

Hurricane Katrina and the Paradoxes of Government Disaster Policy: Bringing About Wise Governmental Decisions for Hazardous Areas

By
RAYMOND J. BURBY

The unprecedented losses from Hurricane Katrina can be explained by two paradoxes. The safe development paradox is that in trying to make hazardous areas safer, the federal government in fact substantially increased the potential for catastrophic property damages and economic loss. The local government paradox is that while their citizens bear the brunt of human suffering and financial loss in disasters, local officials pay insufficient attention to policies to limit vulnerability. The author demonstrates in this article that in spite of the two paradoxes, disaster losses can be blunted if local governments prepare comprehensive plans that pay attention to hazard mitigation. The federal government can take steps to increase local government commitment to planning and hazard mitigation by making relatively small adjustments to the Disaster Mitigation Act of 2000 and the Flood Insurance Act. To be more certain of reducing disaster losses, however, the author suggests that we need a major reorientation of the National Flood Insurance Program from insuring individuals to insuring communities.

Keywords: Hurricane Katrina; disasters; public policy; hazard mitigation; comprehensive plans; building codes; state planning mandate; National Flood Insurance Program

Economic losses from Hurricane Katrina, estimated to be more than \$200 billion, are the largest for any disaster in U.S. history. Katrina captured national and world attention, but it is just the most recent in a series of increasingly severe catastrophic events (Cutter and

Raymond J. Burby is a professor of city and regional planning at the University of North Carolina at Chapel Hill. He is an associate editor of the Natural Hazards Review and former coeditor of the Journal of the American Planning Association. He is the editor of Cooperating with Nature (Joseph Henry Press, 1998) and the coauthor of Making Governments Plan (Johns Hopkins University Press, 1997) and Environmental Governance (Routledge, 1996). He is a member of the College of Fellows of the American Institute of Certified Planners. From 1992 to 2000, he was a distinguished professor of city and regional planning and held the DeBlois Chair in Urban and Public Affairs at the University of New Orleans.

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Emrich 2005). The 460 presidential disaster declarations of the 1990s were double the number of the previous decade. That trend has continued during the present decade, with 299 disaster declarations through September 2005 (Federal Emergency Management Agency [FEMA] 2005a, 2005b, 2005c). Of the 62 weather-related disasters that have resulted in \$1 billion or more in damages over the twenty-five years between 1980 and 2004, a quarter have occurred since 2000 (U.S. Department of Commerce 2005).

In this article, I argue that the extensive damage in New Orleans and the trend in increasing numbers and severity of disasters are the wholly predictable (in fact, predicted) outcomes of well-intentioned, but short-sighted, public policy decisions at all levels of government. These decisions create two paradoxes. One I term the safe development paradox, since I show that in trying to make hazardous areas safe for development, government policies instead have made them targets for catastrophes. The second I term the local government paradox, since I show that while citizens bear the brunt of losses in disasters, local public officials often fail to take actions necessary to protect them. The consequences of each paradox reinforce the other and in combination lead to a never ending cycle of ever more unsafe urban development and ever larger, ever more catastrophic losses from natural hazards.

The political considerations of the president and Congress that create the safe development paradox are not likely to change. Federal assistance following disasters is likely to increase with increasingly severe disasters, as will federal efforts to make places at risk safer communities in which to live and work. What can change, I argue, is uninformed local government decision making about urban development that results in millions of households and businesses occupying at-risk structures in vulnerable locations. The vehicles for bringing this about are federal policies that (1) require local governments to prepare comprehensive plans that give due consideration to natural hazards and (2) require local governments to assume greater financial responsibility for the consequences of their urban development decision making. Using data on National Flood Insurance Program (NFIP) claims and payments in coastal counties over a twenty-five-year period, I show that comprehensive planning requirements adopted by state governments already have resulted in lower per capita losses from flooding. But less than half of the states require local governments to prepare plans, and fewer than ten states require that plans pay attention to natural hazards.

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The wake of Hurricane Katrina provides an opportunity for the federal government to use the public concern created by the disaster to spur more local governments to prepare comprehensive plans that address hazard mitigation. In addition, if the government reorients the NFIP so that more of the burden of responsibility for insurance coverage is borne by local governments, local officials may become more committed to limiting development in hazardous areas and to mitigating the hazard to existing development at risk (see Burby and May 1998). This article points out several ways the government can accomplish these ends and in doing so erase yet another paradox, noted by Platt (1999, xvii), "On the one hand, the federal government is called upon to assume a major share of state, local and private economic costs of disasters. . . . But on the other hand, the government at all levels is increasingly impotent to demand . . . that local governments and individuals assume the political and financial burdens of curtailing unwise development in hazardous locations."

The article is organized as follows. In the next two sections, I describe the two paradoxes and illustrate them with evidence from policy choices made by federal, state, and local agencies in the New Orleans area over the decades prior to Hurricane Katrina. Next I examine state requirements for local government planning and building code enforcement as a means of dealing with the adverse consequences of the paradoxes and present empirical evidence on their effects in reducing disaster losses. The article concludes with a brief look at various ways the federal government can increase local government commitment to reducing vulnerability to hazards by (1) requiring that they prepare comprehensive plans with hazard mitigation elements and (2) requiring that they assume more responsibility for insuring private and public property at risk from hazards.

Safe Development Paradox

For most of this century, the federal government has pursued a policy toward the use of hazardous areas that I term safe development. The basic idea is that land exposed to natural hazards can be profitably used if steps are taken to make it safe for human occupancy. The means of achieving this have evolved over time, but they basically include measures to mitigate the likelihood of damage and measures to deal with residual financial risk (see Platt 1999; King 2005). To minimize damage, they include federal financial support for flood and hurricane protection works and beach nourishment, federal requirements through the NFIP for safe building practices such as elevation of construction in flood hazard areas, and federal incentives for local government mitigation efforts through provisions of the Disaster Mitigation Act of 2000 and National Flood Insurance Reform Acts of 1994 and 2004. To minimize the adverse financial consequences for individuals and businesses when steps to make development safe from hazards fail (known technically as residual risk), the federal government has provided generous disaster relief, particularly for homeowners, low-cost loans to ease business recovery, income tax deductions for uninsured disaster losses, and subsidized flood insur-

ance. The costs of these policies to the federal government were estimated conservatively by Conrad, McNitt, and Stout (1998, 5) at \$9.5 billion a year (adjusted to 2005 dollars; this amount does not include the cost of lost revenue through tax write-offs and the cost of insurance subsidies).¹ The development stimulus of these policies is further augmented by federal aid that reduces the cost to localities of providing infrastructure in hazardous areas, such as water and sewerage service and highway access (for further discussion of federal incentives for the use of hazardous areas, see H. John Heinz III Center 2000).

