

Preventing Disaster

A Geogist perspective on flood control
in New Orleans

Robert Ross



Introduction

In 1965, category three Hurricane Betsy flooded New Orleans, causing more than \$10 billion in damages and killing 76 people. At the time, it was one of the most disastrous urban floods in the country's history and, in response, the Corps of Army Engineers embarked on a grand flood control program that cost upwards of a billion dollars and continues to this date. Almost exactly 40 years later, another category three hurricane flooded nearly the same areas of New Orleans that Betsy had. But this time, when the floodwaters subsided, the devastation was unimaginable. After the Corps' monumental effort to protect New Orleans from hurricanes, Katrina left more than 2,000 people dead and more than \$88 billion in damages.

How did the government's grand effort produce such a spectacular failure? In fact, New Orleans' case is unique in the extent of the damage, but not in its overall struggle with urban flooding. Cities across the country struggle with flooding for the simple reason that many flood prone locations are excellent places to found cities, either because they have access to shipping lanes, a portage, they have military value, or some other comparative advantage. Communities across the United States are founded along the banks of rivers, on coasts or on flat, low lying land because those places are profitable *in spite of* their risks.

Other communities, however, would not exist but for subsidized infrastructure projects that shift the cost of flood protection away from floodplain landowners and onto the general taxpayer. This encourages development in risky areas without a coincident increase in revenues. For these communities, the benefits of flood protection *don't* outweigh the costs; these communities thrive on federal largesse and are at perpetual risk of destruction.

New Orleans partly falls into both of these categories. The oldest sections of the city are both sustainable and smart, more than 15 feet above sea level and with ample access to natural

resources. The sections of the city that were settled less than 50 years ago are, for the most part, those most at risk and least sustainable. Like much low density development throughout the country, they exist at the cost of the denser urban center. They are the product of poorly conceived land policy, from the local level all the way up to the federal.

New Orleans has been largely overlooked, however, by researchers studying the problem of urban flooding. The city was not included among 17 urban areas investigated in the twentieth century's seminal work on urban flood management, nor does it seem to be included in many subsequent works.¹ Also unusual is the fact that the Federal Emergency Management Agency has only recently begun to seriously address the problem of repetitive flood loss. And almost no economists, outside of those employed by the insurance industry, have investigated the economic impacts of floodplain management. Perhaps this is the case because New Orleans' situation is analytically problematic or perhaps, more cynically, northern economists' biases discourage the city's inclusion in their analyses. As Ari Kelman writes, "New Orleans has always stood apart in our national discussions. Too French, too Spanish, too ethnically diverse, too many good times, too corrupt, too Deep South, the northernmost Caribbean port, a tripartite racial system, and so on and so on."²

Even in the early decades of the Union, New Orleans was cast as pit of disease and vice, with the *New York Times* eagerly reporting every nineteenth century plague, hurricane, flood and river accident in vivid detail. Part of this was pure economic rivalry; for the first hundred years of America's history, New Orleans was one of the largest and fastest growing cities in the

¹ White, Gilbert F., Wesley C. Calef, James W. Hudson, Harold M. Mayer, John R. Sheaffer and Donald J. Volk. *Changes in Urban Occupance of Flood Plains in the US*. Chicago: University of Chicago Department of Geography. Research Paper No. 57. 1958.

² Kelman, Ari. *A River and Its City: The Nature of Landscape in New Orleans*. Berkley: University of California Press. 2006. pp. 215

country, rivaling east coast metropolises including New York, Boston and Philadelphia for national supremacy.

But much of the acrimony between New Orleans and the rest of the country goes beyond simple economic rivalry; it is also cultural. In more ways than one, New Orleans is a bit of a black sheep among US cities. Its diversity has always threatened the rest of the country, particularly during the nineteenth century. Northerners have been quick to write off New Orleans as a lost cause, failing and/or refusing to understand why people continue to settle in such a difficult position. Here, we attempt to overcome some of the cultural elements that have shuffled *The Big Easy* to the margins of public conscience, and we try to bring New Orleans into consideration as a relevant case study by exploring the city's didactic potential.

In the wake of Katrina, the country demanded an explanation for the devastation. But the media and many analysts fell upon red herrings. Some cited race as the reason for Katrina's flooding, arguing that White America in general and the Corps in particular, cared not for the fate of poor blacks living on New Orleans' floodplains. Others cited the incompetence of a federal agency in the planning, construction and maintenance of a local flood abatement program. And still others pointed to oil companies that helped destroy the wetlands that protected New Orleans, or to projects upstream that constricted the flow of silt down the Mississippi. But, underneath these various contributing factors, there lies a single, consistent variable that was the true root cause of New Orleans' tragedy: land.

New Orleanians' relationship to land should be at the center of macro and microeconomic analysis. This is thoroughly appropriate for *The Crescent City* since it is a wholly manufactured landscape at constant odds with its environment. That conflict bestows great value to what little dry land exists, and it would not be a stretch to say that economic

activity in New Orleans is entirely dependent on the social and legal treatment of land. Throughout its history, New Orleans' has struggled to define its urban spaces. Its current social topography is a direct product of that struggle, and a modern product of that.

“This city is haunted by its past,” writes Patricia Brady, expressing a notion that is the essence of this paper.³ The disaster of Katrina was due, in large part, to poor land-use planning on the part of New Orleans, Louisiana and the Corps of Army Engineers over the last 50 years. Many put the responsibility of the Storm's destruction almost entirely at the Corps' feet, but this is myopic. The second half of the twentieth century saw a massive program of expansion and land speculation that was enabled by Federal infrastructure initiatives, but encouraged also by politicians, capitalized on by speculators and developers and generally ignored by much of the population. Focus on the physical failure of levees is actually distracting from the overall picture. New Orleanians engaged, for various reasons, in a massive speculative drive that put the city at great risk. The inevitable levee failures were simply a catalyst for destruction.

New Orleans has always been a transition point, a crossroads of sorts, a place where different modes of travel and thought come together to form a unique blend of products and people. As such, New Orleans has been at the center of a conflict that has defined America since its inception. The inalienable right to *landed* property is imbedded as an unassailable concept in the American psyche and jurisprudence. But, in New Orleans, the exercise of that right conflicts with New Orleanians' ability to ensure their own personal safety. The equitable distribution of land within a community is vital to its prosperity. When land is distributed fairly, when some groups don't gain at the expense of others, prosperity is attainable. But when the government plays the role of land developer, investing billions in flood control structures that enrich some at the expense of others, society fails. When society fails in New Orleans, people die.

³ Brady, Patricia. “Foreword,” in *Literary New Orleans*. Athens: Hill Street Press. 1999. pp. vii.

Levees and Land Values

The largest oversight made by every level of government and every agency involved in floodplain management is the failure to recognize one fundamental principle: changes in the market value of land on and off the floodplain constitute the final resting place of most benefits and costs of floodplain management programs, except those costs paid directly by the taxpayers.⁴ Flood control structures decrease the probability of flood damage on floodplain land. Decreases in the risk of flooding decreases expected losses in the future, which in turn increase the present value of land on the floodplain. On the other hand, use management programs including insurance, building codes and risk awareness campaigns generally increase the cost of holding floodplain land, thereby reducing the present value of that land.⁵

To see clearly that economic rent is the final resting place of the benefits of physical flood control structures, consider the case of a farm abutting the Mississippi whose owner builds his own levees. The value of this farm is equal to the net present value of expected future output, and his objective is to maximize the expected profits of his farm. With every foot increase in the height of the levee, future losses due to flooding decrease and the farmer's land increases in value. The farmer will build his levee such that the annualized cost of the last foot of levee protection is equal to the marginal increase in the value of his land. This is true when the difference between the value of his land and the total cost of levee construction is maximized.

The changes in the value of the farm constitute the final resting place of the benefits and costs of his levee, and the farm bears the disability of flood risk just as it would bear the

⁴ Foster, John H. "Flood Management: Who Benefits and Who Pays?" *Water Resources Bulletin*, Vol. 12, No. 5. October 1976. pp 1030.

