

Coastal Development

Is over-building putting coastal regions at risk?

Superstorm Sandy, which devastated portions of New York, New Jersey and Connecticut last October, has revived longstanding debates about coastal development. Congress has approved more than \$60 billion in relief funding for Sandy, which ranks as one of the most destructive storms in U.S. history. Future storms could be even worse because of climate change, which is raising global sea levels. New York officials are considering building floodgates to protect against storm surges, one of many strategies under consideration. Some experts argue that to make coastlines better able to withstand extreme weather, storm-damaged houses in vulnerable zones should not be rebuilt. Meanwhile, critics blame the federal flood insurance program, designed to help homeowners who cannot get private coverage, for subsidizing risky development with taxpayer dollars. But advocates say the program is needed to protect homeowners against catastrophic loss.



Scientists expect high-density oceanside communities such as Atlantic Beach, N.Y. — shown nearly a year before Superstorm Sandy heavily damaged the town last October — to be increasingly threatened by intense storms and rising sea levels due to climate change. Environmentalists and taxpayer groups want the government to stop encouraging coastal development.

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Coastal Development

BY JENNIFER WEEKS

THE ISSUES

Before Superstorm Sandy barreled up the Atlantic coast last October, the worst flooding John Schreiber had experienced was in 2011, when Hurricane Irene left three inches of water standing in a back room of his house on the south shore of Long Island. Schreiber's neighborhood is laced with canals, including one directly behind his property.

But Sandy was the most intense storm to hit New York and New Jersey in 40 years, even though it had been downgraded to a tropical storm by the time it made landfall near Atlantic City on October 29.¹ Striking at high tide during a full moon, it pushed flood waters as much as nine feet above average high-tide marks.² Four feet of water poured into Schreiber's back room and flowed through the ground level of his home.

Today, nearly four months after Sandy, up to half of the houses on Schreiber's block are still vacant. "People have ripped out the insides and are waiting for contractors to put in new Sheetrock, or plumbing, or floors," he says. A retired teacher, Schreiber estimates that he has spent \$20,000 of his savings to tear out damaged walls and floors and replace appliances.

It could have been worse. Sandy killed 72 people in the United States and 75 in the Caribbean.³ High winds knocked out electricity for more than 8.5 million homes in 16 states and the District of Columbia. Heavy flooding in New Jersey and New York damaged or destroyed more than 650,000



Gary Silberman surveys the damage to his home wrought by Superstorm Sandy last October in Lindenhurst, N.Y., located on the south side of Long Island. Sandy caused an estimated \$50 billion in damages, making it the second-costliest storm in U.S. history and reviving a longstanding debate over coastal development. Critics say government policies encourage construction — and constant reconstruction — in storm- and flood-prone areas, endangering people and property and harming critical wetlands and estuaries.

homes and swamped thousands of businesses.⁴

Damages from Sandy totaled an estimated \$50 billion, according to the National Hurricane Center. That makes it the second-costliest storm in U.S. history, exceeded only by Hurricane Katrina, which caused damage worth \$128 billion (in 2012 adjusted dollars) after striking the Gulf Coast in August 2005.⁵

Sandy's devastation has revived a longstanding debate over development in coastal areas. Critics of coastal development, including many scientists and environmentalists and even some free-market advocates, say government policies encourage construction in storm-

and flood-prone areas. This puts people and property directly in harm's way. Coastal development also harms beaches and coastal wetlands and estuaries, which are highly productive ecosystems that provide habitat for fish, shellfish and birds — including many endangered species — and provide a natural storm buffer for inland areas. Thus, the critics contend, government policies should be changed to encourage homes and businesses to move out of harm's way and make it harder to build along the shore in the future.⁶

"Sandy was a wake-up call for New York and New Jersey," says Robert Young, a coastal geologist and director of the Program for the Study of Developed Shorelines at Western Carolina University. "Scientific panels had been prodding people to get ready for [a direct hit] for some time, but most of that advice was ignored." In Young's view, most zones of the Atlantic and Gulf Coasts are equally vulnerable.

"Everyone should be concerned about storm risks," he warns.

Multiple government programs directly or indirectly subsidize coastal development, including federal flood insurance, post-storm disaster aid and federal cost-sharing for beach restoration projects. Some of these measures provide benefits beyond their immediate scope. For example, states that write plans for managing their coastlines can receive federal grants to redevelop urban waterfronts or protect coastal resources — steps that make those areas more enjoyable for both residents and visitors.

But other programs encourage harmful overdevelopment. A prime

Floodgates Proposed for New York Harbor

Engineers have proposed two separate designs for floodgates to block storm surges in New York Harbor. Both systems would require a barrier across the Upper East River to close off surges from Long Island Sound. A three-gate system would place short barriers between New Jersey and Staten Island and from Staten Island to Brooklyn. The alternative system would include a five-mile-long barrier stretching from the Gateway National Recreation Area in New Jersey to the Rockaway Peninsula on Long Island. Cost estimates for the structures range from \$7 billion to \$29 billion.

Storm Surge Barriers Proposed for New York Harbor



Source: "Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure," NYS 2100 Commission, January 2013, p. 121; map adapted with permission from the American Society of Civil Engineers

example is the federally administered National Flood Insurance Program (NFIP), created in 1968. Conventional homeowners' insurance policies do not cover flooding be-

cause private insurers consider the risk too high, so the federal program insures coastal properties for less than what the private sector would charge.

On Jan. 6 President Obama signed a bill authorizing the NFIP to borrow \$9.7 billion from the U.S. Treasury to pay claims stemming from Sandy. The program already owes the Treasury more than \$18 billion for claims from storms in 2005 and 2008 that far exceeded premiums collected from policyholders.

Flood insurance advocates say the NFIP saves the federal government money because premiums help pay for flood relief. "I'm certainly glad I had it," says Schreiber, who expects his flood insurance to pay all or most of his Sandy repair costs. Moreover, to participate in the program communities must adopt and enforce floodplain management regulations designed to reduce losses — for example, elevating new homes in flood zones above the level of a 100-year flood.⁷ (See chart, p. 190.) But critics argue that the program subsidizes development in flood-prone areas. They want to privatize NFIP so owners pay the full cost of protecting risky properties. (See "At Issue," p. 197.)

The federal government also provides billions of dollars in emergency aid to states and communities during and after major disasters such as storms, tornadoes or earthquakes. Under the Stafford Act, passed in 1988, the federal government pays 100 percent of eligible housing assistance and at least 75 percent of costs for removing debris and repairing or replacing public facilities.⁸ President Obama issued major disaster declarations for Sandy that covered all or part of 12 states and the District of Columbia, making them eligible for federal disaster aid.⁹

On Jan. 29, Obama signed a \$50.5 billion emergency spending bill for disaster relief for the affected area, including funds for the Federal Emergency Management Agency (FEMA) and several other agencies.¹⁰ House Republicans initially delayed the bill and objected that some items — such as funds to improve weather forecasting

— were not directly related to Sandy. But politicians from affected states assailed them for delaying relief funds.

