution, 2005) and expenditures in sewerage and streets allowed these centers to prosper (City

Planning Commission, 1999). Most of these low lying areas were flooded during Hurricane Katrina. Federally protecting areas against flooding has had the unintended consequence of fueling development in disaster prone areas. A lack of state and local cooperation and guidance, which allow individual flood control projects without a comprehensive management framework, further increases vulnerability.

Natural systems

The ecosystem functions provided by Louisiana's coastal wetlands are of national economic significance. Louisiana's wetlands mitigate the effects of storm surges, serve as sources of biodiversity, provide inland navigable waterways and are underlain by sources of oil and natural gas. The ecosystem functions of the wetlands have not historically been quantified in cost benefit analysis of flood control or prioritized in land use planning.

Human intervention has reversed the long-term trend of delta building that had been occurring for some 10,000 years (NRC, 2006). Modifications include levees, channelization, canals, and draining and filling of land which have disrupted the hydrology and spatial distribution of the wetlands. The land loss rates for Louisiana's coastal wetlands in the last 50 years have exceeded 104 km² / year (LCWCR, 1998) and they are projected to lose an additional 2,550 km² by 2050 (USACE, 2004).

Socio-economic vulnerability

Hurricane Katrina was a natural disaster, exacerbated by human influence. The flood protection system designed for New Orleans over 40 years ago is incomplete and inadequate. The wetland ecosystem, the first line of defense against storms, continues to diminish due to human influences. Further, natural disaster planning failed to provide adequate evacuation of mostly low income, minority citizens.

Paradigm shift

Hurricane Katrina has raised the profile of coastal management to unprecedented levels in the US. How to effectively balance development with natural systems and processes is a crucial question that Louisiana, and the country, must address in order to build resilient cities. Agencies involved in coastal affairs often impact each other in negative ways due to differing missions and structures and poor communication channels. There is a lack of comprehensive planning and coordination channels, and the interconnectedness of natural systems is not reflected in the development of management approaches that are similarly holistic.

Management frameworks that integrate social and ecological indicators are necessary at all levels of government, as are tools that effectively quantify development risk and ecosystem services. The US does not have a national water policy or oceans policy and the ineffectiveness of federal natural disaster planning was made clear during Katrina. Neither local comprehensive plans nor local code enforcement was required by any of the Gulf States impacted by Katrina (Burby, 2006). Figure 1 illustrates aspects of socio-economic and wetland ecosystem health that could be used to integrate management frameworks. The figure highlights aspects of the diversity of planning and management frameworks needed to develop social-ecological resilience and the characteristics of socio-economic and wetland ecosystem health needed to inform those frameworks.