⁵ Estimates from Holway, James M. and Raymond J. Burby. "The Effects of Floodplain Development Controls on Residential Land Values". *Land Economics*. Vol. 66, No. 3. 1990. pp. 259-271.

disability of poor soil quality or inaccessibility. If the farm were relatively infertile, and the marginal increase in its value due to reduced flood risk was less than the cost of providing levee protection, the farmer would simply forgo building a levee. In that case, we would say it simply is not worth the cost to protect his farm from flooding. Similarly, if the farm were arid and required investment in irrigation to produce, the farmer would invest in irrigation structures until the marginal cost of irrigation was equal to the marginal increase in the value of his land. The principle that land with a disability, be it aridity or flood risk, should bear the cost of use with this disability should be applied to almost all land, regardless of who owns it.⁶ The cost of protecting flood prone land should not be shifted onto other lands or other factors of production.

From this basic principle we may discern some features of social system that provides flood protection for a group of landowners. Suppose that a floodplain farmer has neighbors who also build their own levees. In this case, he receives protection not only from his own levee, but also the levees from every one of his neighbors. If one neighbor's levee breaks, the others' lands will flood as well. Everyone's levees together thus qualify as a public good, a medium through which the benefits of the actions of one agent are transmitted to other non-excludable agents. The structure of the bureaucracy that builds and maintains this common good affects both the efficiency of the levees, as well as the equitable distribution of their positive effects. An improperly structured bureaucracy, on the other hand, will lead to a "tragedy of the commons" whereby individuals acting in their own self-interest end up worse off than if they had acted in the interest of the society as a whole. The tragedy of the commons is a classic example of the "free-rider" problem, whereby individual members of a collective avoid paying the costs of

⁶ National landmarks, locations of military value and cultural heritage sites are some examples of land that the taxpayer should be willing to pay protect. This is so because these elements' values are not transmitted through land values, but other means.

organizing while enjoying the benefits of being in the organization.⁷ Such behavior leads to degradation of the common property, since no individual is willing to accept the cost of maintaining it. In this case, the levee will degrade until it breaks, since no single landowner will be willing to pay the cost to have the entire structure maintained.

Flooding is a problem common to every landowner on the floodplain, and it is far more cost effective for farmers to cooperate to construct one single levee than to individually build their own levees. Economies of scale decrease the cost of intermediate inputs, and the landowners can collectively assign one individual the responsibility of building the levee, reducing the time cost to each member of the collective. In a perfectly competitive market operating in the absence of transaction costs, all floodplain landowners would cooperate on levee construction. But in the presence of transaction costs, individual landowners may fail to organize into a single decision making body on their own. The probability that the landowners will fail to initiate and maintain a collective arrangement increases as the number of landowners and the size of the floodplain increases.

Cooperation among floodplain landowners is nonetheless crucial to achieve the optimal level of levee protection, and that the form of that cooperative arrangement is critical to that goal. Under a cooperative arrangement, the farms with the highest value pay the farms with the lowest value to build their levees higher until all the levees form one continuous barrier of the same height. Collectively, the farmers' objective is to maximize the net present value of their lands. As a collective, the farmers will build levees until the marginal cost of levee construction is equal to the marginal increase in the value of the land protected by the levee. Under this scenario, each farm will equally bear the cost of levee protection.

⁷ Albanese, Robert and David D. van Fleet. "Rational Behavior in Groups: The Free-Riding Tendency." *The Academy of Management Review*. Vol. 10, No. 2. 1985. pp. 244-255

Throughout its history, New Orleans's landowners have struggled to come to a cooperative agreement for the purpose of mutual flood protection. Some of their difficulty stems from racial tension, inadequate communication and general orneriness. But much of it can be traced back to divergent views on property ownership and the role of government in the treatment of land. Those that believed in the right to own land and benefit, unconditionally, from its income resisted the community's efforts to form a collaborative bargain. And those that saw landownership as conditional upon community's prosperity resisted individual landowners' attempts to collect private rents. New Orleans landscape, including its flood control systems, has been defined by that conflict.

Inalienable Right to Land v. Community Priority

Throughout New Orleans' history, its political system has, to a greater or lesser degree, perpetuated and exacerbated conflict between private interests and the public good.⁸ Over the last hundred years, flood control structures have been created to favor some groups over other groups, and there is a large body of literature focusing on race based discrimination in this area. This corpus of works shows clearly that African Americans enjoyed the benefits of municipal improvements long after Anglo Americans.⁹

Much less literature has been written on the subject of class based discrimination in provision of flood control structures in New Orleans, except where it intersects with race issues. Though there seems an implicit acknowledgement among academics that landowners played a major role in the creation of flood control structures, no author directly examines the issue. It is clear nonetheless that the development of the critical structural flood control systems in an

⁸ This observation has been made by various authors, including Ari Kelman and Craig Colten.

⁹ Colten, Craig. *An Unnatural Metropolis; Wrestling new Orleans from Nature*. Baton Rouge: Louisiana State University Press. 2004. pp 77.

around New Orleans consistently favored landowners over others, and among landowners, consistently favored those seeking speculative gain. This is not to say that race was not a factor; certainly, black landownership was heavily restricted in the Jim Crow south.¹⁰ It is a mistake, however, to assume that any economic discrimination that involves race is exclusively based on race, or is racially determined. Examining the history and present condition of flood control structures in and around New Orleans, we can see that landownership and land speculation influenced the allocation of flood control resources.

The conflict between competing conceptions of landownership manifested the moment New Orleans came into American possession. Four years after the United States acquired New Orleans in the Louisiana Purchase, the Orleans Territory Superior Court passed a unanimous ruling in the case *John Gravier v. Mayor, Alderman and Inhabitants of the City of New Orleans* that was supposed to settle a local land dispute.¹¹ Rather than settle the issue, however, the decision sparked a sort of cold war between John Gravier, his counsel, the famous Edward Livingston, and the people of New Orleans that would last through the summer and end with a hostile and probably illegal federal intervention by Thomas Jefferson. The case, and the events that followed its resolution, exemplify the conflict between Creole New Orleanians (here used as Kelman does to mean Louisiana-born) familiar with French cadastral practices and northern land speculators coming from an English cadastral background.

¹⁰ With the notable exception of Pontchartrain Park residents. The Pontchartrain Park neighborhood was one of the first suburban subdivisions developed for African Americans after WWII and the first neighborhood without deed restrictions African Americans in Louisiana. Often touted as a symbol of the Jim Crow south's belated civil rights progress, Pontchartrain Park was built on some of the lowest land in New Orleans, protected by a new system of levees along the lakefront. One wonders whether its developers took advantage of racial barriers in the housing market and the new flood control structures along the lake to appropriate massive rents from the families purchasing their homes, while, at the same time, white middle to upper class New Orleanians enjoyed an increase in their property values as black families moved out of their neighborhoods.

¹¹ For a fascinating and in-depth historical analysis of this case, see Kelman, chapter 1. The following summary of the case comes from that work.

The different cadastral systems left a lasting impression, and the different land-use patterns they created can still be seen in satellite images today.

In the late 1790s, wealthy landowner Bertrand Gravier divided his estate and sold it off parcel by parcel for urban development. This would later become common practice as the city expanded; landowners would weigh the revenue gained by additional years of cultivation against the revenue gained by subdividing and selling, and as the city limits came closer to their property they would hire surveyors to lay out a street pattern and sell off their land. New Orleans' maddening street pattern, with major avenues radiating away from the river and intersecting at odd angles, and cross-streets that do not exactly line up, is the result of the piecemeal way landowners surveyed and sold off their land. In any event, the sale of Gravier's land would have resulted in New Orleans' first suburb, and nothing more, had the Mississippi not bestowed one of its random blessings upon Gravier's heir, Jean Gravier.

The Mississippi drains the third largest watershed in the world. Extending from western Montana to eastern Pennsylvania, it discharges, on average, 16,000 cubic miles of water into the Gulf of Mexico every second and drains 41% of the United States. The Mississippi also carries millions of tons of fine silt which is deposited along its banks and floodplains. The enormity and diversity of the Mississippi's drainage basin and extreme variation in discharge volume and silt content create an extremely unpredictable riparian environment. Heavy spring rains in Pennsylvania can raise the height of the Mississippi in New Orleans thousands of miles away, and silt laden runoff from the Midwestern bread basket can create sediment deposits that shift the river's channel.

Occasionally, before the river was hemmed in by levees, the Mississippi shifted its bed. These shifts were unexpected, and resulted in the loss of riparian land in one spot and the

accretion of land in another. In 1803, the Mississippi deposited a large amount of silt in front of what used to be the Gravier estate, and though Bertrand had long ago sold his river abutting plots to developers, his brother, who still owned some plots away from the river, eyed the accretion with a speculator's interest. Land was becoming increasingly valuable in the budding metropolis, particularly riverfront land, and Jean Gravier quickly began to build levees to keep the new land dry year round.