“Sixty-six days and counting. Shame on you,” New Jersey’s Republican governor, Chris Christie, declared on Jan. 2, noting that Congress passed emergency aid just 11 days after Hurricane Katrina flooded New Orleans in 2005.

“This is not the United States. This should not be the Republican Party,” grouched Rep. Peter King, a New York Republican.¹¹

Beyond pork-barrel spending, observers see a bigger problem: Disaster relief money often does not require recipients to make new homes, businesses or other structures safer or move them out of harm’s way, even though such steps (known as risk mitigation) can reduce future damage. Under the Stafford Act, funds can be used only to upgrade structures to meet stricter building codes or zoning standards if a state or local government adopted such requirements before the disaster.¹²

“After disasters we usually build back almost exactly what was there before, and I think that’s what we’re going to find after Sandy,” says Steve Ellis, vice president of Taxpayers for Common Sense, a nonpartisan fiscal watchdog group in Washington.

For example, he notes, the Sandy relief bill includes \$5 billion for the Army Corps of Engineers, which constructs and maintains dams, waterways and navigation channels. The Corps also manages “beach replenishment” projects — pumping sand from offshore onto beaches to restore eroded dunes. Many coastal communities see beach replenishment as a shield against storm damage because dunes can absorb some of the force from storm surges. But critics say replenishment does not last and can harm the environment. For example, pumping fine sediments onto beaches can make water murky, and building new dunes can bury sensitive wildlife habitats.¹³

Development Concerns Spawn National Seashores

Concerns over heavy development in coastal regions have led Congress to designate 10 areas in the National Park System as National Seashores. The designation protects the areas from new development.

Federally Designated National Seashores

National Seashore	Location	Year est.	Acreage
Cape Hatteras	North Carolina	1953	30,351
<i>Located in the Outer Banks. Known for beaches, waterfowl, fishing and points of historical interest, including the iconic Cape Hatteras Lighthouse. Includes 6,000-acre Pea Island National Wildlife Refuge.</i>			
Assateague Island	Maryland, Virginia	1965	39,727
<i>Known for sandy beaches, waterfowl and wild horses. Includes 9,000-acre Chincoteague National Wildlife Refuge.</i>			
Cape Lookout	North Carolina	1966	28,243
<i>Composed of three islands in the Outer Banks. Islands have two historic villages and the Cape Lookout Lighthouse. Camping, fishing and hiking are traditional recreational activities.</i>			
Cape Cod	Massachusetts	1966	43,608
<i>National Seashore located on the outer part of the cape. Includes archaeological sites, lighthouses and the Marconi Station Site, where trans-Atlantic wireless communication began in 1903.</i>			
Padre Island	Texas	1968	130,434
<i>World’s longest undeveloped barrier island. Known for fishing and abundant bird and marine life. U.S. military used island as a bombing range during World War II.</i>			
Gulf Islands	Florida, Mississippi	1971	137,991
<i>Includes four historic forts used for Civil War defense. Once home to Apache Indians. Includes the Naval Live Oaks Reservation, which has been set aside for tree preservation.</i>			
Point Reyes	California	1972	71,068
<i>San Francisco-area peninsula with beaches backed by tall cliffs, lagoons, forested ridges and offshore bird and sea lion colonies. Occupied by elk and elephant seals.</i>			
Cumberland Island	Georgia	1972	36,415
<i>Largest of Georgia’s Golden Isles. Once home to Native Americans, missionaries and slaves.</i>			
Canaveral	Florida	1975	57,662
<i>Barrier island includes multiple bird species in lagoon habitats. Kennedy Space Center occupies southern end.</i>			
Fire Island	New York	1984	19,579
<i>Known for beaches and dunes. Includes the estate of William Floyd, a signer of the Declaration of Independence.</i>			

Source: “The National Parks: Index 2009-2011,” National Park Service, 2011, www.nps.gov/history/history/online_books/nps/index2009_11.pdf

The Sandy relief bill directs the Corps to help restore navigation channels, beaches and other damaged infrastructure to pre-storm conditions. “It aims to put beaches back, but they won’t last,” says Young. Instead, he and other coastal experts say, the hardest-hit areas should not be reconstructed.

Climate change will exacerbate coastal flooding by warming the oceans, which causes seawater to expand, and melting glaciers and ice caps on land.¹⁴ These processes raise global sea levels. A recent study by the National Research Council estimated that global sea levels will rise roughly 1.5 to 4.5 feet this century.¹⁵ But the increases will not be uniform. According to the U.S. Geological Survey, sea levels are rising at three to four times the global rate along the Atlantic coast from North Carolina to Massachusetts because of such factors as ocean currents, water temperature and salinity.¹⁶

As politicians, scientists and coastal communities consider where and how to rebuild after Superstorm Sandy, here are some issues they are considering:

Should state and local governments block coastal development?

Many scientists say that as climate change raises sea levels, it will make storms — the main cause of coastal erosion — more catastrophic.¹⁷ Thus, governments should limit development near the water’s edge, contend many environmentalists, coastal scientists and taxpayer watchdog groups. And in zones hit hard by storms like

Sandy, they say, now is the time to move development back from coastlines.

“We should strongly discourage the reconstruction of destroyed or badly damaged beachfront homes in New Jersey and New York,” Orrin H. Pilkey, an emeritus professor of earth sciences at Duke University and longtime critic

are gravy for towns — they generate high taxes and don’t require a lot of municipal services, since they’re only occupied for part of the year.”

In the wake of Sandy, New Jersey Gov. Christie initially dismissed the need to regulate where or how owners could rebuild. “I think, in the main, that’s a local decision, and the localities need to make that decision themselves,” Christie said just a few days after the storm.¹⁹ But in December FEMA released updated flood hazard maps for the Jersey shore showing that flood waters could rise 1 to 5 feet higher than previous versions of the maps had indicated. (FEMA had begun updating its maps of flood-prone areas before Sandy hit.)

In January Christie ordered the immediate adoption of the new maps as the state rebuilding standard. The order did not block owners from rebuilding in high-risk zones, but if people do not mitigate flood risks — for example, by raising their homes on posts or pilings — they will face sharp increases in flood insurance premiums. Raising houses, Christie said, is “what we need to do to build a 21st-century Jersey shore.”²⁰

Democratic New York Gov. Andrew Cuomo has urged Sandy victims to consider raising their houses, but he also advocates a second option: selling damaged homes in high-risk areas to the state, which would demolish them and leave the properties undeveloped. “At one point you have to say maybe Mother Nature doesn’t want you here,” Cuomo said in late January. Sales would be voluntary, the governor emphasized: “I’m not saying



Getty Images/John Moore

New Jersey's Republican governor, Chris Christie, and other politicians from affected states assailed House GOP members in early January — more than two months after Superstorm Sandy — for delaying relief funds for storm-hit states.

of shoreline development, wrote three weeks after Sandy. “This is tough medicine to be sure, and taxpayers may be forced to compensate homeowners. But it should save taxpayers money in the long run by ending this cycle of repairing or rebuilding properties in the path of future storms.”¹⁸

