


# GUARDING PEOPLE AND PROPERTY AGAINST NATURAL HAZARDS



**R**ising populations and poorly planned development in coastal areas are increasing the vulnerability of people and property to storms, hurricanes, flooding, shoreline erosion, tornadoes, tsunamis, and earthquakes. In addition, climate change may lead to more frequent storms and sea-level rise, both of which increase coastal susceptibility. Not only can natural hazards have devastating impacts on people and property, but they may also have deleterious effects on the environment, particularly sensitive habitats.

To lessen the threat from natural hazards, the federal government should coordinate the efforts of all coastal management agencies to reduce inappropriate incentives created by federal infrastructure investments. It should also improve a number of natural hazards-related activities implemented by the Federal Emergency Management Agency, including hazards mitigation planning, information collection and dissemination, and the National Flood Insurance Program.

## Assessing the Growing Cost of Natural Hazards

**T**he nation has experienced enormous and growing losses from natural hazards. Conservative estimates, including only direct costs such as those for structural replacement and repair, put the nationwide losses from all natural hazards at more than \$50 billion a year, though some experts believe this figure represents only half or less of the true costs.<sup>1</sup> More accurate figures for national losses due to natural hazards are unavailable because the United States does not consistently collect and compile such data, let alone focus on specific losses in coastal areas. Additionally, there are no estimates of the costs associated with destruction of natural environments. Between 1967 and 1996, insurance payouts (which cover only a small portion of losses) rose steadily from \$1 billion between 1967 and 1971, to \$61 billion between 1992 and 1996, roughly doubling every five years (Figure 10.1).<sup>2</sup> While stricter building codes, improved forecasts, and early warning systems have helped save lives, deaths from natural hazards are expected to rise along with development and population along the nation's coasts.<sup>3</sup> Climate change may increase storms and sea-level rise, making the coastal zone even more vulnerable.

## Improving Federal Management of Hazards in Coastal Areas

Many federal agencies have explicit operational responsibilities related to hazards management, while numerous others provide technical information or deliver disaster assistance. The nation's lead agencies for disaster response, recovery, mitigation, and planning are the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers (USACE). These agencies implement programs that specifically target the reduction of risks from natural hazards. The National Oceanic and Atmospheric Administration (NOAA) and the U.S. Fish and Wildlife Service (USFWS) also have a significant influence on natural hazards management.

NOAA's weather forecasting and ocean observing functions are vital to hazards management. NOAA's National Weather Service plays a key role in collecting atmospheric weather and oceanic real-time data for management, assessments, and predictions.

Through its implementation of the Coastal Zone Management Act, the agency also plays a notable role in discouraging coastal development in areas at risk from natural hazards. (Additional discussion of these roles, and recommendations for enhancing NOAA's contributions, are found in Chapters 9 and 26.) The Coastal Barrier Resources Act administered by USFWS (discussed in Chapter 9), also has significant implications for natural hazards management.

This chapter focuses on those federal programs that specifically target the reduction of losses of life and property due to natural hazards along the nation's coasts. Among the opportunities for improving federal natural hazards management, four stand out: amending federal infrastructure policies that encourage inappropriate development; augmenting hazards information collection and dissemination; improving the National Flood Insurance Program; and undertaking effective and universal hazards mitigation planning.

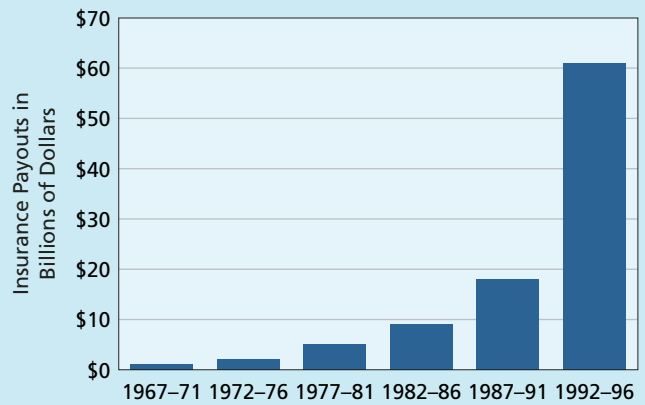
### Changing Inappropriate Federal Incentives

The federal government has made substantial investments in infrastructure designed to reduce human exposure to hazards, including flood control and coastal erosion projects. These efforts often eliminate or conflict with the natural buffers that would otherwise help shield communities. Furthermore, because such projects are not accompanied by strict restrictions on subsequent construction, they may actually encourage further commercial and residential development in hazard-prone areas (Box 10.2). In some cases, a federal infrastructure project intended to reduce a hazard merely drives the problem to a nearby location, such as when erosion control efforts lead to further coastal armoring up or down the coast. The cumulative impact of such projects may be weakening the ecosystem's natural resilience to hazards and creating the potential for even greater losses to property, health, and natural resources.