When he began to restrict access to the batture, residents of New Orleans became incensed. To them, the batture was common property. Access to the river was crucial for the commercial interests of the city, as well as being considered a basic freedom for residents who used the intermittently dry land for fill, storage and promenade. From Gravier's perspective, the batture was his property since he hadn't sold it with the other parcels. From theirs, it was common property, to serve the interests of the public free of charge.

Gravier hired Livingston and sued the city for the rights to the batture. Livingston, a New-Yorker with a savvy eye for real estate, couldn't understand how the most valuable land in the city could just be left for anyone to use how they saw fit. In New York, where accretion is not nearly as commonplace as it is on the Mississippi, the wharfs and ports had been owned and developed by private parties. Livingston looked at the disorganized and cluttered batture¹³ and saw great potential for development, if only the area could be privatized.

In May of 1807, Livingston won a unanimous court ruling granting him exclusive ownership of the batture and began to erect more permanent structures, presumably wharves, warehouses and levees.¹⁴ But every time Livingston tried to bring workers onto the area, a sentry

¹³ The entire river bank was considered public property during this domain, and was used for a variety of purposes, including storage of wares, docking and unloading of ships, bartering and marketing, and even digging for landfill. This created a bustling, dirty waterfront that struck northerners as chaotic and unmanaged.

¹⁴ Gravier had agreed to make Livingston a partner in his development project if he won in court.



25 feet tall, the levees that protect New Orleans from river flooding are the highest in the area. The thin strip of riparian land between the levee and the river is called a batture, and questions over who owns it and what uses it may be put to persist to this day. See Waller, Mark. "Batture Property Rights in Question." *NOLA.com*. May 29, 2007. Accessed February 28, 2009. Photo by author.

would beat a drum to bring a mob to chase away the workers. This standoff between Gravier and the population went on for four months until, in September, Livingston appealed to the state's Governor, who in turn appealed to the Federal Government for aid in protecting Livingston's workers. President Jefferson, who had been the prime mover behind the Louisiana Purchase and who regarded the Mississippi as the property of the people of the United States, not only refused to aid Livingston - he had him evicted from the batture altogether. This action effectively ended this conflict over the batture, but was only the beginning of the war over land in New Orleans.

This early example of conflict over common property in New Orleans isn't merely an interesting anecdote. It shows that, from the very moment the United States acquired New Orleans, conflict over scarce and valuable resources would hamper the city's growth. The conflict lay between those operating under a Lockean conception of private property, where the owner had full discretion over the use and disposal of his land, and a more accommodating view that saw the landowner as having responsibilities to the community as a whole. As New Orleans

has expanded and built large-scale flood control structures, conflicting notions over property ownership and responsibilities have led to structures wholly inadequate for protecting the city.

Failure to Cooperate

The nineteenth century saw two eras in flood control in the lower Mississippi region. During the first half of the century, individuals and local governments struggled to form bureaucracies that efficiently provided levee protection to New Orleans. The second half of the century saw the beginning of federal involvement that led to a massive program of levee construction which primarily served the interests of speculative land owners. This program formed the basis for future federal involvement and, eventually, the current apparatus New Orleans has today. But throughout the entire evolution of our modern flood control program, the simple and necessary linkage between land values and flood protection was never fully established.

In the early 1800s, New Orleans attempted to assign responsibility for levee construction and maintenance remotely across multiple groups. Self-protecting landowners on floodplains was not a new concept in colonial law; French colonizers had passed a writ in 1724 requiring riparian landowners to maintain their own levees without providing for any unifying authority with the power to raise revenues. As settlement spread away from the natural levee and into the backwoods, riparian landowners began to resent paying for the protection of the entire community. This led landowners to build shorter levees than they would otherwise have built had non-riparian landowners contributed towards the cost of protection. When a flood destroyed most of the New Orleans' levees in 1735, riparian landowners were slow to rebuild the structures. A 1743 ordinance threatening landowners with foreclosure if they did not rebuild their

levees attests to the reluctance of private landowners to provide the public good of flood protection.¹⁵

The self-protecting landowner strategy lead to another problem: the “race to the top.” Flooding is a way for excess water to escape a river’s channel into neighboring areas. Levying a river has the effect of trapping rising waters in the channel, increasing pressure on the levee and increasing the river’s height at flood stage. Thus, with every increase in the height of levees on one sections of the river came an increase in risk for landowners on all the other sections, who would in turn build their own levees higher, continuing the cycle.

Differences in riparian land values also lead to a third problem, namely, wide variation in the quality and height of levees from riparian parcel to riparian parcel. Rich agricultural land built high, strong levees, while less productive land farther upstream built weak, low levees. This strategy of allowing each individual landowner to build and maintain his own levees without any government supervision or intervention produced inadequate and inefficient protection, and by 1846, it was clear that the system was in immediate danger of collapse. As Colten puts it, “society along the lower river faced a continued struggle to raise the levees in order to offset the higher flood stages they created.”¹⁶ As the region’s population grew, farmers spread up and down the Mississippi, building levees along the river wherever they cultivated. Each region’s levees increased the flood hazard for other regions. Then state engineer P. O. Herbert wrote:

Every day, levees are extended higher and higher up the river – natural outlets closed – and every day the danger to the city of New Orleans and to all the lower country in increased. Who can calculate the loss by an outflow to the city of New Orleans alone? Instead, therefore, of throwing suddenly a larger quantity of water in the Lower Mississippi and elevating its level of by opening cut-offs above, we should, on

¹⁵ Cowdrey, Albert. “Land’s End; A history of the New Orleans District, U.S. Army Corps of Engineers, and Its Lifelong Battle with the Lower Mississippi and Other Rivers Wending Their Way to the Sea.” Baltimore: U.S. Army Corps of Engineers. 1977.

¹⁶ Colten, Craig. pp. 22.

the contrary, endeavor to reduce this level, already too high and too dangerous, by opening the outlets of the river. We are every year confining this immense river closer and closer to its own bed – forgetting that it is fed by over 1500 streams – and regardless of a dangers becoming every year more and more impending.¹⁷

On May 3, 1849, the inevitable happened; a crevasse at Pierre Sauve’s plantation upriver of New Orleans opened, allowing the swollen Mississippi to flow into the natural basin formed by the region’s topography. The city was flooded from the rear, with brackish water inundating the poorer sections of the city. As is a recurring phenomenon in throughout the country, local topography strongly influences social geography, and those hardest and most frequently hit by flooding tend to be the poorest. In this case, political fragmentation hampered the city’s response to the flood as it had hampered the city’s preventative actions, and more than a month passed before the crevasse was close and the city drained.

The fundamental problem was, as Colton puts it, that “farmers in [the] swamps did not embrace the notion that they shared a community of interest with New Orleans residents. They did not subscribe to the concept that they should sacrifice their crops for the city’s security.”¹⁸ And they shouldn’t have. Had the city formed a collaborative relationship with farmers in the same flood basin, those farmers would be compensated for any losses resulting in flood protection measures for the city. The compensation would have induced farmers to give up some of their land for the sake of flood control for New Orleans. But the city’s inability to form a collaborative relationship with farmers on its fringe led to repeated flooding in the urban area and surrounding country. Floods in 1862, 1865, 1867, 1868, 1871 and 1874 dealt sequential blows to the city and local industries, and it was not until 1879 that Congress created the Mississippi River Commission to design a federally supported flood control system. But

¹⁷ P. O. Herbert. “Annual Report of the State Engineer to the Legislature of the State of Louisiana”. *The Jeffersonian*, New Orleans, 1846. pp. 10-11. Via Colten, Craig. pp. 26.

¹⁸ Colten, Craig. pp. 29.

federally sponsored levee construction encouraged speculative development in low lying areas, leaving more property and persons exposed to flooding.