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The New Orleans metropolitan area's two largest parishes (Jefferson and Orleans) provide examples of federal safe development policies in action. This region is extremely susceptible to floods and hurricanes. Over the twenty-three-year period between 1978 and 2000, the two parishes were exposed to nineteen damaging flood events and eighteen hurricane events, almost one per year (Hazards Research Lab 2005). Given this high level of risk, Congress, following devastating hurricane losses in 1947, authorized federal assistance for levees that would make it possible to convert ninety-six hundred acres from wetland to "productive use." Following even larger flood losses from Hurricane Betsy in 1965 (America's first billion-dollar hurricane), Congress authorized construction of the Lake Pontchartrain and Vicinity, Louisiana, Hurricane Protection Project, which sought to protect virtually all of Orleans Parish and the northern (east bank) portion of Jefferson Parish from storm surge flooding from hurricanes up to a one in two-hundred-year recurrence interval (equivalent to a Category 3 hurricane). It proposed to do this by raising existing levees and constructing new levees along much of the southern shore of the lake. These levees would help prevent a recurrence of the losses experienced from Hurricane Betsy, and, more important, they would facilitate continued urbanization of this very hazardous region. In fact, protection of *existing development* accounted for only 21 percent of the benefits needed to jus-

tify the project. An extraordinary 79 percent were to come from *new development* that would now be feasible with the added protection provided by the improved levee system (Comptroller of the Currency 1976).² At about the same time the Corps of Engineers was formulating an improved hurricane protection system, Congress in 1968 passed the National Flood Insurance Act to enable households and businesses to insure their property from flood damages, which most commercial insurance companies refused to cover in standard property insurance policies. This newly available insurance provided another important federal underpinning for continued conversion of wetlands in the parishes to urban uses.

Federal safe development policies had their *intended* effect in easing development of hazardous areas in Jefferson and Orleans parishes. During the decade after Congress authorized the Lake Pontchartrain hurricane protection project and launched the NFIP, Jefferson Parish added forty-seven thousand housing units and Orleans Parish added twenty-nine thousand. According to Lewis (2003, 76), "the metropolitan area . . . simply exploded into the swamps—first toward the East Bank section of Jefferson Parish; more recently into the eastern reaches of Orleans Parish and beyond." He went on to note that "most of the newly developed land is built on muck and is sinking at various rates. Much of the land is subject to extremely dangerous flooding" (p. 77). Although Hurricane Betsy revealed the potential for widespread flooding of the low-lying areas of both parishes, the construction of improved hurricane protection works and availability of flood insurance evidently persuaded thousands of households that the region was reasonably safe.

The development of the area east of the Industrial Canal, which contains 50 percent of the land area in the City of New Orleans, is a case in point. In 1960, before the new levee plan, eastern New Orleans consisted mostly of wetlands with a few scattered highway commercial activities and subdivisions along Downman Road and the Chef Menteur Highway (U.S. 90), which linked New Orleans to the Mississippi Gulf Coast. With the pending construction of the I-10 Twin Span across the east end of Lake Pontchartrain and extension of the interstate through the heart of the area and the decision to extend the city's hurricane protection levee system to the east, the New Orleans City Planning Commission adopted a plan in 1966 calling for intensive urban development in what later became known as Planning District 9. The *New Century New Orleans Plan* noted,

Full scale development ensued . . . and concurrent expenditures for streets, parks, schools, and sewerage and drainage was the largest single factor to change the land use profile . . . as well as make the area a significant growth area for the future development of the Metropolitan area . . . the area continued to grow from 1975 to 1985. New subdivisions were developed at a rapid pace . . . (and) major commercial centers developed and prospered. (City Planning Commission 1999, 188)

Further to the east in Planning District 10, the 1970s saw the development of NASA's 830-acre Michoud rocket assembly facility, which is a major employer in

the region, and an attempt to build a major new community (Pontchartrain New Town-In Town Plan) with support from the federal new communities program. When the federal program was shut down in 1975, these projects, renamed Orlandia and New Orleans East, proceeded as wholly private ventures that hoped to provide housing for an estimated 250,000 residents. Even though the pace of development slowed after 1985, between 1970 and 2000 this area of former marshes and swamps saw more than 22,000 new housing units built and the city wanted more. In its 1999 *New Century New Orleans Land Use Plan*, the city planning commission argued,

Moreover, there are extensive opportunities for future development of the vacant parcels that range from single vacant lots to multi-thousand acre tracts. Long term, these development opportunities represent not only population increases but also significant potential employment for the city. (City Planning Commission, 1999, 201)

Ironically, just six years later, the entire area of urban growth the city had been promoting and the Corps protecting for forty years was entirely under water.

As the experience of New Orleans illustrates, federal policy has had its *intended* effect of facilitating and sustaining development in hazardous areas. The paradox is that in trying to make the most hazardous parts of New Orleans safe for urban expansion, it had the *unintended effect* of contributing directly to the devastation of Hurricane Katrina. It did that by increasing the amount of development possible in low-lying, flood-prone areas such as New Orleans East; and, some contend, by providing levee protection and new drainage works to that area of suburban growth, the Corps and city diverted resources that could have been used to improve drainage, pumping capacity, and levees in older areas of the city (see Drew 1984, 1, 10).

Supposedly safe development in New Orleans (and elsewhere) has proven to be unsafe for several reasons including limitations of flood and hurricane protection works and limitations of the NFIP's efforts to control losses through floodplain mapping and regulation of construction practices. Flood control and hurricane protection measures have serious limitations, most of which are not recognized by households and businesses who put themselves at risk by locating in potentially hazardous areas. These limitations include (1) design limits that can lead to levees being overtopped by flood and hurricane events that are larger than they were designed for and (2) design flaws and construction and maintenance shortcomings that lead to protective works being breached when they cannot stand up to the forces exerted by large flood and hurricane events. Both apparently contributed to the levee failures along three New Orleans canals that flooded the city (Carter 2005). This occurrence is not unique inasmuch as FEMA estimated in 1987 that levee overtopping or failure was involved in approximately one-third of all flood disasters. Concern about them is also not recent. Noted geographer Gilbert White observed in 1975 that flood control works "will be of little value if the reduction in damages that they accomplish is more than offset by new damage potential resulting from additional development in floodplains" (p. xviii). This potential was demonstrated by Burby and French (1985), who studied more than twelve hundred

communities with flood hazards and found a positive correlation between the degree to which communities used flood control works to limit their vulnerability to flooding and the amount of new development taking place in their flood hazard areas *after* the flood control works were completed.