Of course, the federal government is not the sole driver of infrastructure development in coastal areas. State and local governments also build roads and bridges along and over the water, underwrite wastewater treatment, and support water supply projects, all of which have impacts on coastal development and vulnerability.

The great majority of federal infrastructure programs are implemented by USACE, whose hazards-related activities include flood control efforts such as dams, dikes, and levees, and coastal erosion projects such as groins, sea walls, revetments, and beach

Figure 10.1 The Growing Cost of Natural Disasters



In the thirty years between 1967 and 1996, insurance companies have experienced a 6,000 percent increase in payouts to federal and private insurance holders for damages due to natural catastrophes.

Source: Consumer Federation of America. *America's Disastrous Disaster System*. Washington, DC, January 1998.

## Box 10.1 Hurricanes Wreak Havoc Along the Coast

In 1989, Hurricane Hugo hit the U.S. Virgin Islands and Puerto Rico before coming ashore at Charleston, South Carolina, causing twenty-six deaths in the United States and an estimated \$9.7 billion in damages. Just three years later, Hurricane Andrew struck southern Florida and Louisiana, causing twenty-three deaths directly and dozens more indirectly. Andrew wrought an estimated \$35 billion in damages, making it the costliest hurricane in U.S. history. And in 1999, Hurricane Floyd, the deadliest of recent hurricanes, made landfall along the Mid-Atlantic and northeastern United States, causing fifty-six deaths and an estimated \$4.6 billion in damage.<sup>i</sup> (All figures adjusted to 2000 dollars.)

<sup>i</sup> Jarrell, J.D., et al. *The Deadliest, Costliest, and Most Intense United States Hurricanes from 1900 to 2000*. NOAA Technical Memorandum NWS TPC-1. Silver Spring, MD: National Oceanic and Atmospheric Administration, 2001.

nourishment. USACE also has responsibilities for dealing with disaster response efforts such as construction of emergency infrastructure.

Evolving public values that favor environmental protection, as well as a growing understanding of the complex workings of natural systems, have propelled USACE to adopt more environmentally conscious initiatives, including the pursuit of nonstructural approaches to some flood control projects. However, such initiatives are not universally embraced within the agency, by all stakeholders, or in Congress, and remain greatly outnumbered by traditional, construction-oriented USACE projects that may disrupt natural hydrological and geomorphological processes, harm ecosystems, and create incentives for additional human development in high-risk regions.

USACE has also been the focus of debates about the cost-benefit analyses used to review proposed projects. Some experts have suggested that these analyses are often flawed by a reliance on incorrect assumptions and faulty methodologies. In 2001, the National Research Council (NRC) began a comprehensive review of USACE programs and procedures. A 2002 NRC report recommended external review of all controversial or complex USACE civil works projects.<sup>4</sup>

### Recommendation 10–1

The U.S. Army Corps of Engineers' Civil Works Program, with guidance from the National Ocean Council, should ensure valid, peer-reviewed cost-benefit analyses of coastal projects, provide greater transparency to the public, enforce requirements for mitigating the impacts of coastal projects, and coordinate such projects with broader coastal planning efforts.

## Improving Understanding

The federal government plays an important role in acquiring complex hazards-related data and translating them into information that states and communities can use to reduce their vulnerability to natural disasters. A number of federal agencies and departments, including NOAA, the U.S. Geological Survey, the National Aeronautics and Space Administration, and the U.S. Department of Defense, are charged with increasing both basic understanding and site-specific knowledge about natural hazards. These agencies' principal contributions include: developing and deploying new technologies for understanding land, ocean, and atmospheric processes and their interactions; tracking and predicting hazards, particularly meteorological hazards; assessing hazards risks; conducting post-disaster research; and communicating this information to end users. These contributions have significantly improved the quality and timeliness of weather-related warnings, increasing the lead time for protective measures and evacuations. Implementation of the Integrated Ocean Observing System (discussed in Chapter 26) would improve weather-related warnings and provide