Typically, homeowners and communities want to rebuild damaged structures wherever possible. “Most people still see coastal property as highly desirable even if they face repetitive damage,” says Grover Fugate, executive director of the Rhode Island Coastal Resources Management Council, a state regulatory agency. “Property owners want to keep holding the line until they’ve got no more property to build on. Local communities will push for development because vacation homes

anybody should sell, but you should think about it.”²¹

New York City wants the Obama administration to use up to \$400 million in storm relief money to buy out homeowners, paying them the pre-storm value for their property and even a premium above fair market value to entice owners in some of the most vulnerable zones to move.²²

States can use eminent domain (the right to take private property for a public use) to ban redevelopment or require owners to abandon developed property in areas where flood risks are extreme.²³ Such actions would likely generate “takings” claims — lawsuits citing the Fifth Amendment’s ban on depriving citizens of their property without due process of law and seeking compensation from the state. But J. Peter Byrne, a law professor at Georgetown University, says less-drastic options exist for steering development away from flood-prone areas and preventing landowners from “hardening” coastal areas with such fixtures as seawalls, which block the natural shifting of sand and actually promote erosion.

“When the California Coastal Commission [a state regulatory agency] awards permits for new housing, it adds a provision that limits owners’ ability to harden shorelines,” says Byrne. “You could imagine going a step further and letting owners rebuild, but limiting it to one time if some specific fraction of the property was destroyed again. That’s a limit on future development, not current activities. Governments could justify it as protecting public health and safety by reducing risks of future shoreline damage.”

Rhode Island imposes multiple limits on shoreline development, including bans on constructing seawalls and other hard shoreline protection structures and building on dunes. The state assumes for planning purposes that sea levels will rise three to five feet by 2100. Many of the development restrictions, adopted in

the 1980s, are controversial today. “With each storm we’re challenged because people obviously want to protect their homes, and many of our policies don’t let them,” says Fugate. “But if states are really concerned about public finances and public safety and health, they’ve got to address this issue aggressively.”

Some states are less willing to acknowledge risks from climate change. In 2010 North Carolina’s Coastal Resources Commission advised coastal communities to plan for three feet or more of sea-level rise by 2100. Local critics assailed the recommendation, arguing that it would limit development. Last summer the state’s Republican-majority legislature passed a bill barring the commission from planning on anything beyond historic rates of change. After the measure was widely mocked as an attempt to outlaw science, the legislature amended the bill, directing the commission to study the issue until 2016 without defining rates of sea-level change.²⁴

Opponents called the bill shortsighted. “By putting our heads in the sand literally, we are not helping property owners. We are hurting them,” state Democratic Rep. Deborah Ross said during debate. “Ignorance is not bliss. It is dangerous.”²⁵

Can the federal flood insurance program be fixed?

The National Flood Insurance Program offers discounted coverage for homes and businesses in areas at moderate to high risk of flooding. It is intended to save taxpayers money by providing affordable insurance in zones where private insurance companies will not write policies, reducing the need for massive federal-aid legislation every time a big flood occurs.

But critics say people who live in flood-prone areas should have to pay insurance rates that reflect the actual risk to their properties. About one-fourth of NFIP policies insure “grand-

fathered” properties that predate the program. These policies cost only 40 to 45 percent as much as full-risk premiums. Moreover, since the NFIP was designed to provide affordable flood protection, even the rates NFIP considers full-price premiums are cheaper than what private insurers would charge.

Those subsidies encourage risky development, critics argue. “Before federal flood insurance, people built beach shacks that they could afford to lose,” says David Helvarg, president of the Blue Frontier Campaign, an ocean conservation advocacy group. “But once the federal government started providing insurance that the private sector wouldn’t offer, it was easy to get mortgages, and that triggered a [coastal] development boom.”

Insurers say that without the NFIP, many people in flood zones would not be able to afford coverage. “When you underwrite this risk correctly, it’s very expensive,” says John Prible, vice president for government affairs with the Independent Insurance Agents and Brokers of America (IIABA). “You don’t want to drive people away by making it too expensive. Some people say they’ll self-insure instead by setting the money aside to mitigate risks” — in other words, they’ll pay to protect the property themselves. “But they don’t usually follow through,” Prible says. “That’s why insurance exists.”

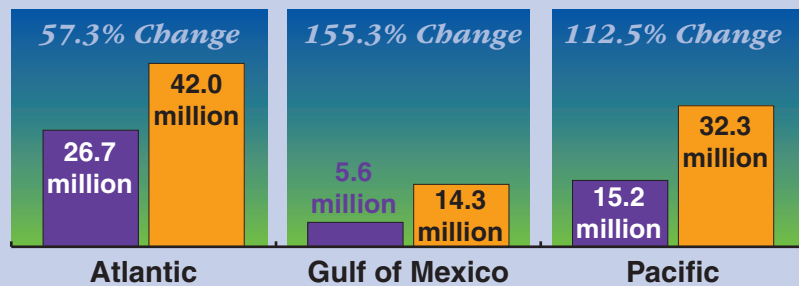
For the NFIP’s first several decades, damage reimbursements to policy holders were funded by premiums on policies. But when Hurricanes Katrina and Rita hit the Gulf Coast in 2005, damage was so widespread that the program had to borrow money from the Treasury to pay claims. Before Sandy struck, the NFIP already owed the Treasury \$18 billion, and it received nearly \$10 billion in additional borrowing authority last month to pay claims from Sandy.

Insurance premiums are based on flooding risk in the zone where a property is located. To help property

Coastline Population Booming

The coastline population of the United States grew from 47 million in 1960 to 89 million in 2010. The greatest change occurred in the Gulf of Mexico region, which grew by more than 150 percent over the period. The coastal population in the Pacific region more than doubled.

**Coastline Population and Percent Change,
1960 to 2010**



* Coastline counties include those adjacent to coastal waters or territorial seas. These do not include the counties adjacent to the Great Lakes or other inland bodies of water.

Sources: "Coastline Population Trends in the United States: 1960 to 2008," U.S. Census Bureau, May 2010, p. 24, www.census.gov/prod/2010pubs/p25-1139.pdf; U.S. Census Bureau press office

owners and mortgage lenders judge flood risks, FEMA, which administers the NFIP, has produced maps of flood-risk areas across the United States. All homes and businesses in high-risk areas must be covered by flood insurance to qualify for federally regulated or insured mortgages. (See box, p. 190.) In fact, however, the NFIP currently insures only about 25 percent of eligible households in these areas, totaling roughly 5.6 million policies.²⁶

"Some consumers buy coverage when they get their mortgage, but then let it lapse," says Prible. "And a lot of older homes in coastal areas are paid off and don't have mortgages."

When Congress reauthorized the NFIP in July 2012, it took steps to strengthen the program. For example, it voted to let premiums rise by 20 percent yearly (increases previously had been capped at 10 percent) and to phase out subsidies for second homes, business properties and homes that have suffered repeated losses. One extreme

case is the Alabama beach community of Dauphin Island, which has been hit repeatedly by hurricanes over the past 30 years. Dauphin Island has only about 1,300 year-round residents, but owners there have received \$72 million in payments from the NFIP.²⁷

In addition, FEMA is updating its flood-hazard maps, which will raise premiums for some owners whose communities have become high-risk zones.