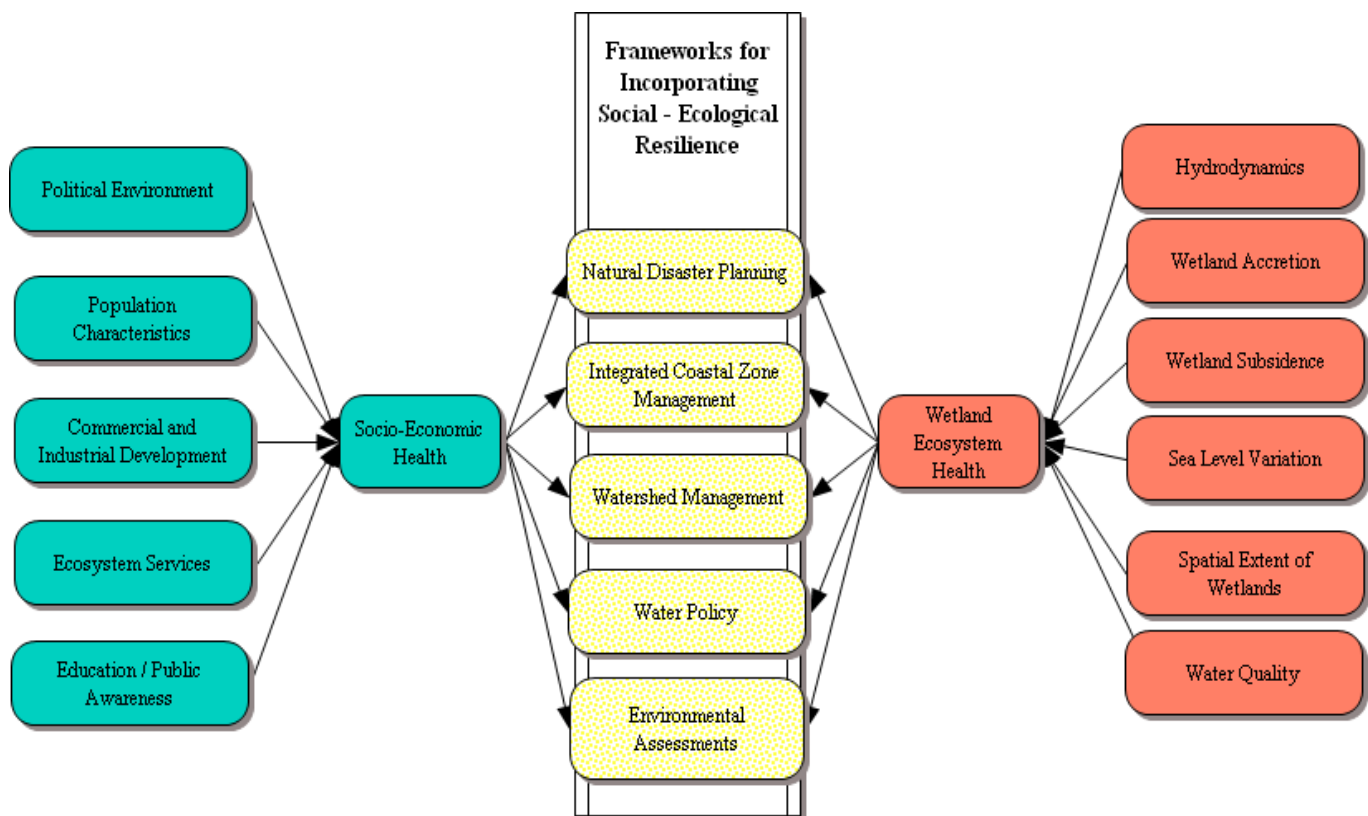


Figure 1: Aspects of Socio-Economic and Wetland Ecosystem Health to Inform Broader Frameworks.

The post-Katrina context has seen much activity to incorporate lessons learned. Some of the tools that are being used include:

- The National Environmental Policy Act (NEPA). NEPA requires that environmental impact statements be prepared for major federal actions having a significant effect on the natural and human environment. The USACE must consider elements of ecosystem health and social justice, and incorporate public comments, when deciding which flood control alternative to implement.
- Louisiana Coastal Area Ecosystem Restoration Study (LCA). A USACE project, the LCA considers hurricane protection and ecosystem restoration projects. Not yet completed.
- Louisiana Comprehensive Master Plan. Written by the Coastal Protection and Restoration Authority of Louisiana, an integrated restoration and protection plan that helps to prioritize coastal management projects. Will be incorporated into the LCA.
- Louisiana Regional Plan. Represents the first long-term community planning initiative ever undertaken by the state.
- Strategic Recovery and Redevelopment Plan. Authorized by the city of New Orleans, the first comprehensive land use plan developed for a Louisiana city. Outlines 17 recovery areas to target resources and utilize smart growth principles.

Increasing resilience of the coastal zone necessitates an inclusive view of the human linkages in social-ecological resilience, as well as a holistic view of ecological systems. The current levels of planning are unmatched for Louisiana and present an opportunity to correct the vulnerability that Katrina exposed. New Orleans serves as a stark reminder that coastal development must be

integrated into broader frameworks in order that indicators of both social and economic health can further inform cost benefit analysis and strategic planning.

Note

1 According to the National Academy of Engineering/National Research Council Committee (2006), the authorized level of protection denoted by the term 'Standard Project Hurricane' for the New Orleans Hurricane Protection System refers to a 1959 definition; 'the most severe storm that is considered reasonably characteristic of a region' and authorized in US Public Law 89-298, passed on October 27, 1965.

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