The NFIP tries to limit flood losses by imposing construction standards that reduce the likelihood of newly constructed buildings being flooded. These standards, which must be adopted and enforced by local governments as a condition for participation in the program, include elevation or flood proofing to the level of floods with a one in one hundred chance of occurring in any given year. For a variety of reasons, that level of protection is not achieved in some cases and even when achieved may not be adequate (see Burby [2002] for a fuller elaboration of these issues). For one, accurate estimation of flood risk is a critical ingredient in regulating the elevation of new development, but the program has had difficulty doing that because it has been unable to update in a timely manner flood insurance rate maps to take into account increased flood risk from sea-level rise, subsidence, coastal erosion, or increased runoff as watersheds develop in urban areas. Flood insurance is available, but buildings are not required to be elevated in areas at risk from dam and levee failure, in areas with localized storm water drainage flooding, or in small watersheds of less than one square mile. As a consequence of these problems, the NFIP has regularly not been able to cover its costs from premiums and has had to borrow from the Treasury. According to Pasterick (1998), operating losses occurred annually between 1972 and 1980 and in the years 1983, 1984, 1989, 1990, 1992, 1993, 1995, and 1996. An operating loss also occurred in 2004, and with more than \$22 billion in expected claims from Hurricanes Katrina, Rita, and Wilma in 2005, the program will require an infusion of money from the Treasury that it will not be able to repay from future premium income (Crenshaw 2005, A8). To the degree the program fails to adequately reflect risk in rates and operates at a loss, it subsidizes the occupancy of hazardous areas and facilitates more development than is economically rational.

Furthermore, the basic standard of protection used by the NFIP—the one-hundred-year flood event—may be ill-advised, since most flood losses in the United States stem from less frequent flood events. One early study reported that 66 percent of losses in floods come from events with recurrence intervals less frequent than the one-hundred-year flood (Sheaffer et al. 1976). Another study reported that 83 percent of losses from hurricane winds and flooding come from Category 3, 4, and 5 storms, which have recurrence intervals lower than the one-hundred-year event (Pielke and Landsea 1997). Tropical Storm Allison in 2001 flooded forty-five thousand buildings in the Houston area, but only seven thousand were located within one-hundred-year floodplains. In recognition of the limitation of the one-hundred-year flood standard, the Association of State Floodplain Managers (2000) recommends that the five-hundred-year flood be used in regulating the elevation of new urban development.

In addition to limitations in its ability to limit losses to new development, by subsidizing rates for existing development, the program provides little incentive for

property owners to take steps on their own to reduce flood vulnerability. Household surveys by Burby et al. (1988) and Laska (1991) found that less than 15 percent of property owners took action to improve their buildings prior to experiencing flood losses. There are a variety of reasons, in addition to subsidized flood insurance, for this inaction, including misperception and underestimation of the risk of flooding, inability to recover investments in mitigation investments through higher resale values, budget constraints, and expectations that federal disaster relief will cover losses. For the NFIP, the consequences have been dire since repetitively flooded properties (which account for about 2 percent of all NFIP policies) account for more than 25 percent of claims payments made (see Anderson 2000).

In summary, federal policies have sought to make areas at risk from natural hazards safe places for urban development by reducing the degree of hazard and by shielding hazard-area occupants from financial risks of loss. Over time, these policies have facilitated the development of these areas, as illustrated by urban growth in New Orleans, but they have increased the potential for catastrophic losses in large disasters. In this sense, Hurricane Katrina and the flooding of New Orleans could be viewed as an expected consequence of federal policy rather than an aberration that is unlikely to be repeated.

Local Government Paradox

Mileti (1999, 66) scrutinized the \$500 billion in losses from natural disasters in the United States between 1975 and 1994. He found that a relatively small proportion was covered by federal disaster relief, and that most losses were not insured. Instead, "losses were borne by victims." Given that the incidence of disaster losses is primarily borne by local residents and businesses, one would expect that avoidance of losses would be a high priority for local officials. The paradox is that this is typically not the case.

Prior to being coerced into adopting floodplain management regulations by the National Flood Insurance Act in 1968, virtually no local governments in the United States had adopted building or zoning regulations to minimize flood losses (e.g., see Murphy 1958). Although thousands of governments subsequently adopted the minimum building standards needed to participate, many did not enforce them seriously or take other actions to deal with flood and hurricane risks. In South Carolina, for example, building code violations were found to be an important cause of damages from Hurricane Hugo in 1989 (All-Industry Research Advisory Council [AIRAC] 1989). In south Florida, a quarter of the \$16 billion in insured losses from Hurricane Andrew in 1992 were attributed to Dade County's failure to enforce its building code (Building Performance Assessment Team 1992). A study by the Southern Building Code Congress International, Inc. (1992) found that more than half of local building officials surveyed on the Gulf Coast did not understand or enforce the provisions of the Southern building code related to hurricane wind damage.

Three examples of decision making in the New Orleans area illustrate a lack of local government concern about hazards. Grunwald and Glasser (2005) in an article in the *Washington Post* on the New Orleans levee systems wrote, "Local officials often resisted proposals to protect their communities from storms because they did not want to pay their share of federal projects." Decisions recounted to support this contention include the following. The Orleans Parish Levee Board lobbied the Corps of Engineers for protection to the level of a one-hundred-year, rather than two-hundred-year, hurricane after the local share of the cost of the Lake Pontchartrain and Vicinity Project had escalated many times beyond original estimates. The levee district also opposed hurricane protection floodgates at the mouths of the city's drainage canals, which led to the construction of the walls along

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the canals that failed in Katrina. As another example of low priority for flood protection, in the early 1980s the Federal Insurance Administration (FIA) launched a subrogation suit for more than \$100 million against Jefferson, Orleans, and St. Bernard parishes (subrogation occurs when an insurance entity that pays its insured client for losses then sues the party it contends caused the damages). The FIA contended the parishes caused it to pay excessive flood insurance claims by failing to maintain levees and failing to enforce elevation requirements for new construction, which then led to buildings being flooded and their owners to seek compensation from the federal flood insurance program. The courts ruled in the FIA's favor and ordered the parishes to improve their levee maintenance and enforcement practices (see Malone 1990). As a third example, the city of New Orleans did not update its 1970 comprehensive plan for almost thirty years. When it got around to this in 1999, its *New Century New Orleans Land Use Plan* made absolutely no mention of the extreme flood hazard facing the city, ways of mitigating the hazard through land use or building regulations, or how the city might recover from an event such as Hurricane Katrina.