These steps could change the demographics of coastal communities. "Middle-income owners may not be able to afford to stay on the shore, but wealthy people will," says Skip Stiles, executive director of Wetlands Watch, a conservation advocacy group based in Norfolk, Va. "On the Outer Banks [a popular strip of barrier islands off the coast of North Carolina], insurance is hard to get, so people are forming syndicates to pool money and build rental houses for cash. They don't need mortgages, so they don't need flood insurance."

Observers widely agree that higher premiums are an essential step toward stabilizing the NFIP, but officials in New York and New Jersey have warned that increases could displace many victims of Sandy. Ronald Schiffman, a former member of the New York City Planning Commission, predicted "a massive displacement of low-income families from their historic communities," unless these residents receive some relief from Congress or state governments.²⁸

Moreover, many observers say that even with higher premiums, the NFIP will continue to be financially unsound. "A regular insurance carrier would take steps to cover its risk, like buying reinsurance [insurance that insurance companies purchase to protect themselves in the event of large payouts] and price it into policies. NFIP can't do that — it can only borrow from Uncle Sam," says Ellis of Taxpayers for Common Sense. "And it can't diversify its risk into many geographic areas or write different types of policies. All of the market forces are going in the wrong direction."

Texas Republican Rep. Jeb Hensarling, chair of the House Financial Services Committee and a longtime critic of NFIP, wants to privatize the program. On Jan. 4, as Congress debated increasing the program's borrowing power to pay claims from Sandy, Hensarling argued for ending "unsustainable taxpayer bailouts" and announced that he would introduce legislation to transition to "a private, innovative, competitive, sustainable flood-insurance market." (See "At Issue," p. 197.)

Ellis calls that approach too extreme. "If we got rid of federal flood insurance tomorrow, the private sector wouldn't cover everyone," he says. Instead he supports further reforms, such as requiring more people to buy coverage so risks are spread over a larger pool of policy holders. "We've enticed people to build in high-risk areas. Abolishing the program would be a big shock to the system."

Does New York City need floodgates?

As New York recovers from Superstorm Sandy, officials are considering large-scale investments to reduce the impact of future storms. One controversial proposal is to build large floodgates that could block major storm surges from entering New York Harbor.

These systems already are used in Europe. London, Rotterdam and St. Petersburg, Russia, are all protected by large storm-surge barriers on nearby rivers, and Venice is building a flood control system to close off its lagoon. (See sidebar, p. 192.) In the United States, smaller gates protect Stamford, Conn., and Providence, R.I. William Merrell, a professor of marine science at Texas A&M

University, has proposed building a floodgate that would close off Galveston Bay during storms. The “Ike Dike” — named for 2008’s Hurricane Ike, which caused \$30 billion in damage around Houston — would cost an estimated \$6 billion.²⁹ So far it has not attracted high-level support or federal funding.³⁰

In recent years engineers have proposed two designs for floodgates in New York Harbor. One would be a two-gate system, with barriers reaching from New Jersey to Staten Island and from Staten Island to Brooklyn. Alternatively, the city could build a five-mile barrier stretching from New Jersey to the Rockaway Peninsula on Long Island. Either approach would require an additional barrier to close off surges from Long Island Sound up the East River. Cost estimates for either range from \$7 billion to \$29 billion.³¹ (See map, p. 184.)

The New York City Panel on Climate Change (NPCC), a high-level advisory group convened by Mayor Bloomberg, examined the city’s vulnerability to climate change and in 2010 recommended steps to adapt to rising sea levels. The panel concluded that floodgates were worth considering but would require “very extensive study,”

the Rockaways “likely would have prevented the flooding of the subways, tunnels, airports, wastewater treatments plants and other critical infrastructure” that occurred during Sandy, the group stated.

But the panel also noted shortcomings. Surge barriers would not protect the city against flooding from rainfall or high water on the East or Hudson Rivers. And because they would be closed only when a major storm was expected, the barriers would not prevent rising sea levels from gradually inundating low-lying coastal sites. Finally, surge barriers could have major impacts on the ecology of New York Harbor and on shipping and recreation around the harbor.³³

Mayor Bloomberg is skeptical about floodgates. “I don’t think there’s any practical way to build barriers in the oceans,” Bloomberg

said in early November, shortly after Sandy. “Even if you spent a fortune, it’s not clear to me that you would get much value for it.”³⁴

New York has many urgent fixes on its post-Sandy task list, such as making its subway network more storm-resistant; relocating electric power lines and substations and restoring dunes and other natural barriers destroyed by Sandy. The NYS 2100 report also recommended many longer-term steps, such as developing new transportation links to give commuters more ways to get around the city if some systems are damaged. And it called for more use of “green” infrastructure techniques, such as paving roads with porous materials to soak up runoff, and restoring wetlands and oyster reefs to buffer coastlines against floods. (See sidebar, p. 192.)

But even with billions of dollars in



Ocean waves crash over the seawall in Winthrop, Mass., on Feb. 9, 2013, as a powerful winter storm swept through New England, dumping more than two feet of snow in some areas and knocking out power to at least 600,000 homes.

Getty Images/Darren McColister

especially since other, smaller-scale strategies were available.³²

“Key research questions need to be answered,” says Radley Horton, a research scientist at Columbia University’s Center for Climate Systems Research and adviser to the NPCC. “How do you test a system like this? How do you minimize the risk that it will fail? Will it create a false sense of security and encourage people to live close to the coast? What will its environmental impacts be? What happens to people who live just outside of the barrier, where flood risks will increase?”

After Sandy, Gov. Cuomo convened another expert group, the NYS 2100 Commission, to recommend ways to make the entire state more resilient against future storms. In its report last month the group called for an in-depth study on building floodgates for New York Harbor. A barrier from New Jersey to

Defining Flood Risks for Landowners

Maps prepared by the Federal Emergency Management Agency designate the level of flood risk in low-lying areas of the country. Government officials, insurance agents and lenders use the designations to set flood insurance rates and premiums and determine whether a home or business owner must buy flood insurance to obtain a federally insured mortgage. To enable residents to buy flood insurance, communities in these zones must participate in the National Flood Insurance Program (NFIP) by adopting and enforcing minimum standards for development in floodplains.

- **High risk areas** — Zones expected to flood once every 100 years (also known as 100-year flood areas). This risk translates to a 1 percent chance of flooding in any given year, or roughly 1 in 4 odds over the life of a 30-year mortgage. All home and business owners in these zones must buy flood insurance in order to qualify for federally regulated or insured mortgages.
- **Moderate risk areas** — Zones that typically lie between 100-year and 500-year flood lines (1 to 0.2 percent chance of flooding in any given year), or that lie in 100-year flood zones but are protected by levees. Flood insurance in these zones is not generally required as a condition for federally regulated mortgages, although some states or lenders may require it.
- **Low risk areas** — Zones typically above the 500-year flood line. Flood insurance in these zones is not generally required as a condition for federally regulated mortgages.