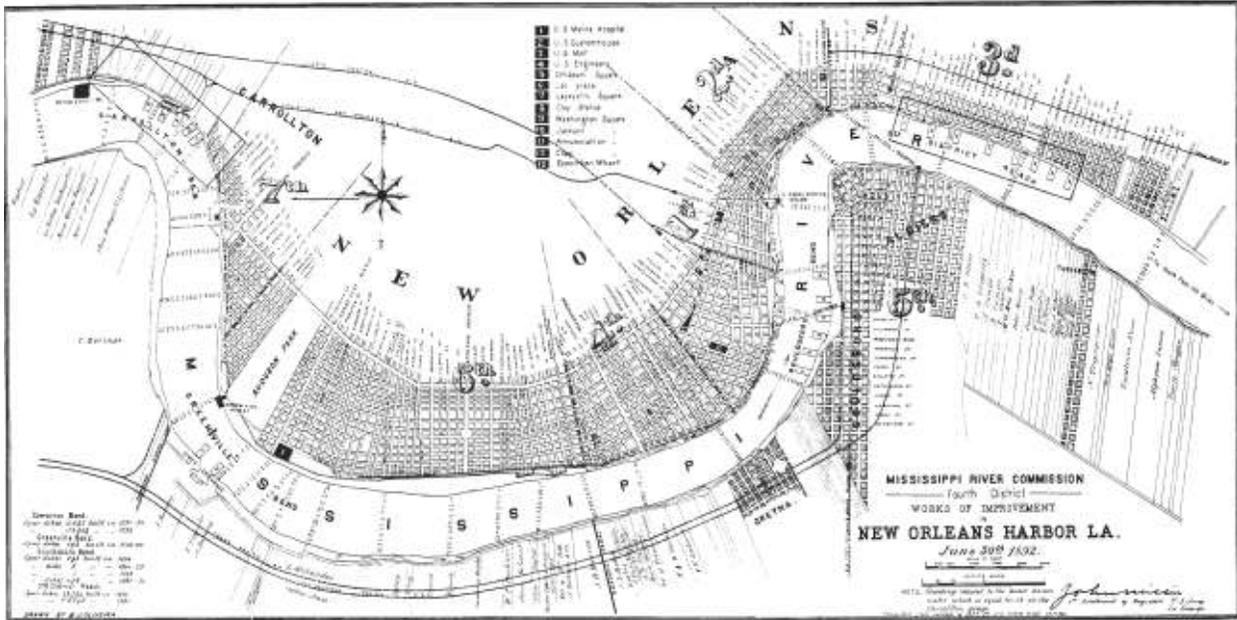
The Sauve Cravass incident and subsequent floods provoked a strong reaction among riparian landowners, who had previously demanded that the state tax all residents benefitting from levee protection in proportion to those benefits. By 1856 a complex system of land taxation had emerged based on the levee district model, with taxes going to a local levee board that maintained the levees for a single floodplain. That system fell apart in the late-1850s, however, as the Federal Government granted federally owned swampland to states and local levee boards.

As Cowdrey writes

The states were to levee and drain these lands, and to pay for the work by selling the reclaimed land, which would presumably rise in value as the work progressed. The attempt to solve the flood problem by creating a sort of perpetual motion machine, with revenue producing improvement and improvement producing revenue, ran as well as most such machines. The cost of reclamation was underrated, the work itself – notably in Louisiana – grossly mismanaged, and by the mid-1850s the scheme had evidently failed.¹⁹

It is unclear why this system failed to allocate the preferred level of protection. It could have been that the costs of organizing were not distributed equally across the landowners in the district. Or, it could have been that the cost of creating developable property out of swampland was greater than the benefits, as Crowley indicates. If this was indeed the case, it would suggest that society, as a whole, did not value this land enough to expose the capital necessary for its improvement to flooding. But this land would be developed later on, as the Federal Government would pick up a larger portion of the cost of levee protection. Another, more tenuous perpetual motion machine would arise; the Federal Government would levee one area, increasing the risk to another area, which would itself require levees, which would increase the risk to a third area

¹⁹ Cowdrey, Albert. 1977. pp. 9.



This map created in 1892 by the newly formed Mississippi River Commission, the precursor to the Corps of Army Engineers, shows that, at the turn of the century, New Orleans' urban development was largely restricted to the high ground along the river. Over the course of the next century, it would explode into surrounding wetlands. Photo from Cowdrey, Albert. 1977.

and so on. This would morph into a speculative cycle that would drive development in the second half of the twentieth century.

When the Mississippi River Commission inspected the state of the delta's levees in 1874, its report was grim. It found 143.4 miles of crevasses south of Commerce, Missouri, and stated that the local levee boards were desperately poor, without credit, and often incompetent in their methods of building levees. As a result of inadequate heights and erosion of the river's banks, 107.5 miles of levee had been destroyed in Louisiana alone since the end of the Civil War. It attributed the sorry state of the region's levees to poor coordination and cooperation among different localities. "The army of defense," it wrote, "has been content to remain a simple aggregation of independent companies, with here and there a battalion under the command of a board of officers. That victory has not more frequently perched upon their banners is surely not

surprising.”²⁰ The commission recommended that each drainage basin be presided over by a single authority to coordinate and unify the construction of flood control structures. Though not enacted until some years later, this recommendation would form the basis for a unified federal approach to flood mitigation in the Mississippi delta.

Even during the era of unified flood control measures, however, local landed interests continued to have an effect on the construction of flood control structures along the Mississippi. Until the late 1930s, the Federal Government followed the now infamous “levees-only” policy of flood control. Abandoning outlet channels, flood basins, dams and other structures that help redirect floodwaters into safe areas, the Corps exclusively focused on building levees, falling into the trap clearly identified by P. O. Herbert in 1846. Though some have argued that the “levees-only” policy is the result of a Corps culture of complicity, where members blindly accept the theories of influential leaders, Cowdrey suggests another explanation,

The real source of the “levees-only” policy was to be found not in Humphreys and Abbot, but in the political and economic facts of the situation faced by the Mississippi River Commission. Fundamental was the pressure of Valley residents for immediate and local rather than long-range and comprehensive protection against floods... “levees-only” became policy because congress wanted it, and, in fact, **because almost everybody of influence in the Mississippi Valley wanted it** [emphasis added].²¹

Though adequate data from that region and era are non-existent, we may infer from other evidence that the reason local politicians preferred a levees-only policy was that levees most immediately improved land values. Other large-scale projects like the Bonnet Carre spillway discussed below take more time to complete, their effects are less palpable, and they are not immediately visible. A levee one mile away is much more tangible, and therefore has a more immediate effect on land values, than a spillway 100 miles upstream.

²⁰ Ibid.

²¹ Ibid.

Thus, the latter half of the 1800s and the early 1900s were characterized by increasing federal subsidization of landowners in the Mississippi floodplain. Time and again, congressmen and senators from southern, floodplain states supported the Commission's policy of levees-only above all other flood control measures because it benefited their landed constituents. In 1886, Congress revoked funding for revetment work along the Mississippi, instead allocating that money to levees.²² This is particularly telling, since the open navigation of the Mississippi was the original justification for the formation of the Commission, and revetments helped prevent sedimentation in the Mississippi. Flood protection was a humanitarian concern added as a secondary objective of the Mississippi River Commission, but, as the century came to a close, it became the Commission's only occupation.

On June 30, 1887, Senator Randall Gibson of Louisiana "congratulated the Commission upon the fact that their recommendations [of channeling] had not been approved by the Secretary of War. The sentiment of the two Houses was opposed to revetment. The contraction of the river by levees is the proper method of procedure." By the end of the nineteenth century, local officials petitioning for levee improvements did not even bother justifying their requests by referencing navigation of the Mississippi. Interest in levee construction extended far beyond southern riparian states; the New York Chamber of Commerce led a delegation before the Commission urging that it spend half of its budget on levee construction. Railroads had applied for and received levee protection with strong congressional support, and, particularly telling, many levees were financed by eastern capital.²³

By the beginning of the twentieth century, lobbying for and obtaining federal support for local levee projects in the Mississippi floodplain had become an integral part of development in

²² Ibid.

²³ Ibid.

the region. The Progressive era in American saw the end of the levees-only policy, but not the end of landowner influence on flood mitigation in the Mississippi floodplain. Instead, the scope and magnitude of the Commission's work increased, along with the potential for speculative gain.