There are many reasons for the local government paradox. In his national assessment of natural hazards in the United States, Mileti (1999, 160) touched on several of them.

Few local governments are willing to reduce natural hazards by managing development. It is not so much that they oppose land use measures (although some do), but rather that, like individuals, they tend to view natural hazards as a minor problem that can take a back seat to more pressing local concerns such as unemployment, crime, housing, and education. Also, the costs of mitigation are immediate while the benefits are uncertain, may not occur during the tenure of current elected officials, and are not visible (like roads or a new library).

May (1991) noted that these local political factors stem in part from the lack of citizen concern about hazards, which he believes creates a "policies without publics" dilemma that stifles local policy initiatives. In addition, other scholars believe federal encouragement of the intensive use of areas exposed to natural hazards has created a form of "moral hazard" that discourages local governments (and individuals) from taking actions to reduce the risk of loss.

Moral hazard is an insurance term that refers to cases where the availability of insurance protection lowers an insured party's incentive to avoid risk. Insurance companies try to counter this through the use of deductibles and the threat of canceling policies if claims are too frequent. The potential for moral hazard in the federal approach to natural hazards was first noted by the Interagency Floodplain Management Review Committee (1994, 180) following disastrous floods in the upper Midwest in 1993. In commenting on the potential for federal programs to create a form of moral hazard, the committee observed, "Through provision of disaster assistance and, in some cases, enhanced flood protection, the government may in fact be reducing incentives for local governments and individuals to be more prudent in their actions." Also written in 1994, the House Bipartisan Natural Disasters Task Force stated, "If state and local governments believe that the federal government will meet their needs in every disaster, they have less incentive to spend scarce state and local resources on disaster preparedness, mitigation, response and recovery . . . (and) people are encouraged to take risks they think they will not have to pay for" (quoted in Platt 1999, 39). Finally, Mileti (1999, 7) has argued that a "scattershot approach, as well as the federal and state trend to cut risk and assume liability, has undermined the responsibility of local governments for using land-use management techniques to reduce exposures to hazards."³

By the 1990s, various federal programs were being adjusted to deal with the moral hazard issue. The Stafford Act in 1988 and more recent Disaster Mitigation Act of 2000 both provide federal assistance for the preparation of state and local hazard mitigation plans and implementation of hazard mitigation projects. Although the Stafford Act has been found to be ineffective in many cases (see Godschalk et al. 1998), some of the problems identified may be countered by the more recent Disaster Mitigation Act of 2000 legislation. A similar effort has been made to counter the potential of the NFIP to foster local complacency toward flood hazards. The Flood Insurance Reform Act of 1994 established incentives for the preparation of floodplain management plans and other flood mitigation measures, and the Flood Insurance Reform Act of 2004 provided tools for dealing with repeatedly flooded properties. However, the degree to which any of these efforts

have had an effect on local government commitment to dealing with hazards is not known at this time.

Avoiding the Two Paradoxes

The paradoxes that contributed to the flooding of New Orleans are coming to be widely recognized. An October 2005 analysis by the Brookings Institution Metropolitan Program noted,

Federal policies and investments in flood protection facilitated development in dangerous locations . . . and failed to discourage floodplain development. . . . [T]he traditional federal deference to state and local land-use planning has meant that federal spending on levees and other protections has been unaccompanied by sensible restrictions on subsequent construction. . . . At the same time, the availability of subsidized federal flood insurance for new development in flood plains . . . also represents a failure of Washington to take the lead in discouraging communities from building in harm's way. (Brookings Institution Metropolitan Program 2005, 23, 25)

It seems obvious that unless the two paradoxes discussed here are addressed directly in federal policy, the devastation brought about by Katrina will be repeated continually across the United States.

Having noted this, it seems to me unlikely that the pork barrel politics that sustain federal investments in flood and hurricane protection, federal disaster relief, and federal insurance subsidies are likely to change even though policy analysts increasingly recognize their adverse effects. What can change is how local governments manage the development and redevelopment of areas at risk. A series of studies supported by the National Science Foundation has shown that through appropriate land-use planning and oversight of development, risk and damages from hazards can be significantly reduced (see Burby, French, and Nelson 1998; Olshansky 2001; Nelson and French 2002; Burby 2005).⁴ The difficulty, given the local government paradox, is how to bring this about.

One approach state governments have used is to formulate state building codes and planning policies and to mandate that local governments enforce the codes and prepare comprehensive plans that are consistent with the policies. To determine whether these state requirements are having an effect on loss reduction, I examined the distribution of flood insurance claims and amount of claims payments made by the NFIP in coastal counties of the Atlantic, Gulf, and Pacific states over the twenty-five-year period from January 1, 1978, through December 31, 2002. These states differed significantly in their requirements regarding local enforcement of building codes and local planning for urban development and redevelopment, as shown in Table 1. Six coastal states, including each of those hit by Katrina, required *neither* local code enforcement nor local comprehensive plans. Eight states required local governments to enforce codes or to develop plans, but not both; and ten states required both local code enforcement and local

TABLE 1
STATE REQUIREMENTS FOR LOCAL GOVERNMENT BUILDING
CODE ENFORCEMENT AND COMPREHENSIVE PLANS IN ATLANTIC,
GULF, AND PACIFIC STATES

State Requirements for Local Government Building Code Enforcement and Comprehensive Plans	States (Number of Coastal Counties/Parishes)
No state local government building code enforcement or comprehensive plan requirements	6 states with 58 counties: Alabama (2), Louisiana (25), Mississippi (3), New Hampshire (2), Pennsylvania (3), Texas (23)
State local government building code enforcement requirement but not comprehensive plan requirement	3 states with 37 counties: Connecticut (4), New Jersey (17), New York (16)
State local government comprehensive plan requirement but not building code requirement	5 states with 33 counties: Delaware (3), Georgia (6), Hawaii (5), Maine (10), South Carolina (9)
Both state local government building code and comprehensive plan requirements	10 states with 236 counties: Alaska (19), California (22), Florida (67), Maryland (17), Massachusetts (9) (plan requirement for larger cities and towns), North Carolina (20), Oregon (13), Rhode Island (5), Virginia (46), ^b Washington (17) (plan requirement for high growth counties only)

SOURCE: Schwab (2002).

a. Local governments in seven of these ten states (California, Florida, Maine, Maryland, North Carolina, Oregon, South Carolina) are also required to include a hazards element in the comprehensive plan.

b. Includes independent cities as well as counties.

formulation and adoption of comprehensive plans. Most of the states that required both code enforcement and planning also required that plans address natural hazards.