## Box 10.2 New Orleans at Risk

Prior to 1965, New Orleans—a community that sits as much as 10 feet below sea level—had suffered substantial losses of protective barrier islands and wetlands and developed an elaborate system of flood control measures. After Hurricane Betsy struck in 1965, causing more than \$1 billion in damages,<sup>i</sup> hundreds of millions of dollars were spent to upgrade the flood control system that now includes more than 520 miles of levees, 270 floodgates, 92 pumping stations, and thousands of miles of drainage canals.<sup>ii</sup>

While the new protections did reduce risks to people and property in developed areas, they also encouraged additional development in flood-prone regions.<sup>iii</sup> Jefferson Parish and the adjoining Orleans Parish ranked first and second among communities receiving repeat payments for damage claims under the National Flood Insurance Program between 1978 and 1995. These two communities alone accounted for 20 percent of the properties with repeat losses, at an average of nearly three claims per property, for a total of \$308 million in claims.<sup>iv</sup>

New Orleans' protective levees are designed to withstand only a moderate (Category 3) hurricane storm surge. Were they to fail, the city and surrounding areas could suffer upward of \$25 billion in property losses and 25,000–100,000 deaths by drowning.<sup>v,vi</sup>

<sup>i</sup> Leatherman, S., and V. Burkett. "Sea-Level Rise and Coastal Disasters: Lessons from the East Coast and New Orleans." *Natural Hazards Observer* XXVI, no. 4 (March 2002).

<sup>ii</sup> Burby, R.J. et al. "Unleashing the Power of Planning to Create Hazard-Resistant Communities." *Journal of the American Planning Association* 65 (Summer 1999): 247–58.

<sup>iii</sup> Ibid.

<sup>iv</sup> National Wildlife Federation. *Higher Ground: A Report on Voluntary Property Buyouts in the Nation's Floodplains*. Washington, DC, 1998.

<sup>v</sup> Pielke, Jr., R.A., and C.H. Landsea. "Normalized Hurricane Damages in the United States: 1925–1995." Presented at the American Meteorological Society 22nd Conference on Hurricanes and Tropical Meteorology. Fort Collins, CO, May 19–23, 1997.

<sup>vi</sup> Leatherman, S., and V. Burkett. "Sea-Level Rise and Coastal Disasters: Lessons from the East Coast and New Orleans." *Natural Hazards Observer* XXVI, no. 4 (March 2002).

additional predictive capabilities for tsunamis and for chemical and biological hazards, such as sudden pollutant loadings, harmful algal blooms, and pathogens.

FEMA, as the lead disaster management agency, collects, analyzes, and disseminates hazards-related data. It is also responsible for assessing the effectiveness of its programs. However, these efforts fall short of shaping an effective overall national policy and providing the information state and local decision makers and individuals need to fully understand their risks from coastal hazards. The absence of a standard, centralized data collection system that could produce accurate accounting for losses from natural hazards is only one example. An inability to provide adequate, useful information at the local, state, and regional levels can lead to incorrect estimates of risk, which then affect cost-benefit analyses of proposed development and mitigation projects. Local land use decisions are frequently made without information about cumulative impacts or the vulnerability of individuals and groups in the community, and without an ability to judge the full impact of disasters on humans, institutions, the economy, natural resources, and ecosystem services. This lack of accurate information is likely to reinforce the tendency to underestimate risks from natural hazards and delay taking action to prevent future problems.

Flooding is the most costly of natural hazards, and maps produced by the National Flood Insurance Program are the federal government's primary tool for communicating flood risks to communities and individuals.<sup>5</sup> Most existing flood hazard maps are not georeferenced, limiting their usefulness for hazards planning.

The combination of mounting federal and nonfederal disaster expenses, vigorous advocacy by the insurance community, state and local governments, and others who rely on flood maps prompted FEMA to design an ambitious map modernization program in 1997.<sup>6</sup> The incorporation of FEMA into the U.S. Department of Homeland Security

spurred Congress to provide substantial financial support to underwrite the effort beginning in fiscal year 2002. This program will create a digital base map, update and digitize flood hazards information, and provide standard protocols that state and local governments and others can use to incorporate and relate information about other natural and manmade hazards. Though FEMA's map modernization effort is intended to target the highest-risk communities first, the initial selection made in 2003 did not include any coastal communities—despite their status as high-population, high-risk regions. This is attributable to technical difficulties in mapping coastal flood hazards. FEMA's plans call for updating priority coastal community maps starting in fiscal year 2004 when such obstacles are resolved.<sup>7</sup>

Although many communities are in a position to benefit from this opportunity, others may be constrained by a lack of technical and financial resources and expertise. National maps that reflect all hazards (for example, coastal erosion, localized stormwater drainage flooding, potential flood control structure failures, and increased risk from development, land subsidence, and sea-level rise) are needed to communicate the true vulnerability of a community, its social and physical infrastructure, and the surrounding ecosystem. Because relative sea level is rising in many coastal areas, it will be particularly important for maps to reflect this to more accurately analyze the potential impacts of coastal hazards. Such maps will also be essential in informing prospective purchasers of coastal property about potential hazards. FEMA and other relevant agencies will need to work together to make such comprehensive mapping a reality.