As part of the liberal Progressive movement, the Federal Government passed the Flood Control Act in 1936, extending federal flood protection to the nation at large. This would extend the lessons learned, and the mistakes consistently made in the protection of the lower Mississippi region from flooding, to the rest of the country's floodplains. The Flood Control Act of 1936 codified into law to unspoken principle that flood protection create speculative gain for landowners by establishing the cost-benefit ratio as the primary method for evaluating potential flood control projects. The law held that "the Federal Government should improve or participate in the improvement of navigable waters of their tributaries, including watersheds thereof, for flood-control purposes if the benefits **to whomsoever they may accrue** are in excess of the estimated costs [emphasis added]."²⁴ Under this rule, a levee that causes land values to increase beyond the cost of the levee itself would qualify as a project to be funded by federal tax dollars. The increase in land values would largely go to the pockets of the landowners, not towards to cost of the levee or into public coffers.

The Corps used this standard for the next 30 years until the environmental movement modified it slightly to include environmental costs. Under this standard, questions regarding which groups would benefit and which groups would bear the costs were rendered legally irrelevant. This principle lead the Corps to produce the largest flood control structures the Mississippi Delta had ever seen, creating some of the largest windfalls for landowners *they* had

²⁴ 74th Congress. *Statutes at Large*. Vol. 49, pp. 1935-1936. via Foster, John. "Flood Management: Who Benefits and Who Pays?" *Water Resources Bulletin*. Col. 12, No. 5. 1976. pp. 1029-1039.

ever seen. Through the last half of the twentieth century, the Corps continued to create levees and other flood control structures that cost billions of federal tax dollars but benefitted a relatively small group of landowners in the lower Mississippi.

This put the Federal Government and its policies at the heart of the issue, for by using expected increases in land values and future development as justification for large-scale flood control structures, the Corps is explicitly encouraging the development of risky areas. White puts it best when he writes

(I)t would seem desirable to recognize that, under current policy, the Corps of engineers is, against its inclinations, **one of the major real estate developers in the country**. The effect of its operations on more than 650 urban flood plains is to stimulate and support occupancy changes which are already in progress. While under its method of discounting future benefits and costs it assumes that occupancy will remain essentially unchanged or that if there is value enhancement the owners will bear an appropriate share of the cost, it does not attempt any reimbursement where most reservoirs are involved and it does not project any changes in the types and distribution of land uses. In short, it avoids an explicit shaping of land use patterns. To do so would take it into urban planning and beyond its present authority. The history of changes in the selected urban areas suggests that some such liaison would be in order. There is no denying the fact that the protection works do accelerate certain land use changes and make others possible. A more pertinent question is whether such effects are to be ignored in the planning by Federal agencies or are to be taken into account in collaboration with local agencies and are to be managed so that **part of the development profits are returned to the Federal Treasury** [emphasis added].²⁵

The history of flood control projects in New Orleans strongly supports this assessment. As more flood control has been added, progressively riskier land has been developed and occupied and larger segments of the population have been exposed to increasing levels of risk.

Though a detailed summary of those projects would be tedious, one project in particular bears examination because it exemplifies both the kinds of projects the Corps undertakes and their effects. The Bonnet Carrè spillway was the first large-scale flood control project to be

²⁵ White et al. 1958.

completed after the Flood Control Act. Spanning more than a mile, the spillway is an enormous dam that can be opened to allow the Mississippi to drain into Lake Pontchartraine, redirecting water away from New Orleans. This and a few other spillways have effectively reduced the risk of river flooding in New Orleans to nearly zero. After the spillway's completion in the 70s, the Corps turned its attention to protecting New Orleans from coastal flooding caused by hurricanes. Unfortunately, the lessons learned taming the Mississippi, namely, that levees-only was not a practical approach to preventing flooding, were forgotten.

Billion-Dollar Betsy and the Hurricane Protection Program

Hurricane Betsy marked the beginning of a new era of flood control in New Orleans. "Billion-Dollar Betsy," as it was later coined, hit the city September 9, 1965, causing \$1.42 billion in damages (1965 dollars) and killing 76 people in Louisiana. Betsy flooded nearly the same areas that Katrina did, though the floodwaters did not sit in the city for nearly the amount of time they did in 2005.²⁶ New Orleans rebounded comparatively quickly after Betsy; the population returned within weeks and hospitals and other public services were up and running within a few months. But the massive flooding spurred Congress to pass the Flood Control Act of 1965, authorizing the Corps to design and implement the current Hurricane Protection Program, calling for new and improved levees at New Orleans' rear, along the lake and navigation channels.

²⁶ After Katrina flooded New Orleans, the city's levees acted like the walls of a bowl, trapping floodwaters in the city for more than a month. The stagnant waters did almost more damage to structures than the flooding itself, since it caused mold to grow. Once mold begins to grow in a structure, the entire building needs to be gutted.

40 years separate Betsy from Katrina, and in those five decades, the Corps built a massive system of levees and floodgates around New Orleans to protect it from coastal flooding. City planners and developers were granted massive amounts of new land as the Corps erected new levees that encircled thousands of acres of undeveloped wetlands lining the new I-10 corridor. In accordance with the Corps' cost-benefit rule, 79 percent of the estimated benefits



“Billion-Dollar Betsy” hit New Orleans September 9, 1965, flooding about 80% of the city. The picture above shows flooding in the lower-ninth ward, the same area that was nearly wiped clean in 2005 when the levees along the Industrial Canal broke. Picture from the public domain.

that the corps initially used to justify the cost of the project came from the future development of those wetlands. Within a decade, the exodus had begun, and New Orleans demographic profile shifted drastically as middle class whites moved out of the city into new, suburban developments in Jefferson Parish and blacks moved onto the floodplains, where real estate was cheaper, albeit riskier.

The city itself participated in this shift by building the drainage canals necessary to carry water from land under local sea level into the lake. Jefferson parish also dug extensive canals and invested in pumps that move water out of the developed areas. The low areas around New Orleans are like leaky ships; literally floating in the soggy soil, they would quickly fill with water without a pump operating 24/7. The water table is so high, in fact, that when contractors install pools, they have to weight

them down for fear that the buoyancy of the water table will lift the pool out of the ground before it's filled with water. Canals and pumps provided the second flood control system that allowed massive suburban expansion into much riskier territory (see the map below).

As the Federal Government provided more levee protection, the city drained more wetlands for development. And as more wetlands were developed, the Federal Government provided even more levee protection. The first half of the twentieth century saw the beginning of the leap-frog urban sprawl that today spans hundreds of square miles of former cypress swamp and places huge populations at risk of major flooding. Fifty five years later, the country witnessed the calamitous results of that sprawl. In his comparison of Miami and New Orleans, floodplain management expert Raymond J. Burby writes,

After 1965, their paths diverged. Urban growth in New Orleans exploded into the swamps of eastern New Orleans to take advantage of the development opportunities created by the construction of Interstate Highway 10 and the concurrent efforts of the U.S. Army Corps of Engineers to enhance hurricane storm surge protection by extending levees to the east of the Industrial Canal. In doing this, it continued a century-long process of accommodating population pressures by draining wetlands. In contrast, after 1965, the Florida state government intervened with a series of laws that sought to strengthen local government's ability to plan for and manage urban development and to protect wetlands and other flood hazard areas.²⁷

Burby is wrong in one thing. Population pressure could not have spurred New Orleans to invade its floodplains since the city has lost, on average, 7% of its population every decade from 1970 to 2000.²⁸ In that same time, however, the city expanded its footprint nearly threefold. It was the desire for speculative gain on the part of developers, residents' desire to move farther from the urban center and the desire to generate political capital on the part of local leaders lead New Orleanians that lead to the development of the floodplains.

²⁷ Burby, Raymond J., Arthur C. Nelson, and Thomas W. Sanchez. "The Problems of Containment and the Promise of Planning," in *Rebuilding Urban Places After Disaster*. Philadelphia: University of Pennsylvania Press. 2006. pp. 53.

²⁸ US Census Bureau, *Decennial Census*.

When Katrina hit New Orleans on August 29, 2005, the city's massive levee system created a funnel that channeled storm surge right into the heart of the city (yellow arrows on the map below mark the funnel that the storm surge followed into the heart of New Orleans). Storm surge overwhelmed the outer levees and pressed up against the main walls of the Industrial Canal. The floodwall protecting the lower 9th ward broke, and a wall of floodwater with enough force to lift an entire house off its foundations nearly wiped five residential blocks clean. Floodwaters broke through levees and floodwalls at various locations, eventually flooding most of New Orleans proper. Where there had been mostly swampland and low density development in 1965, there was medium density residential development in 2005, and thus the flooding caused much more damage.