The number of NFIP insurance claims per capita for compensation of flood damages and the per capita dollar amount of payments made to settle claims were *highest* in states that did not require responsible behavior—neither building code enforcement nor comprehensive plans—from their local governments. They were lowest in states that required one or both from their local governments, as shown in Table 2. The three states hardest hit by Hurricane Katrina left decisions about code enforcement and planning for urban development and redevelopment wholly to local discretion. The consequences for them and the nation have been calamitous. Among all coastal counties, the NFIP experienced thirteen flood-loss claims per thousand residents between 1978 and 2002. In Louisiana, the rate was fifty-five claims per thousand residents of coastal counties, while it was thirty-one and thirty-two in Alabama and Mississippi, respectively. Dollar losses per capita were \$133 among all coastal counties. They were \$530 per capita in Louisiana, \$337 per capita in Alabama, and \$277 per capita in Mississippi.

TABLE 2
 MEAN PER CAPITA NATIONAL FLOOD INSURANCE PROGRAM (NFIP)
 CLAIMS AND PAYMENTS, 1978-2002, IN COASTAL COUNTIES BY PRESENCE
 OR ABSENCE OF STATE BUILDING CODE ENFORCEMENT AND
 COMPREHENSIVE PLANNING MANDATES

State Requirement	Mean Per Capita (Thousands)	Standard Error	Mean Per Capita (\$)	Standard Error
Neither code enforcement nor plan mandate (<i>n</i> = 58)	30	4	\$299	\$46
Code enforcement but not plan mandate (<i>n</i> = 33)	11	5	79	31
Plan but not code enforcement mandate (<i>n</i> = 32)	9	3	137	55
Both code enforcement and planning mandated (<i>n</i> = 224)	10	2	99	16
Statistical significance (one-tailed <i>p</i>)				
Code mandate	.007		.001	
Plan mandate	.001		.03	
Code Mandate × Plan Mandate	.003		.009	

The statistical association between state requirements for the preparation of local comprehensive plans and lower per capita NFIP claims and payments continues when adjustments are made for a number of other factors that affect the likelihood of suffering flood damages, including the number of severe weather events experienced over the twenty-five-year period, population size and density, population growth, and the value of homes at risk.⁵ However, when these other factors are statistically controlled in multivariate analyses, the impact of planning mandates is lower (a reduction in losses of about 1 percent) and the existence of a building code enforcement mandate is no longer statistically significant. These results are shown in the appendix.

Also revealing is a comparison of Florida and Texas, two states that escaped damage from Hurricane Katrina but are similar in other ways in terms of coastal urbanization and storm history. Texas has chosen to leave decisions about building code enforcement and planning wholly to the discretion of local governments. Florida mandates local code enforcement, and since 1975, it has required the preparation of local comprehensive plans. Florida, but not Texas, requires that comprehensive plans develop and implement objectives for hazard mitigation (see Deyle, Chapin, and Baker 2005). Flood insurance claims from coastal residents between 1978 and 2002 were one per thousand residents in Florida, but twenty-one per thousand residents in Texas. Flood insurance payments per capita were \$71 in Florida but \$325 in Texas.

Sharing the Burden

In this article, I have argued that two paradoxes help explain the devastation caused by Hurricane Katrina in New Orleans and can be expected to contribute to similar disasters in the future. The *safe development paradox* occurs when federal efforts to make inherently hazardous areas safe for development in fact make them highly susceptible to disasters of catastrophic proportions. In New Orleans, these federal efforts consisted primarily of funding hurricane protection levees and other flood control works to promote urban development in the "protected" areas and the provision of flood insurance at subsidized rates. The *local government paradox* occurs when local governments, whose citizens bear the brunt of human suffering and financial loss when disasters occur, give insufficient attention to threats posed by hazards when they allow the intensive development of hazardous areas. In New Orleans, this paradox is illustrated by the city's facilitation of development in eastern New Orleans and by the Orleans Parish Levee Board's unwillingness to help underwrite the costs of higher levels of flood and hurricane protection.

The two paradoxes help account for the upward spiral in the frequency and magnitude of natural disasters. If this trend is to be slowed or reversed, I believe it will be necessary for local governments to share more of the burden of disasters through careful planning and management of development in hazardous areas and by assuming more of the financial responsibility for development at risk. I have shown that where states have required local governments to prepare and implement comprehensive plans for urban development, losses from flooding are lower than they are when states leave these matters solely to local governments' discretion. State requirements for building code enforcement also may have some effect, although it could not be confirmed in multivariate analyses. Not surprisingly, the states of Alabama, Louisiana, and Mississippi have been noteworthy for their reluctance to interfere in local land-use and development decision making. In contrast, equally flood- and hurricane-prone Florida has demanded local action, and as a result per capita flood losses over twenty-five years have been much lower there.

There are two relatively easy-to-accomplish steps the federal government could take to encourage local governments to prepare comprehensive plans. First, the Disaster Mitigation Act of 2000 could be amended to require that regular mitigation plan updates mandated by the legislation be integrated into local comprehensive plans, where they exist. Without this step, the mitigation plans are likely to be ignored in local government decision making because of the lack of commitment to hazard mitigation activities noted earlier. Many states require that local government land-use and infrastructure decisions be consistent with comprehensive plans. Thus, by incorporating mitigation plans into comprehensive plans, the mitigation plans to some extent would be self-enforcing in the sense that local officials would have to pay attention to them as they make decisions about public investments and development permits. In addition, this would provide a stimulus to broaden the scope of mitigation plans beyond narrow safe development and emergency management considerations.

Second, the Flood Insurance Act could be amended to add the preparation of local comprehensive plans with hazard mitigation provisions as a condition for continued participation in the program. At present, participation in the program is conditioned on local governments' agreement to adopt and enforce building regulations to reduce the likelihood of flood damage. Previous research has shown that local governments with plans are more likely than those without plans to use land-use regulations, in addition to the building regulations, to reduce vulnerability to flooding (Burby and Dalton 1994). Financial assistance could be provided to the states to encourage them to facilitate this through parallel state legislation and to also provide technical assistance to localities.