### Recommendation 10–2

The National Ocean Council should establish a task force of appropriate federal agencies and state and local governments, with the Federal Emergency Management Agency in the lead, to improve the collection and use of hazards-related data.

Under the oversight of the NOC's Committee on Ocean Resource Management, the hazards-related data task force should develop a coordinated effort that includes the following functions:

- systematic collection, storage, analysis, and dissemination of data on post-disaster losses and the cost of mitigation efforts.
- development and transmittal to communities of the information and tools they need to understand the risks of hazards to their residents and their social, physical, economic, and environmental infrastructures.
- cooperation with the Federal Geographic Data Committee and state and local governments to achieve comprehensive, digitized, georeferenced mapping and identification of all natural hazards.
- development of adequate funding proposals for the National Flood Insurance Program map modernization initiative, including a high-priority effort to update maps for high-risk coastal communities.

The Federal Geographic Data Committee, as well as other important issues related to mapping and charting, are discussed in Chapter 25.

## The National Flood Insurance Program

Enacted in 1968, the National Flood Insurance Program (NFIP) is the federal government's primary tool for managing flood hazards through a combination of incentives and regulation. In addition to the development of maps identifying flood-prone areas, the NFIP provides (or helps private companies provide) flood insurance to owners of commercial and residential structures in communities that adopt appropriate construction standards. Premiums and fees from property owners cover most program costs. Other NFIP responsibilities include identifying flood hazards, assessing risks, and implementing measures for reducing losses. While the NFIP is a national program, the majority of its





Dave Gatley/FEMA News Photo

Homes built close to shore, like these in Nags Head, North Carolina, are frequently threatened by coastal erosion and high storm surge.

policies, total coverage, and premium revenues are associated with coastal communities.

Without the NFIP, many of the more than 19,000 participating communities most likely would not have had the incentive to develop active programs to manage flood risks. Unlike private-sector insurers, the federal government can carry debt over the long term and replenish funds depleted by catastrophic disasters over time. For this reason, the federal government is able to undertake the expense of mapping flood hazards nationally and subsidize coverage for older buildings. FEMA estimates that NFIP building standards and other floodplain management measures reduce flood losses by \$1 billion per year.<sup>8</sup>

As impressive as these accomplishments are, concerns have been raised that the NFIP may inadvertently facilitate inappropriate coastal development and redevelopment. While many factors weigh heavily in such decisions, including the market forces that make real estate in coastal floodplains and estuarine areas so valuable, the availability of flood insurance also plays a role. Determining the extent of this role is difficult because the impacts of the NFIP have never been comprehensively evaluated. FEMA recently commissioned such an evaluation, with several reports expected to be issued, including a final comprehensive report scheduled for September 2005. This study will help inform the National Ocean Council and may determine any further action. Nonetheless, three aspects of the program—treatment of erosion hazards, coverage of repetitive losses, and availability of insurance in undeveloped floodplain and erosion zones—are issues that merit immediate attention.

### ***Informing the Public about Erosion Risks***

Property owners within 500 feet of the shoreline face as large a risk from erosion as from flooding. Under current conditions, approximately one-quarter of all homes within 500 feet of the coast will be lost to erosion in the next sixty years. Insurance rates in areas designated as coastal high-hazard zones would need to double over the next thirty to sixty years to keep pace with these increasing erosion risks.<sup>9</sup> Although FEMA has developed a plan for undertaking erosion mapping and reflecting actual risks in future NFIP insurance rates, the agency is awaiting congressional authorization to implement the plan. If erosion mapping and rating are not carried out, higher premium rates will have to be spread across all policyholders, losing an important opportunity to discourage building in the riskiest areas.