Source: <https://msc.fema.gov/webapp/wcs/stores/servlet/info?storeId=10001&catalogId=10001&langId=-1&content=floodZones&title=FEMA percent 2520Flood percent 2520Zone percent 2520Designations>

federal relief money, some of which can be used to prepare for future storms, New York officials will have to make choices about where to invest and how to sequence projects.

“There won’t be one silver bullet to solve this problem. We need a robust mixture of tools and strategies, from elevating buildings to long-term retreat in vulnerable areas,” says Timothy Beatley, a professor of urban and environmental planning at the University of Virginia who has written about making coastal areas more resilient against disasters. ■

BACKGROUND

Wealth and Trade Centers

For more than two centuries scholars have observed that coastal areas tend to attract more wealth, investment and people than inland zones. Scottish economist Adam Smith pointed out this correlation in his landmark work, *The Wealth of Nations* (1776),

and it still holds true: Coastal economies prosper because they have direct connections to international shipping routes, which are the cheapest way to move goods around the globe.³⁵

Only 5 percent of the population in colonial America lived in major cities, the largest of which were the port cities of Boston, Philadelphia, New York and Charleston, S.C. Those cities’ trade links to Europe made them commercial, political and cultural centers.³⁶

Acquiring new ports was a priority during Westward expansion. In 1803 President Thomas Jefferson approved spending up to \$10 million — an enormous sum at that time — to buy New Orleans from France. Eventually, the United States ended up purchasing not only New Orleans but the entire Louisiana Territory for \$15 million, nearly doubling the size of the country. Jefferson then sent the Lewis and Clark expedition West to find a route to the Pacific Ocean.

Naval blockades during the War of 1812 and the Civil War highlighted the economic importance of port cities. The U.S. Army Corps of Engineers, established in 1802, built forts and military batteries along the Atlantic and Gulf coasts, and later along the Pacific Coast. The Corps also constructed canals, light-houses, piers and other harbor facilities and mapped navigation routes to support more trade and travel.

The Corps’ mission turned to flood-prevention after disasters in 1927 and ’28 — including devastating flooding along the Mississippi River and hurricanes in South Florida that killed thousands and flooded hundreds of acres. The Corps began building massive dike systems in flood-prone areas, enabling landowners there to build homes and farms. The disasters of the 1920s also led private companies to stop providing flood insurance because it had become too costly.³⁷

After the Civil War, industrialization accelerated in Northern states, but

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Chronology

1900-1960

Industry, ports and military bases spread along large sections of U.S. coastlines.

1900

Hurricane inundates Galveston, Texas, killing between 6,000 and 12,000 people.

1922

First U.S. beach replenishment program launched at Coney Island, N.Y.

1940

After France falls to Nazi Germany, United States launches a massive military expansion along its coasts, including new naval bases, shipyards and port facilities.

1956

Federal Aid Highway Act authorizes construction of the Interstate Highway System, boosting tourist travel to coastal resorts.

1960-1980

Economic growth spurs increased tourism, putting new pressure on coastal areas and raising concerns about over-development.

1966

Cape Cod National Seashore established as part of the National Park System.

1968

Congress creates National Flood Insurance Program (NFIP) after Hurricane Betsy inflicts heavy damage on Gulf Coast. The program offers coverage to homeowners, renters and businesses in communities that adopt measures to mitigate flood risks.

1969

Stratton Commission on management of U.S. coastal resources warns that these zones are threatened by heavy development and calls for better coastal zone management.

1970

National Oceanic and Atmospheric Administration (NOAA) created to protect and manage marine resources.

1972

Congress enacts Coastal Zone Management Act to help states along the nation's coasts manage growth in coastal areas. . . . California voters pass Proposition 20, creating a state commission to regulate coastal development.

1973

NFIP is amended to require homes and buildings in high-risk flood areas to have flood insurance in order to receive a federally regulated or insured mortgage.

1980-2000

Growth outstrips conservation measures in many coastal areas.

1982

Congress passes Coastal Barriers Resources Act, banning federal subsidies for development on 186 Atlantic and Gulf coast barrier islands.

1988

Congress passes Stafford Act (named after its sponsor, Sen. Robert T. Stafford, R-Vt.), establishing a system of federal aid to state and local governments after natural disasters.

1992

In *Lucas v. South Carolina Coastal Council*, U.S. Supreme Court rules that forbidding all use of private land in a potential flood zone amounts to a "taking" of private land, so the government must pay the owner. . . . Hurricane Andrew hits Miami, causing \$25 billion in damages, according to a 1993 National Hurricane Center report.

1996

Congress raises NFIP borrowing authority from \$1 billion to \$1.5 billion.

2001-2013

Storms inflict heavy damage in many coastal zones.

2005

Hurricanes Katrina and Rita strike Gulf Coast, inflicting \$117 billion in damages.

2006

Congress raises NFIP borrowing authority to \$20 billion.

2008

Hurricane Ike causes \$27 billion in damage to the Texas coast.

2012

Congress reauthorizes NFIP through 2017 with higher premiums. . . . Hurricane Sandy strikes East Coast, causing an estimated \$50 billion in damages.

2013

Congress raises NFIP borrowing authority to \$30 billion and approves \$50.5 billion in emergency aid for Hurricane Sandy victims.

Cities Seek Ways to Block Rising Oceans

Movable gates are part of broader protection systems.

Some cities vulnerable to flooding from storms and rising sea levels are building a variety of structures to block or mitigate the damage. They range from 10 massive movable gates in the Thames River near London to Rotterdam's "Climate Proof" system, which includes a large set of flood gates and innovative features such as water plazas and floating buildings.

London is about 40 miles from the coast, spreading along both sides of the Thames River. Because the Thames flows into the North Sea, its lower section is affected by tides, and high tides have flooded London throughout its history. The Thames Barrier, a line of 10 movable gates that can be raised to block storm surges, has been closed 106 times since its completion in 1982. More than half of those incidents have occurred since 2000.¹

When the system is open, the gates lie on the river bottom, allowing ships to pass over them; when activated, they rotate upward, forming a solid wall.² The gates are the largest element of a system of barriers and locks that protects London and downriver communities from floods.

Last November the United Kingdom's Environment Agency released its Thames Estuary 2100 Plan, which sets out strategies for protecting lives and property along the Thames from growing flood risks through 2100. The document is based on scientists' estimates that climate change will raise global sea levels by about three feet by 2100, but the plan can be adapted for higher levels. It projects that many existing flood control structures will be raised or upgraded between 2035 and 2050 and that a new Thames Barrier may have to be constructed between 2050

and 2070 if oceans rise to even higher levels.³

Venice, which dates back to the Middle Ages, was built on 118 small islands in a marshy lagoon adjacent to the Adriatic Sea and straddling the mouths of two rivers. Once a commercial and naval power, Venice today is a major tourist destination — famous for its network of canals, plied by colorful gondoliers. But Venice is sinking as sea levels are rising. About 100 times a year floods inundate stores, restaurants and popular sites such as the Piazza San Marco, the city's main square.