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The two policy changes suggested above would be beneficial, but given the lack of concern for hazard mitigation revealed by the local government paradox, I believe a sea change in government policy is likely to be needed before the trend in increasing disaster losses can be halted. The major change in approach I have in mind would involve amendment of the Flood Insurance Act to shift the program from insuring individuals and businesses for flood losses to insuring communities (and all of their dwellings and commercial/governmental buildings). With this new approach, flood insurance coverage and premiums would be based on the degree of exposure to loss in jurisdictions (i.e., the aggregate of the current number of dwellings and other buildings located within the five-hundred-year floodplain and other areas at risk of flooding localities wished to insure plus some set coverage for personal property). Local governments could pay the premiums from general fund revenues, raising tax revenue from all citizens or businesses, but, most likely, they would set up special assessment districts or storm water/flood insurance utilities to raise the required funds from properties that benefit from the flood insurance coverage. Storm water utilities are being used increasingly by localities to fund storm water management activities required by the U.S. Environmental Protection Agency to curb nonpoint source pollution. In cases where local governments refuse to participate, which might be the case when they have few properties at risk or cannot raise the revenue needed to pay flood insurance premiums, state governments could take responsibility for acquiring needed insurance and requiring that

both local governments and property owners take steps to reduce their risk of flood loss.

This revolutionary change to the flood insurance program might have a number of benefits:

1. If a community chose to participate in the program, *all* of its flood-prone dwellings and businesses would be covered, which would avoid the problem of a high proportion of properties without insurance as has been the case in many flood disasters. For communities with any degree of flood risk, there would obviously be tremendous political pressure to participate in the program.
2. Incentives for community participation, such as the withholding of disaster relief benefits for the amount of losses that would have been paid by flood insurance if the community were participating in the program, could be created and, with adequate political will, enforced.
3. The cost of insurance coverage could create incentives for state and local governments to reduce the risk of flood loss and the size of the insurance premiums they pay. They also might think more carefully about plans for development and redevelopment of flood hazard areas and be less willing to approve new development in these areas. If communities use some version of a storm water utility to fund insurance premiums, there would be a direct link between flood insurance and local land use and water resources management.
4. The change from an individual- to a community-based program would also make it possible for the NFIP (or private insurance companies) to more precisely align premium amounts with risk and allow the creation of stronger incentives for risk reduction. It could encourage local governments to take steps to reduce risk through retrofit or relocation of properties most at risk of flooding. In addition, it might be possible to begin insuring infrastructure at risk in flood hazard areas, as called for by Platt (1999, 291).

Significant political opposition and government costs could be involved in the transition from the current flood insurance program to this new one. But I suspect that the advantages of wider flood insurance coverage and the benefits in reduced federal flood insurance and disaster assistance costs would outweigh them. In addition, potential state and local opposition might be muted if Congress passes the Safe Communities Act of 2005 (HR 3524, 109th Congress, 1st Session), which authorizes significant financial assistance to help communities integrate hazard mitigation into their ongoing comprehensive planning and urban development decision making. Similar legislation to the Safe Communities Act was recommended by the Interagency Floodplain Management Review Committee (1994, xi) following the 1993 Midwest floods.

Concluding Note

Obviously, before they could be seriously considered, the policy initiatives suggested here would require additional examination of the procedural changes that would be needed to bring them about and in-depth analysis of their benefits and costs and potential for unintended consequences. Nevertheless, there are several reasons for thinking them worth that effort. The policies proposed are cooperative in nature. They are designed to increase local government commitment to hazard

mitigation primarily through the creation of new, more powerful incentives. The increased government costs in the short run would be counterbalanced by improved financial security for both citizens and local governments. As local officials take steps to improve safety from hazards, costs would decline over time. In addition, federal financial assistance to meet insurance costs could be provided to particularly poor communities, so that budgetary considerations do not preclude them from insuring their residents. By providing a means to extend flood insurance to *all* local residents and businesses at risk, the suggested policies promise to speed recovery when disasters occur. By strengthening incentives for states and localities to do what they should already be doing on their own initiative—paying systematic attention through existing local planning mechanisms to finding ways to reduce hazards vulnerability—they promise to halt and possibly reverse the trend in increasingly serious natural catastrophes.

Appendix
 Factors Associated with Variation in National Flood Insurance Program (NFIP) Claims
 in Coastal Counties, 1978-2002: Ordinary Least Squares (OLS) Multiple Regression Models

	Number of NFIP Claim Payments Per Capita, 1978-2002 ^a			Dollar Amount of NFIP Claim Payments Per Capita, 1978-2002 ^a		
	<i>B</i> ^b (SE)	Std <i>B</i>	<i>t</i> -Value	<i>B</i> ^b (SE)	Std <i>B</i>	<i>t</i> -Value
Constant	-3.040 (2.195)		-1.385	-1.198 (2.666)		0.449
State building code enforcement mandate	0.355 (0.345)	.09	1.239	0.396 (0.419)	.09	0.943
State comprehensive plan mandate	-0.859 (0.330)	-.22	-2.604**	-1.111 (0.401)	-.25	-2.770**
Interaction of code enforcement and comprehensive plan mandate	-0.409 (0.438)	-.11	-0.934	-0.106 (0.532)	-.03	-0.200
Control variables						
Number of severe weather events, 1978-2000 ^c						
Coastal storms	<0.000 (0.011)	.002	0.046	0.003 (0.013)	.02	0.264
Floods	0.039 (0.013)	.19	3.142***	0.052 (0.015)	.22	3.384***
Hurricanes	0.217 (0.021)	.60	10.455***	0.234 (0.025)	.57	9.287***
Tornadoes	-0.005 (0.011)	-.03	-0.454	-0.015 (0.013)	-.07	-1.109
Thunderstorms	-0.007 (0.012)	-.03	-0.548	-0.009 (0.015)	-.03	-0.637
Property at risk (proxy variables)						
Population, 1980 (log)	-0.233 (0.085)	-.22	-2.750**	-0.065 (0.103)	-.05	-0.631
Population change, 1980-2000 (log)	0.015 (0.024)	.03	0.640	0.025 (0.029)	.04	0.850
Median home value, 1990 (log)	0.535 (0.205)	.16	2.610**	0.434 (0.249)	.12	1.742*
Population density, 1997 (log)	-0.015 (0.060)	-.02	-0.256	-0.177 (0.073)	-.19	-2.435**
Adjusted <i>R</i> ²		.47			.39	
<i>F</i> -value		39.75			19.14	
Significance		.000			.000	
Number of cases		345			340	

SOURCE: Hazards Research Lab (2005).

a. Natural log values of dependent variables.

b. *B*-values are unstandardized coefficients.

c. Weather events that resulted in \$50,000 or more in property damage.

p* < .05. *p* < .01. ****p* < .001 (one-tailed test).