The media immediately focused on the physical failures of the floodwalls, while only a few asked the more difficult question why were people living there in the first place? What incentivized people to put their homes, their property, their very lives in the path of destruction? And, most importantly, what can society do in the future to avoid such calamity? The development of New Orleans' floodplains is not a new phenomenon. But the last half of the twentieth century saw explosive development unrivaled by previous periods. By ignoring the lessons of the past, New Orleans, Louisiana and the Federal Government encouraged people to move into risky areas, putting them directly in harm's way. In the future, the government needs a non-invasive policy tool that will fully fund flood control programs while, at the same time, mitigating the risk floods pose to people and property. That policy tool is land value taxation.

Geography of Infrastructure in New Orleans Metropolitan Area

Yellow lines represent levees. Red Squares represent pumping stations. Blue lines represent drainage canals. Red lines represent interstate highways. Approximate height of levees given.
Source: NASA Landsat, April 26, 2000. <http://earthobservatory.nasa.gov/IOTD/view.php?id=2158>



Approximately 5 miles

The Solution Long Overdue

New Orleanians live in a tenuous city, made even more so by aggressive land speculation facilitated by federal pork. We have seen that New Orleans situation is not unique but for the degree of her misery. We have seen that the Federal Government's approach to flood control actually increases the risk of catastrophic floods while transferring vast sums of wealth from the public coffers to landholder's purses. And we have seen that, in New Orleans, federally planned and funded flood control structures increased the city's footprint at the expense of residents' safety and well being. There is one policy tool that, if properly implemented, would address these issues and more. A land value tax (LVT) would ensure that levees served their primary purpose, protecting people and property, rather than creating speculative opportunities for developers. In addition, it would speed recovery in New Orleans, and, in the future, encourage a stronger, more efficient city.

To encourage urban renewal and to reduce their city's exposure to flood risk, the New Orleans City Council should pursue the following policy objectives: increase the tax rate on land values, reduce the tax rate on improvements and sales, strengthen land-use management policies including public awareness programs and building codes, and **finance all structural flood protection entirely through taxes on land values.** The Louisiana legislature should increase funding for the OPBA and invest in highly skilled staff and information technology. Finally, the Federal Government should revise its policy towards flood protection such that **most of the costs of flood control structures are born by the district receiving the protection.**

A decisive shift away from taxes on capital and consumption and toward a tax on land would discourage invasive sprawl in New Orleans and correct some of the inequities inherent in New Orleans tax system. Additionally, a LVT will hasten the city's recovery and encourage

much needed development. New Orleans has an extremely onerous and regressive tax structure, taxing sales and buildings heavily while under-assessing land. This is foolish; in a city where dry ground is one of the most valuable resources, if not *the* most valuable resource, a heavy tax on land coupled with lighter taxes on capital and consumption would encourage a compact, efficient city rather than a sprawling metropolis struggling to fund even the most basic services. Land value taxation would function with minimal bureaucracy and would have two major consequences. It would eliminate the cross-subsidy between the general taxpayer and landowners, ensuring that levees really only protect land for which the benefits of protection outweigh the costs. And it would shrink the footprint of the city itself, reducing the exposure of people and property to flood risk. As the city shrinks, developed land will increase in value and municipal expenses will decline, and the city will ultimately see an improvement in the public ledger.

After the Storm, many urban planners and architects suggested that New Orleans' footprint was too large and needed to be shrunk.²⁹ At the same time, few authors suggest practical approaches to achieving this goal. The first rebuilding plans unveiled that advocated abandoning some neighborhoods, but failed to specify how such decisions would be made, were understandably met with public outrage. Later rebuilding plans sidestepped the issue of New Orleans' footprint altogether. In a recent analysis of the impact of Katrina, Robert Giegengack and Kenneth R. Foster write, "Factors that would increase the safety of the city, considered as acceptability of risk, include... relocating residents to safer areas of the city, typically in higher-

²⁹ Allen, Gregg. "New Orleans Officials Unveil Rebuilding Plan." *NPR*. January 12, 2006. Accessed March 16, 2009. Also, "Can a 'Shrinking Footprint' Save New Orleans?" *Bloomberg*. January 23, 2006. Accessed March 16, 2009.

lying regions and away from the immediate proximity of flood walls.”³⁰ Though accurate, and similar to many other analyses, this assessment is not particularly useful. Mark Zandi et. al. suggest special tax incentives for businesses and developers to “offset the higher cost of building required for raising homes off the ground in the lower sections of New Orleans.”³¹ Today, New Orleans offers special tax breaks to developers in special development districts. But this seems to be exactly the wrong approach, since subsidizing floodplain development put New Orleans at risk in the first place. Burby, on the other hand, advocates urban planning and zoning as a tool for floodplain management, but we have reason to be skeptical of such an approach in New Orleans. We have seen that bureaucratic institutions rarely function as intended in New Orleans, particularly institutions that are susceptible to corruption. Mason Gaffney is the only theorist who has so far suggested land value taxation in New Orleans, but he seems to have been largely ignored by analysts and politicians alike.³²

The topography of New Orleans makes it relatively easy to see where a levee financed by a LVT would likely lie (see the map on the last page. Areas not protected would likely go undeveloped). The high land in New Orleans slopes gently away from the banks of the Mississippi into the low area to the rear of the city, where great cypress swamps used to extend north to the banks of Lake Pontchartrain. In building the levees that protect New Orleans from flooding from the rear, the Corps had three general options. They could have put the levee directly at the rear of the high land, leaving the Metairie and Gentilly ridges outside the protected area. Or they could have built the levees on the north side of the ridges, enclosing all the land

³⁰ Giegengack, Robert and Kenneth R. Foster. “Physical Constraints on Reconstructing New Orleans,” in *Rebuilding Urban Places After Disaster*. Philadelphia: University of Pennsylvania Press. 2006. pp. 31.

³¹ Zandi, Mark, Steven Cochrane, Phillip Ksiazkiewicz and Ryan Sweet. “Restarting the Economy,” in *Rebuilding Urban Places After Disaster*. Philadelphia: University of Pennsylvania Press. 2006. pp. 113.

³² Gaffney, Mason. “Repopulating New Orleans.” *Dollars and Sense*. February, 2006. Accessed November 12, 2008. <http://www.masongaffney.org/>.

above local sea level in flood control structures. Finally, they could have built the levees as far out from the Mississippi as possible, and as close to the lake as possible, protecting vast tracts of land lying below sea level.

Flood control structures financed by the general taxpayer end up protecting too much land too little because the groups making spending decisions are not the same groups that finance the projects. When the Corps built the Hurricane Protection System around New Orleans, it chose the third option from those above, enclosing vast tracts of land for which the marginal increase in value was likely less than the marginal cost of protection. To do this, the Corps over-estimated the future increase in land values and over-invested in levees that barely met minimum safety requirements. They also under-estimated the actual cost of the program, as well as the time it would take to complete.

If the Corps had followed the principle put forth in this paper, they would have built a more efficient levee system, since there would have been less political pressure to expand the system and more pressure to assess costs and benefits accurately. Developers would not have had an incentive to push the Corps to enclose more land, since they would not have enjoyed revenue from the increase in land values. Additionally, the entire community would have a profit motive to ensure that unprofitable land was not enclosed, since the additional cost of enclosing that land would be borne by landowners on the high ground. A cross-subsidy from landowners on the high ground to developers on the low ground would have been politically and economically impossible under a LVT scheme.

Hypothetical Geography of Infrastructure in New Orleans Metropolitan Area

Below is a rough estimate of the location of levees had the Corps enacted this paper's recommendations in 1965. This is purely speculative, and not based on any empirical analysis. Essentially, the levees would protect only those areas that were above local sea level, with the possible exception of low land encircled by a ridge. Some other features have been erased or moved as well.