Since 2003 Venice has been building 78 metal sea gates (named MOSE, from the Italian for the Biblical prophet Moses) that can be raised to close off three inlets connecting its lagoon to the Adriatic. The barrier at the first inlet is scheduled to be tested this year.⁴

Other elements of the project include restoring nearby beaches, dunes and salt marshes; reinforcing fragile buildings; and reducing oil tanker traffic in the lagoon. The project is estimated to cost about \$6.5 billion.⁵

Rotterdam, the second-largest city in the Netherlands (population 600,000), lies near the North Sea, much of it on land that is below sea level. Rotterdam also is near the Rhine-Meuse-Scheldt Delta, where three rivers converge and flow into the North Sea, so it is vulnerable to flooding from the river, the ocean and heavy rains, all of which can overwhelm the city's drainage systems and pumping stations.

Rotterdam is protected by the massive Maeslant Barrier, a movable gate that closes off the New Waterway, a large shipping canal linking the Port of Rotterdam to the North Sea. When the

Continued from p. 190

growth lagged in the devastated South. Millions of Americans and new immigrants moved to cities seeking jobs. But urban life in the late 1800s was noisy, polluted and crowded. Coasts offered fresh air and open space.

During the Gilded Age (1877-1893), wealthy industrialists transformed the port town of Newport, R.I., into a summer playground, building so-called "cottages" that actually were opulent mansions. In winter they traveled by train to new, grand beach resorts in Florida. Meanwhile, less wealthy city dwellers escaped to such havens as Cape Cod, Mass.; Cape May, N.J.; and Ocean City, Md. Working-class beachgoers took subways to Coney Island at

Brooklyn's southern tip or to Boston's Revere Beach.

In the 1920s, as wages rose and cars became widely available, middle-class Americans began traveling for pleasure, fueling development along Florida and Southern California beaches.

Trade and economic production stagnated during the Great Depression. But as war loomed in Europe, President Franklin D. Roosevelt (1933-1945) began mobilizing industry and rebuilding U.S. military forces. After France fell to Nazi Germany in 1940, the U.S. War Department launched a major expansion, building or modernizing military bases, shipyards, supply depots and other facilities across the nation. From Alaska to Florida, military construction trans-

formed many sleepy coastal areas into industrial hubs.

Rush to the Shore

After World War II the U.S. economy expanded sharply as soldiers returned to civilian life and weapons factories shifted to producing cars and consumer goods. Leisure travel became affordable for middle- and working-class families. In 1956 President Dwight D. Eisenhower commissioned a new interstate highway system, which made many coastal regions more accessible. Low-cost mortgages for veterans helped to spur a wave of homebuilding, including new construction in coastal areas.

barrier is open, the storm doors are concealed in docks on both sides of the canal. If water levels in the canal rise to a specified level, the doors swing out horizontally into the canal and sink, blocking the channel.⁶ The system has been activated only once, in 2007.

The Maeslant Barrier is one element of the Netherlands' elaborate Deltaworks, a system of river dams and storm-surge barriers developed after 1953, when a hurricane storm surge broke through 89 dikes, killing nearly 2,000 people and contaminating 772 square miles of fertile farmland with salt water. Such massive damage has not recurred, although the Netherlands experienced heavy river flooding in 1993 and 1995.

Maintaining barriers and dikes is a top national priority in the Netherlands, but designers also are exploring innovative flood-control techniques. Rotterdam's "Climate Proof" initiative is designed to make the city resilient to flooding and heat stress caused by climate change.

Rotterdam is building a series of "water plazas" — parks that are set below grade that serve as mini reservoirs, storing



Getty Images/Mike Hewitt

The Thames Barrier — a line of 10 movable gates that can be raised from the river bottom to form a solid wall that blocks storm surges — is part of a system of barriers and locks that protects London and downriver communities from floods.

water during heavy storms. The city also subsidizes construction of green rooftops — covered with plantings that absorb water — and is planning a district of floating buildings where people can live, work and shop on the water.⁷

— Jennifer Weeks

¹ "21st Century Challenges: The Thames Barrier," Royal Geographic Society, www.21stcenturychallenges.org/focus/the-thames-barrier/.

² Video at www.dailymail.co.uk/news/article-2253624/Thames-Barrier-shuts-time-years-prevent-flooding-London-fresh-Atlantic-storm-promises-rain.html#axzz2KFHYuGAE.

³ "Thames Estuary 2100 Plan," U.K. Environment Agency, November 2012, www.environment-agency.gov.uk/static/documents/Leisure/SE_TE2100_briefing.pdf.

⁴ For details, see "Activities for the Safeguarding Venice and its Lagoon," www.salve.it/uk/default.htm.

⁵ Giulia Lasagi, "Italy Goes Big to Save Venice as it Sinks Into the Sea," *The Christian Science Monitor*, April 13, 2012, www.csmonitor.com/World/Global-News/2012/0413/Italy-goes-big-to-save-Venice-as-it-sinks-into-the-sea.

⁶ "Maeslant Barrier," www.deltawerken.com/The-functioning/463.html.

⁷ For details, see "Rotterdam Climate Proof capitalizes on water management opportunities," Rotterdam Climate Initiative, www.rotterdamclimateinitiative.nl/en/100_climate_proof/rotterdam_climate_proof/introduction_rotterdam_climate_proof.

As beaches became increasingly popular destinations, the federal government took a larger role in beach replenishment projects — moving sand and sediment to rebuild eroded shorelines. Before World War II such projects were rare and were funded by state governments and local communities. But in 1946 Congress authorized the Army Corps of Engineers to help restore public beaches and the federal government to pay up to a third of the costs. In 1956 Congress allowed the Corps to participate in private beach replenishment projects that showed substantial public benefits. And in 1962 Congress raised the federal cost-sharing limit for beach restoration to 50 percent.³⁸

In 1965 Hurricane Betsy struck the Gulf Coast, flooding 164,000 homes in New Orleans and killing 76 people.³⁹ The scale of the damage spurred Congress in 1968 to create the National Flood Insurance Program. Initially, purchasing flood insurance was voluntary. But after Hurricane Agnes hit the East Coast in 1972, killing 122 and causing \$2.1 billion in damage, it became clear that many coastal residents had not bought policies.⁴⁰

In 1973 Congress made flood insurance mandatory for federally backed mortgages in high-risk flood areas. But because many eligible owners found ways around the requirement, problems persisted in the program.

Nonetheless, Americans continued moving to the coasts. The population

of counties along the Atlantic, Pacific and Gulf coasts rose from 47 million in 1960 to 89 million in 2010, an 89 percent increase. (See graphic, p. 188.) In contrast, the overall U.S. population grew by 72 percent during that period.⁴¹ About the same time, the average population density of coastal counties, excluding Alaska, rose from 260 people per square mile in 1960 to 479 in 2008.⁴²

Coasts Under Pressure

During the second half of the 20th century, intense coastal development began to alarm observers who worried that scenic areas would be

Interest Grows in “Soft” Shoreline Engineering

“This approach improves the quality of life in cities.”