### ***Repetitive-loss Properties***

The NFIP requires that substantially damaged properties be removed or elevated. However, local governments are responsible for determining whether a property is substantially damaged and they are often reluctant to do so when a property owner does not have the

*The federal government should eliminate subsidies and incentives for development and redevelopment in coastal high hazard, flood and erosion areas. This is a matter of prudent fiscal and emergency management as much as environmental protection.*

—Jane Stahl, Deputy Commissioner of Environmental Protection, State of Connecticut, testimony to the Commission, July 2002

financial resources to move or elevate the home.<sup>10</sup> Absent this designation, many of these properties have been rebuilt in place, leading to repeated claims. Although only 2 percent of NFIP covered properties have received repetitive-loss payments, they account for 40 percent of overall NFIP payments, many at cumulative totals exceeding the property's value. Although a national problem, between 1978 and 1995, Louisiana and Texas accounted for \$1.1 billion, or 40 percent of the \$2.75 billion in total repetitive-loss claims paid by the NFIP.<sup>11</sup>

Approximately 90 percent of repetitive-loss payments are for buildings that predate NFIP maps.<sup>12</sup> This demonstrates the effectiveness and success of NFIP building standards for new construction in flood-prone areas, but also underscores the program's lack of authority for reducing the vulnerability of older buildings. Many property owners underestimate their risk, resist investments in structural improvements that do not directly translate into higher home prices, and then rely on federal disaster assistance as a fallback when floods occur. For some properties, the most acceptable and economical solution for all concerned will be voluntary buyouts at prices that allow property owners to relocate out of harm's way.

### *Eliminating Incentives for Development in Floodplains and Eroding Areas*

The NFIP was created both as a more desirable alternative to federal disaster relief in the wake of flooding and as a tool to guide development away from flood prone areas through state and local floodplain management. However, of the 6.6 million buildings located in the 100-year floodplains of participating communities, more than a third were built after the NFIP maps were created and floodplain management requirements imposed.<sup>13</sup> As one of the federal government's principal tools for influencing development in high-hazard areas, the NFIP's risk assessment, mitigation, and insurance components should be revamped to better achieve the original goal of discouraging communities from building in harm's way.

### **Recommendation 10–3**

The National Ocean Council should recommend changes in the National Flood Insurance Program (NFIP) to reduce incentives for development in high-hazard areas.

Specifically, NFIP changes should:

- establish clear disincentives to building or rebuilding in coastal high-hazard zones by requiring property owners at risk of erosion to pay actuarially sound rates for insurance.
- enforce measures that reduce vulnerability to natural hazards, including assistance in retrofitting older structures and buyout programs for susceptible structures with repetitive-loss histories.
- create enforceable mechanisms to direct development away from undeveloped floodplains and erosion zones.

## **Hazards Mitigation Planning**

Hazards mitigation planning—the process of assessing potential hazards and evaluating and identifying actions to reduce or eliminate vulnerabilities—has been required of states for nearly two decades as a condition of receiving disaster relief and other FEMA funding. However, the quality of those plans, and the degree to which they are based on a sound process with adequate stakeholder involvement, vary widely. Major disaster losses in the 1990s led FEMA to increase its attention to hazards mitigation planning, establishing a unit dedicated to that purpose in 1998.

Congress also recognized that deficiencies in mitigation planning prevented the most effective use of disaster assistance funds. Communities recovering from disasters receive little guidance during the rebuilding process to improve their resilience to future disasters. In the Disaster Mitigation Act, passed in 2000, Congress directed FEMA to impose more stringent mitigation planning requirements on states. States that fail to meet FEMA's new criteria can be denied disaster assistance and some other types of funding, while states

that develop excellent mitigation plans are eligible to use a greater proportion of their disaster funding to implement further hazards mitigation projects.

Effective hazards mitigation planning is fully consistent with watershed and ecosystem-based management approaches because they all attempt to consider communities and the effects of human activities within the broader environmental context. Effective watershed management plans that include a hazards component can be used to satisfy FEMA's mitigation planning requirements. The agency has also expressed a goal of integrating sustainable redevelopment into its program, recognizing the interdependence among economic opportunity, community well-being, and protection of the natural environment.

In 2002, FEMA issued regulations implementing enhanced mitigation planning standards, with compliance required for most state and local governments by October 2004. However, many state and local governments are struggling to comply with the new criteria because of severe fiscal constraints, technical difficulties, and relatively low levels of federal support. In addition to providing greater technical and financial assistance, it may be appropriate to withhold other forms of hazards-related federal financial assistance until mitigation plans are in place. For example, the U.S. Small Business Administration has narrowed eligibility for its low-interest Pre-Disaster Mitigation Loan Program to communities with approved plans.

### Recommendation 10-4

The Federal Emergency Management Agency (FEMA) should enhance technical assistance to state and local governments for developing or improving their hazard mitigation plans. The National Ocean Council should identify opportunities for conditioning federal hazards-related financial and infrastructure support on completion of FEMA-approved state and local hazards mitigation plans.

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