Source: NASA Landsat, April 26, 2000. <http://earthobservatory.nasa.gov/IOTD/view.php?id=2158>



Lake Pontchartrain

Industrial Canal

Mississippi River Gulf Outlet (MRGO)

Bonnet Carre Spillway
7 miles upstream

Approximately 5 miles

Bibliography

- Aaron, Henry. *Who Pays the Property Tax? A New View*. Washington D.C.: The Brookings Institute. 1975.
- Albanese, Robert and David D. van Fleet. "Rational Behavior in Groups: The Free-Riding Tendency." *The Academy of Management Review*. Vol. 10, No. 2. 1985. pp. 244-255
- Allen, Gregg. "New Orleans Officials Unveil Rebuilding Plan." *NPR*. January 12, 2006. Accessed March 16, 2009.
- Andelson, Robert V. "Henry George's Land Reform: A Comment on Pullen." *American Journal of Economics and Sociology*, Vol. 60, No. 2 (Apr., 2001), pp. 581-585.
- Aten, Bettina. "Some Poverty Lines are More Equal Than Others." Champaign-Urbana: University of Illinois. 1996.
- Bahl, Roy. *The Taxation of Urban Property in Less Developed Countries*. London: University of Wisconsin Press. 1979.
- Barnard, Jerald R. "Externalities from Urban Growth: The Case of Increased Storm Runoff and Flooding." *Land Economics*. Vol. 54, No. 3. 1978. pp. 298 – 315.
- Bell, Frederick W. "Mitigating the Tragedy of the Commons." *Southern Economic Journal*, Vol. 52, No. 3. 1986. pp. 653-664.
- Bourne Jr., Joel K. "New Orleans: A Perilous Future." *National Geographic*. August, 2007.
- Brady, Patricia. "Foreword," in *Literary New Orleans*. Athens: Hill Street Press. 1999.
- Brinkley, Douglas. *The Great Deluge*. New York: Harper Collins. 2006.
- Brueckner, Jan K., and Hyun-A Kim. "Urban Sprawl and the Property Tax." *International Tax and Public Finance*. Vol. 10, Issue 1. 2003. pp. 5 – 23.
- Burby, Raymond J. and Steven P. French. "Coping With Floods: The Land Use Management Paradox." *Journal of the American Planning Association*. Vol. 47, Issue 3. 1981.
- Burby, Raymond J., Arthur C. Nelson, and Thomas W. Sanchez. "The Problems of Containment and the Promise of Planning," in *Rebuilding Urban Places After Disaster*. Philadelphia: University of Pennsylvania Press. 2006. pp. 53.

- Burby, Raymond J. and Linda Dalton. "Plans Can Matter! The Role of Land Use Plans and State Planning Mandates Limiting the Development of Hazardous Areas." *Public Administration Review*. Vol. 54, No. 3. 1994. pp. 229 – 238.
- Burton, Ian and Robert W. Kates. "The Floodplain and the Seashore: A Comparative Analysis of Hazard-Zone Occupance." *Geographical Review*. Vol 54, No. 3. 1964. pp. 366 – 385.
- "Can a 'Shrinking Footprint' Save New Orleans?" Bloomberg. January 23, 2006. Accessed March 16, 2009.
- Carver, Humphry. *Cities in the Suburbs*. Canada: University of Toronto. 1962.
- Census 2000. United States Census Bureau.
- Colten, Craig. *An Unnatural Metropolis; Wrestling new Orleans from Nature*. Baton Rouge: Louisiana State University Press. 2004.
- Coase, R. H. "The Problem of Social Cost." *Journal of Law and Economics*. Vol. 3, Oct., 1960. pp. 1 – 44.
- Cornick, Philip H. "Land Value Taxation in the Twentieth Century." *American Journal of Economics and Sociology*. Vol. 15, No. 3. 1956. pp. 307 – 314.
- Coyle, K. "River Tinkering Worsened Flooding." USA Today. July 14, 1993. pp. 13A.
- Chehardy, Lawrence. "Letter to residents." August 20, 2008. Accessed March 1, 2009. <http://www.jpasessor.com/>
- CNN MONEY.com. "Best Places to Live." Accessed March 1, 2009. <http://money.cnn.com/magazines/moneymag/bplive.com>
- Cowdrey, Albert. *Land's End; A history of the New Orleans District, U.S. Army Corps of Engineers, and Its Lifelong Battle with the Lower Mississippi and Other Rivers Wending Their Way to the Sea*. Baltimore: U.S. Army Corps of Engineers. 1977.
- Daniel M. Holland. *The Assessment of Land Value*. Madison, Milwaukee, London: University of Wisconsin Press. 1970.
- Demsetz, Harold. "Some Aspects of Property Rights." *Journal of Law and Economics*. Vol. 9. Oct., 1966. pp. 61 – 70.
- "Toward a Theory of Property Rights." *The American Economic Review*. Vol. 57, No. 2. 1967. pp. 347 – 359.

- "Toward and Theory of Property Rights II: The Competition Between Private and Collective Ownership." *The Journal of Legal Studies*. Vol. 31, No. 2. 2002. pp. S653 – S672.
- "The Exchange and Enforcement of Property Rights." *Journal of Law and Economics*. Vol. 7, Oct., 1964. pp. 11 – 26.
- Driever, Steven L. and Danny M. Vaughn. "Flood Hazard in Kansas City since 1980." *Geographical Review*. Vol. 78, No. 1. 1988. pp. 1- 9.
- Forkosch, Morris D. "Henry George: The Economist as Moralist." *American Journal of Economics and Sociology*. Vol. 38, No. 4. 1979. pp. 357-369.
- Foster, John H. "Flood Management: Who Benefits and Who Pays?" *Water Resources Bulletin*, Vol. 12, No. 5. 1976. pp. 1029 – 1039.
- Gaffney, M. Mason. "A Tax Tool for Meeting Urban Fiscal Crisis." *American Journal of Economics and Sociology*. Vol. 27, No. 3. 1968. pp. 253-258.
- "Equity Premises and the Case for Taxing Rent." *The American Economic Review*. Papers and Proceedings of the Hundred and Fourth Annual Meeting of the American Economic Association. Vol. 82, No. 2. 1992. pp. 274-279.
- "Land Rent, Taxation and Public Policy: Taxation and the Functions of Urban Land Rent." *American Journal of Economics and Sociology*. Vol. 32, No. 1. 1973. pp. 17-34.
- "Land Rent, Taxation, and Public Policy: The Sources, Nature and Functions of Urban Land Rent." *American Journal of Economics and Sociology*. Vol. 31, No. 3. 1972. pp. 241-257.
- "Repopulating New Orleans." *Dollars and Sense*. February, 2006. Accessed November 12, 2008. <http://www.masongaffney.org/>.
- "Land Planning and the Property Tax". *Journal of the American Institute of Planners*. 1969. <http://www.masongaffney.org/>.
- "Containment Policies for Urban Sprawl." *Approaches to the Study of Urbanization*. 1964. pp. 115 – 133.
- "Containment Policies for Urban Sprawl." *Approaches to the Study of Urbanization*. 1964. <http://www.masongaffney.org/>.
- "The Property Tax is a Progressive Tax." Robert Schalkenbach Foundation. Proceedings of the Sixty-Fourth Annual Conference on Taxation. 1971. <http://www.masongaffney.org/>.

- George, Henry. *Progress and Poverty: An Inquiry into the Cause of Industrial Depressions and of Increase of Want with Increase of Wealth... The Remedy*. New York: The Robert Schalkenbach Foundation. 1992.
- Giegengack, Robert and Kenneth R. Foster. "Physical Constraints on Reconstructing New Orleans," in *Rebuilding Urban Places After Disaster*. Philadelphia: University of Pennsylvania Press. 2006. pp. 31.
- Gottman, J. *Megalopolis; The Urbanized North Eastern Seaboard of the United States*. New York: The Twentieth Century Fund. 1961.
- Greater New Orleans Community Data Center and the Brookings Institution Metropolitan Program. "The New Orleans Index." January, 2009. Accessed February 19, 2009. <http://www.gnocdc.org/>.
- Gwartney, J. Ted and Nicolaus Tideman. "The Jerome Levy Economic Institute Conference: Land, Wealth, and Poverty." *American Journal of Economics and Sociology*. Vol. 55, No. 3. 1996. pp. 349-356.
- Hamburger, T. "Floods Renew Interest in Climate Changes: Is global Warming Causing more Precipitation?" *Minneapolis Star-Tribune*. April 29, 1997
- Harvey, Robert O., and W. A. V. Clark. "The Nature and Economics of Urban Sprawl." *Land Economics*. Vol. 41, No. 1. 1965. pp. 1 – 9.
- Heerden, Ivor Can and Mike Bryan. *The Storm: What Went Wrong and Why During Hurricane Katrina – The Inside Story from one Louisiana Scientist*. New York: The Penguin Group. 2006.
- Henley, Albert T. "Land Value Taxation by California Irrigation Districts." *American Journal of Economics and Sociology*. Vol. 27, No. 4. 1968. pp. 377 – 386.
- Herbert, P. O. "Annual Report of the State Engineer to the Legislature of the State of Louisiana". The Jeffersonian, New Orleans, 1846.
- Herring, Chris. "The urbanization of neoliberalism : New Orleans' uneven geographic development after Katrina." Senior Project Submitted to the Economics Program of Bard College. 2008.
- Holway, James M. and Raymond J. Burby. "The Effects of Floodplain Development Controls on Residential Land Values". *Land Economics*. Vol. 66, No. 3. 1990.
- Ihlandfeldt, Keith R. "Does Comprehensive Land-Use Planning Improve Cities?" *Land Economics*. Vol. 85, No. 1. 2009. pp. 74 – 85.