As state and local governments address coastal flooding hazards, some are trying an innovative concept called soft shoreline engineering. It uses plants and other natural materials to stabilize shorelines, rather than hard structures such as concrete retaining walls or banks of riprap (broken stones or chunks of concrete).

Soft engineering projects include restoring marshes and offshore shellfish beds and creating buffer zones of native plants that thrive in floodplains.

Advocates of soft engineering say it is often cheaper than hard engineered strategies and does not interfere with natural ecological processes, such as the transport of sediments along shorelines. Soft techniques also protect upland areas from storms and floods: Shellfish reefs can act as barriers against storm surges, and marshes soak up floodwaters, releasing them slowly after storms have passed.

Soft shoreline engineering also complements city initiatives to reclaim urban waterfronts and make them more attractive and accessible. “We’re developing more parks and finding more ways for people to connect with water,” says Timothy Beatley, a professor of urban and environmental planning at the University of Virginia. “This approach improves the quality of life in cities and makes them more adaptable at the same time.”

The U.S. Fish and Wildlife Service has cooperated with local

partners in the United States and Canada on more than 50 soft engineering projects along the Detroit River and the western shoreline of Lake Erie — a highly urbanized area where heavy industry once occupied most waterfront zones. The projects have removed old dams, restored flood plains and created new habitat for birds and passages for fish.¹

Experts want soft engineering projects monitored and measured so officials can determine whether the projects are producing the ecological benefits they were designed to achieve. One review of 38 projects around Detroit found that only six had carried out any kind of post-construction monitoring, and those projects only measured impacts for a year or two. Damaged ecosystems often need more time to recover.²

A provocative exhibit at New York’s Museum of Modern Art in 2010 presented a radical vision of soft shoreline engineering for the city. The exhibit, titled “Rising Currents,” challenged five teams to design soft engineering structures that could protect zones around New York Harbor during an extreme flood. Their proposals included waterfront parks, restored oyster reefs, parks set in basins designed to hold floodwaters, and streets paved with absorptive tiles to filter runoff.³

After Hurricane Sandy flooded lower Manhattan in October, leaving millions of residents homeless or without utilities and transportation, the designers looked like prophets.

covered with houses, roads and billboards. Between 1953 and 1984, conservationists persuaded Congress to add 10 swaths of unspoiled coasts and islands to the National Park System as National Seashores, protecting them from any new development. (See box, p. 185.) Seven of the sites were located along the Atlantic Coast, two on the Gulf Coast, and one in California.

By the late 1960s many national leaders were becoming concerned about negative impacts of unfettered development across the United States. In 1969 a congressionally mandated commission called for more strategic management of U.S. fisheries, waters and coastlines.⁴³ The commission, chaired by Ford Foundation President Julius Stratton, called coastal zones “in many respects . . . the Nation’s most valuable geographic feature” and warned that they were at risk.

“Rapidly intensifying use of coastal areas already has outrun the capabilities of local governments to plan their orderly development and to resolve conflicts,” the commission reported. Trade, industry, fishing, recreation, the armed forces and other uses were all competing for coastal space, but responsibility for managing coasts was spread among many agencies with no one in charge.⁴⁴

To fill this gap the commission urged Congress to pass a coastal management law that would set priorities; create a new agency to manage oceanic and atmospheric issues (recognizing that oceans and atmosphere interacted to shape global weather and climate patterns); and authorize the federal government to help states pay for coastal-management policies.

Almost simultaneously, an undersea wellhead near Santa Barbara, Calif.,

blew out and leaked 200,000 gallons of oil, contaminating 35 miles of coastline and killing seabirds, seals and dolphins. The Santa Barbara oil spill helped to catalyze the first Earth Day rally in April 1970 and led to state and federal bans on new offshore drilling.

Also in 1970, Congress voted to establish the National Oceanic and Atmospheric Administration (NOAA) within the Department of Commerce to manage U.S. fisheries, monitor the climate, forecast weather and restore U.S. coastlines. And in 1972 Congress enacted the Coastal Zone Management Act, which encouraged coastal states to develop plans for managing and protecting their coasts. The law also created a National Estuarine Reserve Research System to research and conserve large estuaries (bodies of water where salt and fresh water meet),

"It was sort of an, 'Oh my god, we were so right' moment when all the electrical transformers started to blow up," said Susannah Drake, a landscape architect and team leader. "They need my waterproof vaults to put all the infrastructure under the sidewalks."⁴

As the exhibit showed, soft shoreline engineering alone cannot immunize cities from heavy floods. "It's smaller-scale infrastructure that you do along with other changes to the built environment," says Beatley.

Beach replenishment is another form of soft shoreline engineering that is widely used in areas with heavy coastal development, especially along the Atlantic Coast. But since replenishment involves simply pumping sand onto beaches, it is a temporary solution. "If a community decides to manage erosion that way, they will be doing it forever," says Robert Young, a coastal geologist and director of the Program for the Study of Developed Shorelines at Western Carolina University.

After Sandy, many observers contended that dunes (including both engineered and natural dunes) had protected some coastal communities from the full force of the storm and mitigated the damage.⁵ But Young wants more analysis. "Those claims need to be tested scientifically before we assume they're true," he says.

As the U.S. Army Corps of Engineers analyzes the impact of Superstorm Sandy, it is already replenishing beaches in projects approved before the storm. In Virginia Beach, Va., the shoreline is being replenished for the 49th time since 1951.

"It's designed to be a sacrificial buffer," said Jennifer Armstrong, the project manager.⁶

—Jennifer Weeks

¹ For examples, see "Soft Shoreline Engineering," U.S. Fish & Wildlife Service, www.fws.gov/refuge/detroit_river/what_we_do/resource_management/soft_shoreline_engineering.html.

² J. H. Hartig, M. A. Zarull, and A. Cook, "Soft Shoreline Engineering Survey of Ecological Effectiveness," *Ecological Engineering*, vol. 37, 2011, pp. 1231-1238.

³ For details see "Rising Currents: Projects for New York's Waterfront," Museum of Modern Art, www.moma.org/visit/calendar/exhibitions/1031.

⁴ Brad McKee, "In New York, Drying Out," *Landscape Architecture Magazine*, Nov. 1, 2012, <http://landscapearchitecturemagazine.org/2012/11/01/in-new-york-drying-out/>.

⁵ For example, see Evan Lehmann, "Superstorm Sandy Settles Long-Standing Argument over the Value of Dunes," *Scientific American.com*, Dec. 11, 2012, www.scientificamerican.com/article.cfm?id=superstorm-sandy-settles-long-standing-argument-over-the-value-of-dunes; and Janet Babin, "Beach Dunes Spark a Battle After Sandy," WNYC Radio, Dec. 17, 2012, www.wnyc.org/articles/wnyc-news/2012/dec/17/beach_dunes_spark_battle_after_sandy/.

⁶ Jennifer Ludden, "Debate Over Rebuilding Beaches Creates Post-Sandy Waves," National Public Radio, Jan. 30, 2013, www.npr.org/2013/01/30/170301306/debate-over-rebuilding-beaches-post-sandy-creates-waves.

such as the Chesapeake Bay. Many of these zones, which are ecologically rich and harbor many species of fish and birds, had been heavily polluted and threatened by shoreline development.