Notes

1. This estimate was derived from calculations of the average annual costs of federal disaster preparedness, response, recovery/reconstruction, and mitigation programs of the following federal departments and agencies: Agriculture, Commerce, Corps of Engineers, Education, FEMA, Interior, and Transportation. It does not include costs borne by state and local governments or private individuals and businesses.

2. Subsequent to authorization of the Lake Pontchartrain project, Congress authorized the Corps to construct four additional hurricane protection projects, including one to add to and strengthen levees protecting the west bank sections of Jefferson and Orleans parishes (Carter 2005). However, the Lake Pontchartrain Hurricane Protection Project fell behind its construction schedule, in part because by the 1980s costs of the project had escalated more than 1,000 percent. In addition, according to Grunwald and Glasser (2005, 5), "Local officials resisted the goal of Category 3 protection for their communities as overly extravagant. In 1982, the Orleans Levee District urged the Corps to 'lower its design standards to provide more realistic hurricane protection' and argued that 100-year protection would be fine."

3. The potential for moral hazard to undercut local officials' interest in hazard mitigation is based primarily on anecdotes and the opinions of various disaster experts. I am unaware of any systematic empirical studies that have demonstrated a link between the provision of disaster relief and a lower degree of local government hazard mitigation activities. In fact, Burby et al. (1991, 109) studied the effects of local government receipt of public assistance funds following disasters and found that governments that had received federal disaster aid were more, rather than less, likely to take steps to mitigate flood hazards in comparison with governments that had not received federal disaster assistance. They found no effect either way on local government attention to earthquake hazards.

4. The expectation that plans will contribute to a reduction in vulnerability to natural hazards is based on eight considerations: (1) plans provide a systematic way to gather facts about hazards and increase public awareness of them; (2) plans provide a way to systematically examine the adequacy of existing hazard mitigation measures being used; (3) plans enable citizens and local officials to create a vision of hazard resilience and formulate specific policy goals and objectives; (4) plans help to develop consensus about the need to take action to reduce vulnerability and to find courses of action that are politically acceptable; (5) plans improve the likelihood that communities will investigate and use a variety of approaches to hazard mitigation; (6) plans provide guidance to the day-to-day decisions of local officials in approving or disapproving development proposals; (7) plans help coordinate the actions of various local government departments that affect vulnerability; and (8) plans provide the rational nexus between the public interest and governmental actions that is critical in defending them against legal attack. For further elaboration of these benefits of planning, see Burby (2005).

5. Similar findings to these have been reported by Burby (2005) for the impacts of state planning mandates in reducing private property insurance claims. Also, May and Birkland (1994) and May and Feeley (2000) have shown that state building code enforcement mandates spur responsible local building code enforcement.

References

- All-Industry Research Advisory Council (AIRAC). 1989. *Surviving the storm: Building codes, compliance and the mitigation of hurricane damage*. Chicago: AIRAC.
- Anderson, Daniel R. 2000. Catastrophe insurance and compensation: Remembering basic principles. *CPCU Journal* 53:76-89.
- Association of State Floodplain Managers. 2000. *National program review*. Madison, WI: Association of State Floodplain Managers.
- Brookings Institution Metropolitan Program. 2005. *New Orleans after the storm: Lessons from the past, a plan for the future*. October. Washington, DC: Brookings Institution.
- Building Performance Assessment Team. 1992. *Preliminary report in response to Hurricane Andrew, Dade County, Florida*. Washington, DC: Federal Emergency Management Agency.
- Burby, Raymond J. 2002. Flood insurance and floodplain management: The U.S. experience. *Journal of Environmental Hazards* 3:111-22.

- . 2005. Have state comprehensive planning mandates reduced insured losses from natural disasters? *Natural Hazards Review* 6:67-81.
- Burby, Raymond J. (with Beverly A. Cigler, Steven P. French, Edward J. Kaiser, Jack Kartez, Dale Roenigk, Dana Weist, and Dale Whittington). 1991. *Sharing environmental risks: How to control governments' losses in natural disasters*. Boulder, CO: Westview.
- Burby, Raymond J., Scott J. Bollens, Edward J. Kaiser, David Mullan, and John R. Sheaffer. 1988. *Cities under water: A comparative evaluation of ten cities' efforts to manage floodplain land use*. Boulder: Institute of Behavioral Science, University of Colorado.
- Burby, Raymond J. Burby, and Linda Dalton. 1994. Plans can matter! The role of land use plans and state planning mandates in limiting the development of hazardous areas. *Public Administration Review* 54:229-37.
- Burby, Raymond J., and Steven P. French. 1985. *Flood plain land use management: A national assessment*. Boulder, CO: Westview.
- Burby, Raymond J., Steven P. French, and Arthur C. Nelson. 1998. Plans, code enforcement, and damage reduction: Evidence from the Northridge earthquake. *Earthquake Spectra* 14:59-74.
- Burby, Raymond J., and Peter J. May. 1998. Intergovernmental environmental planning: Addressing the commitment conundrum. *Journal of Environmental Planning and Management* 41:95-110.
- Carter, Nicole T. 2005. New Orleans levees and floodwalls: Hurricane damage protection. Congressional Research Service Report RS22238. September 6. Washington, DC: Congressional Research Service, Library of Congress.
- City Planning Commission, City of New Orleans. 1999. *New century New Orleans, 1999 land use plan, City of New Orleans*. New Orleans, LA: City Planning Commission, City of New Orleans.
- Comptroller of the Currency, U.S. General Accounting Office. 1976. *Cost, schedule, and performance problems of the Lake Pontchartrain and vicinity, Louisiana, Hurricane Protection Project*. PSAD-76-161. August 31. Washington, DC: General Accounting Office.
- Congressional Hazards Caucus. 2005. Congressional Hazards Caucus fact sheet: Hurricanes. <http://www.hazardsecaucus.org/resources.html> (accessed October 19, 2005). **NOT CITED**
- Conrad, David R., Ben H. McNitt, and Martha Stout. 1998. *Higher ground: A report on voluntary buyouts in the nation's floodplains, a common ground solution serving people at risk, taxpayers and the environment*. July. Washington, DC: National Wildlife Federation.
- Crenshaw, Albert B. 2005. Flood insurance program seeks more money. *Washington Post*, October 19, p. A8.
- Cutter, Susan L., and Christopher Emrich. 2005. Are natural hazards and disaster losses in the U.S. increasing? *EOS, Transactions, American Geophysical Union* 86:381, 388-89.
- Deyle, Robert E., Timothy S. Chapin, and Earl J. Baker. 2005. Reduced hazard exposure through growth management? An evaluation of the effectiveness of Florida's hurricane hazard mitigation planning mandates. Paper prepared for presentation at the 2005 annual conference of the Association of Collegiate Schools of Planning, Kansas City, MO, October 27-30.
- Drew, Christopher. 1984. New, old parts of the city compete for flood protection. *New Orleans Times-Picayune*, January 18, pp. 1, 10.
- Federal Emergency Management Agency. 1987. *Reducing losses in high risk flood hazard areas: A guidebook for local officials*. FEMA 116. Washington, DC: FEMA.
- . 2005a. *FEMA disaster costs*. Washington, DC: FEMA. http://www.fema.gov/library/df_7.shtm (accessed October 14, 2005).
- . 2005b. *Total major disaster declarations*. Washington, DC: FEMA. http://www.fema.gov/library/dis_graph.shtm (accessed October 14, 2005).
- . 2005c. *2005 disaster declarations*. Washington, DC: FEMA. <http://www.fema.gov/news/disasters.fema?year=2005> (accessed October 14, 2005).
- Godschalk, David R., Timothy Beatley, Philip Berke, David Brower, Edward Kaiser, Charles Bohl, and R. Matthew Goebel. 1998. *Natural hazard mitigation: Recasting disaster policy and planning*. Washington, DC: Island Press.
- Grunwald, Michael, and Susan B. Glasser. 2005. The slow drowning of New Orleans. *Washington Post*, October 9. <http://www.washingtonpost.com/wp-dyn/content/article/2005/10/08/AR2005100801345>.