- Kask, S. B. and S. A. Maani. "Uncertainty, Information, and Hedonic Pricing." *Land Economics*. Vol. 68, No. 2. 1992. pp. 170-184.
- Kelman, Ari. *A River and Its City: The Nature of Landscape in New Orleans*. Berkley: University of California Press. 2006.
- Kerwin K., and J.B. Verrengia. "Rare Storm Loosed Fort Collins flood: Hazard Experts say Deluge should serve as "wake-up call" for Growing Population." *Rocky Mountain News*. August 3, 1997.
- Kunreuther, H., R. Ginsberg, L. Miller, S. Phillip, P. Slovic, B. Borkan, and N. Katz. *Disaster Insurance Protection: Public Policy Lessons*. New York: John Wiley and Sons. 1978.
- Kurtilla, John V.. "An Economic Approach to Coping with Flood Damage." *Water Resources Research*. Second Quarter. 1966.
- Lebaton, S. "U.S. is Considering a 'Revolution' in Flood Control." *New York Times*. August 28, 1993.
- Lewis, Peirce F. *New Orleans: The Making of an Urban Landscape*. Cambridge: Ballinger Publishing. 1976.
- Lichtenstein, S., P. Slovic, B. Fischhoff, M. Layman, and B. Combs. 1978. "Judged Frequency of Lethal Events." *Journal of Experimental Psychology: Human Learning and Memory*. Vol. 4, Num. 6. pp. 551-78.
- Lindhold, Richard. *Property Taxation USA*. Madison, Milwaukee, London: University of Wisconsin Press. 1967.
- Loten, Angus. "Flooded, Abandoned Properties Draw Speculators." *Inc.com*. September 12, 2005. Accessed October 13, 2008.
- Mark Zandi, Steven Cochrane, Phillip Ksiazkiewicz and Ryan Sweet. "Restarting the Economy," in *Rebuilding Urban Places After Disaster*. Philadelphia: University of Pennsylvania Press. 2006. pp. 113.
- Mason, J. Rupert. "The California Irrigation District Case." *American Journal of Economics and Sociology*. Vol. 2, No. 3. 1943. pp. 393 – 402.
- Mills, Edwin. "The Economic Consequences of a Land Tax," in *Land Value Taxation: Can It Work Today?* Puritan Press. 1998. pp. 31.

- Netzer, Dick. *Land Value Taxation: Can It and Will It Work Today?* Cambridge: Lincoln Institute of Land Policy. 1998.
- O'Sullivan, Arthur. *Urban Economics*. 6th Ed. New York: McGraw-Hill/Irwing. 2007. pp. 102.
- Ottensmann, John R. "Urban Sprawl, Land Values and the Density of Development." *Land Economics*. Vol. 52, No. 4. 1977. pp. 389 – 400.
- OPBA. Pamphlet from OPBA offices. Obtained July 21, 2008.
- Pearson, N. "Hell is a Suburb." *Community Planning Review*. September 1957.
- Penning-Roswell, Edmund C. and John W. Handmer. "Flood Hazard Management in Britain: A Changing Scene." *The Geographical Journal*. Vol. 154, No. 2. 1988. pp. 209 – 220.
- Pfaffenberger, Bryan. "The Harsh Facts of Hydraulics: Technology and Society in Sri Lanka's Colonization Schemes." *Technology and Culture*. Vol. 31, No. 3. 1990. pp. 361-397
- Pielke Jr., Roger A., M.W. Downton, and J.Z. Barnard Miller. "Flood Damage in the United States, 1926-2000: A Reanalysis of National Weather Service Estimates." Boulder: University Corporation for Atmospheric Research. 2002.
- Pielke Jr., Roger A. and Mary W. Downton. "Precipitation and Damaging Floods: Trends in the United States, 1932-97." *Journal of Climate*. Vol. 13. 2000. pp. 3625 – 3637.
- Port of New Orleans. http://www.portno.com/pno_pages/about_overview.htm. Accessed January 5, 2009.
- Prest, A. R. *The Taxation of Urban Land*. London: Manchester University Press. 1981.
- Public Affairs Research Council of Louisiana. "PAR Says Consolidate New Orleans Assessors." June 1, 2006. Accessed February 13, 2009. <http://www.la-par.org>.
- Rettger, Michael J. and Richard N. Boisvert. "Flood Insurance or Disaster Loans: An Economic Evaluation." *American Journal of Agricultural Economics*. Vol. 61, No. 3. 1979. pp. 496 – 505.
- Ross, Robert. "An Analysis of New Orleans' Housing Market Before and After Hurricane Katrina." Paper Presented to the Economics Program, Bard College. December, 2008.
- Russell, Gordon. "N.O. Property taxes set to fall in 2008." *The Times-Picayune*. October 18, 2008. Accessed March 19, 2009.

- "Dubious Value." *NOLA.com*. April 4, 2004. Accessed November 10, 2008.
<http://www.nola.com/speced/dubiousvalue/>
- Schleifstein, Mark. "New Orleans 6th District assessor sues 32 over tax values revised by Tax Commission." *The Times-Picayune*. Posted on NOLA.com November 20, 2008, 9:43 PM. Accessed December 3, 2008.
- Schmidt, Charles W. "The Specter of Sprawl." *Environmental Health Perspectives*. Vol. 106, No. 6. 1998. pp. A274 – A279.
- Schwartzman, Jack. "Henry George and the Ethics of Economics." *American Journal of Economics and Sociology*. Vol. 45, No. 1. 1986. pp. 101-114.
- Sims, John H. and Duane D. Baumann. "The Adoption of Residential Flood Mitigation Measures: What Price Success?" *Economic Geography*. Vol. 63, No. 3. 1987. pp. 259 – 272.
- Sokolow, Alvin D. "The Changing Property Tax and State-Local Relations." *Publius*. Vol. 28, No. 1. 1998. pp. 165 – 187.
- Tideman, T. Nicholas. "Market-Based Systems for Assigning Rental Value to Land." Working Paper. Virginia Polytechnic Institute and State University.
- Twain, Mark. "Letter to Wadsworth." July 10, 1803.
- Nechyba, Thomas J. and Randall P. Walsh. "Urban Sprawl." *The Journal of Economic Perspectives*. Vol. 18, No. 4. 2004.
- US Corps of Army Engineers, New Orleans District, Mississippi Valley Division. "Draft: Louisiana Coastal Protection and Restoration Technical Report." New Orleans: US Corps of Army Engineers. February 2008.
- Vogt, Anthony L. "Petition of Appeal to the Fifth Circuit Court." No. 01-30728. 2002.
- Volk, Donald J.. *Changes in Urban Occupance of Flood Plains in the US*. Chicago: University of Chicago Department of Geography. Research Paper No. 57. 1958.
- Vickery, William. "Defining Land Value for Taxation Purposes," in *The Assessment of Land Value*. Madison, Milwaukee and London: The University of Wisconsin Press. 1970. pp. 25.
- Weber, Elke U. and Christopher Hsee. "Cross-Cultural Differences in Risk Perception, but Cross-Cultural Similarities in Attitudes Towards Perceived Risk." *Management Science*. Vol. 44, No. 9. 1998. pp. 1205.

White, Gilbert F., Wesley C. Calef, James W. Hudson, Harold M. Mayer, John R. Sheaffer and Donald J. Volk. *Changes in Urban Occupance of Flood Plains in the US*. Chicago: University of Chicago Department of Geography. Research Paper No. 57. 1958.

74th Congress. Statutes at Large. Vol. 49, pp. 1935-1936.

2007 American Community Survey, U.S. Census Bureau.