- Hazards Research Lab. 2005. The spatial hazard events and losses database for the United States, Version 3.1 [Online database]. Columbia: University of South Carolina. <http://www.sheldus.org> (accessed March 20, 2005).
- H. John Heinz III Center for Science, Economics and the Environment. 2000. *The hidden costs of coastal hazards. Implications for risk assessment and mitigation*. Washington, DC: Island Press.
- Insurance Institute for Property Loss Reduction and Insurance Research Council. 1995. *Community exposure and community protection: Hurricane Andrew's legacy*. Wheaton, IL, and Poston, NY: Insurance Institute for Property Loss Reduction and Insurance Research Council. **NOT CITED**
- Interagency Floodplain Management Review Committee. 1994. *Sharing the challenge: Floodplain management into the 21st century*. Report of the Interagency Floodplain Management Review Committee to the Administration Floodplain Management Task Force. June. Washington, DC: Government Printing Office.
- King, Rawle O. 2005. *Hurricane Katrina: Insurance losses and national capacities for financing risk*. RL33086. September 15. Washington, DC: Congressional Research Service, Library of Congress.
- Laska, Shirley B. 1991. *Floodproof retrofitting: Homeowner self-protective behavior*. Boulder: Institute of Behavioral Science, University of Colorado.
- Lewis, Pierce F. 2003. *New Orleans: The making of an urban landscape*. 2nd ed. Santa Fe, NM, and Harrisonburg, VA: Center for American Places.
- Malone, Linda A. 1995. *Environmental regulation of land use*. Deerfield, IL: Clark Boardman Callaghan.
- May, Peter J. 1991. Addressing public risks: Federal earthquake policy design. *Journal of Policy Analysts and Management* 10:263-85.
- May, Peter J., and Thomas A. Birkland. 1994. Earthquake risk reduction: An examination of local regulatory efforts. *Environmental Management* 18:923-37.
- May, Peter J., and T. Jens Feeley. 2000. Regulatory backwaters: Earthquake risk reduction in the western United States. *State and Local Government Review* 32:20-33.
- Mileti, Dennis S. 1999. *Disasters by design: A reassessment of natural hazards in the United States*. Washington, DC: Joseph Henry Press.
- Murphy, Francis C. 1958. *Regulating flood plain development*. Department of Geography Research Paper no. 56. Chicago: Department of Geography, University of Chicago.
- Nelson, Arthur C., and Steven P. French. 2002. Plan quality and mitigating damage from natural disasters: A case study of the Northridge earthquake with planning policy considerations. *Journal of the American Planning Association* 68:194-207.
- Olshansky, Robert B. 2001. Land use planning for seismic safety: The Los Angeles County experience, 1971-1994. *Journal of the American Planning Association* 67:173-85.
- Pasterick, Edward T. 1998. The National Flood Insurance Program. In *Paying the price: The status and role of insurance against natural disasters in the United States*, ed. Howard Kunreuther and Richard J. Roth Sr., 125-54. Washington, DC: Joseph Henry Press.
- Pielke, Roger A. Jr., and Charles H. Landsea. 1997. Normalized hurricane damage in the United States: 1925-1995. Paper presented at the 22nd Conference on Hurricanes and Tropical Meteorology; American Meteorology Society, Fort Collins, CO.
- Platt, Rutherford H. 1999. *Disasters and democracy: The politics of natural events*. Washington, DC: Island Press.
- Pricewaterhouse Coopers. 1999. *Study of the economic effects of charging actuarially based premium rates for pre-firm structures*. Executive Summary. May 14. Washington, DC: Price Waterhouse Coopers. **NOT CITED**
- Schwab, James. 2002. *Summary of state land use laws*. Tampa, FL: Institute of Business and Home Safety.
- Sheaffer, John R., Frederick J. Roland, George W. Davis, Thomas Feldman, and John Stockdale. 1976. *Flood hazard mitigation through safe land use practices*. Prepared for the Office of Policy Development and Research, U.S. Department of Housing and Urban Development. Chicago: Kiefer & Associates.
- Southern Building Code Congress International, Inc. 1992. *Coastal building department survey*. Chicago: National Disaster Loss Reduction Committee, National Committee on Property Insurance.
- U.S. Census. 2005. <http://quickfacts.census.gov/qfd/states/22/22051.html> (accessed October 6, 2005). **NOT CITED**

- U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center. 2005. Billion dollar U.S. weather disasters. <http://www.ncdc.noaa.gov/oa/reports/billionz.html> (accessed October 9, 2005).
- White, Gilbert F. 1975. *Flood hazard in the United States: A research assessment*. Boulder: Institute of Behavioral Science, University of Colorado.