The Coastal Zone Management Act gave states grants for coastal protection if they adopted a management plan. But some states regulated coastal development more aggressively than others. The act "doesn't set standards for what should be in coastal management plans, so it's pretty toothless," says Georgetown's Byrne.

Congress took a more forceful approach with the 1982 Coastal Barrier Resources Act, which severely limited development on barrier islands along the Atlantic and Gulf coasts. The law recognized that these islands were unique land forms and protected the mainland against storms. Buildings con-

structed or substantially improved on the islands after the law went into effect were ineligible for federal flood insurance, and FEMA disaster aid was limited to emergencies that threatened lives or public health and safety.⁴⁵

"In the last six years alone, the federal government has spent more than \$800 million to aid development and redevelopment of coastal barriers," President Ronald Reagan said. "By signing [the act] into law today, this administration is acting to halt this subsidiary spiral."⁴⁶

In Harm's Way

Through the 1980s and '90s, as Americans continued to flock to the coasts, every storm put more lives and property at risk. After heavy flooding along the Mississippi River in the

early 1990s, Congress tightened penalties for lenders who failed to enforce flood insurance requirements, and FEMA began a public education campaign to boost enrollment. Coverage rose from about 1.5 million policies in the mid-1970s to 4 million in 1997, and the value of property insured increased from \$165 billion in 1978 to \$703 billion in 2000.⁴⁷

In 2005, Hurricanes Katrina and Rita struck the Gulf Coast, devastating communities from Texas to the Florida Panhandle. Together the storms killed nearly 1,900 people and caused more than \$120 billion in damages.⁴⁸ Congress was forced to increase the NFIP's federal borrowing authority from \$1.5 billion to \$20.8 billion to cover claims. The U.S. Government Accountability Office, Congress's oversight agency, warned that the program was not financially sound and

might never be able to repay its loans to the Treasury.⁴⁹

Images of a flooded New Orleans after Katrina drove home the message that large storms could devastate major cities. Planners and environmental advocates warned that the same thing could happen along the East Coast, especially as climate change raises sea levels. Several task forces in 2005, 2006 and 2010 forecast that a direct hit on New York City by a major storm could cause massive damage and disrupt transportation systems and financial markets. But even after Tropical Storm Irene flooded parts of the city's subway system in 2011, New York leaders did not take aggressive steps to flood-proof the city.⁵⁰ ■

CURRENT SITUATION

Clashing Signals

As New York and New Jersey recover from Sandy, many observers say clearer signals from the federal government would help states manage development in hazardous areas. Even when officials propose limits, as Gov. Cuomo has done in New York State, critics argue that many federal policies promote coastal development without considering flooding and storm hazards.



Getty Images/Mario Tama

An iconic roller coaster in Seaside Heights, N.J., sits offshore after Superstorm Sandy struck the community last October. Storm damage along New Jersey's coast was unprecedented in the state's history, according to the National Hurricane Center. Sandy inundated seaside towns with water and sand, swept houses from their foundations and destroyed cars, boats and boardwalks.

"The Federal Highway Administration doesn't have any directives requiring it to assess flood risks before it rebuilds a highway," says Stiles of Wetlands Watch. "Federal tax credits and development incentives don't differentiate between coastal and inland locations. There are no drivers [policy directions] that anticipate risk over the useful lives of building projects."

One meaningful change, Stiles asserts, would be for FEMA to start considering sea-level rise projections in its flood hazard maps. FEMA is studying how climate change could affect the National Flood Insurance Program and already has concluded that sea-level rise could significantly increase the number of high-risk flood areas across the nation this century.⁵¹ However, sea-level rise is not factored into FEMA's mapping practices, so it likely is underestimating the geographic breadth and severity of flood risks.⁵² In contrast, the Army Corps of Engineers requires project managers to consider potential sea-level change in every coastal activity.⁵³

"If FEMA started using sea-level rise projections like the Corps, we would see changes," says Stiles. "State plans are written to FEMA standards, so raising that bar would make a big difference."

Other experts cite disaster relief under the Stafford Act as a major driver of coastal development. "The Stafford Act aid puts back roads, power lines and water lines after storms, which promotes rebuilding of homes," says Young of Western Carolina University. "If coastal communities had to replace that infrastructure them-

selves, their tax rates would be incredibly high, and property values would be very different."

Major disaster declarations under the Stafford Act have increased in recent years, from an average of 18 per year in the 1960s to 56 per year between 2000 and 2009. (These numbers include storms, flooding, tornadoes and other events, not just coastal storms.) Some politicians have suggested that states are requesting disaster declarations more frequently in order to obtain more federal aid.

But analysts say many factors could be driving the increase. For example, population growth and economic development have put more people and property in harm's way.⁵⁴

As Congress debates federal budget policy, some observers have proposed limiting Stafford Act aid. Matt Mayer, a visiting fellow at the conservative Heritage Foundation, recommends cutting the federal portion of shared costs for all FEMA declarations to no more than 25 percent.⁵⁵ The Congressional Research Service suggests

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At Issue:

Should the National Flood Insurance Program be privatized?



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WRITTEN FOR *CQ RESEARCHER*, FEBRUARY 2013

the National Flood Insurance Program (NFIP), in a sense, is responsible for the modern American suburb. Construction of the Interstate Highway System, easy mortgage insurance from the Veterans Administration and Federal Housing Administration and a host of federal, state and local rules favoring low-density residential development all played a role in the nation's post-war suburbanization, to be sure. But the 1968 creation of the NFIP really changed the landscape, literally, by allowing acres of lush river valleys and miles of coastal land to be transformed into manicured lawns and beachfront cottages.

Unfortunately, after nearly 45 years the NFIP is unsustainable, with some \$30 billion in debt that it has no means to repay. With some 5.6 million policyholders across the country, the program also has sparked development in the most risk-prone and environmentally sensitive regions, threatening innumerable endangered species, depleting wetlands and overdeveloping barrier islands that serve as natural buffers against hurricanes.

Today, global warming and rising sea levels appear likely to make future floods and tropical storms both more frequent and more severe. To prepare for that, a functioning private market must be part of the solution. When property owners don't bear the full cost of the risks they face, they are encouraged to take on more. Transitioning to a private, risk-based insurance market for floods will not be easy, but it is a challenge private insurers can meet, just as they have done in countries such as the United Kingdom and Australia. Advances in mapping, risk modeling and the ability to spread risk across the globe means that most of the logistical problems the insurance industry once faced in underwriting floods have been long solved.

Private flood insurance would be expensive, although not nearly as expensive as continually rebuilding flood-prone communities that have no incentive to adapt and mitigate risk because that risk is borne by others. Some policyholders may need financial assistance to harden their homes against flooding, pay their premiums or move to higher ground. But research by the Institute for Policy Integrity shows that the NFIP's benefits currently flow overwhelmingly to the rich, with the wealthiest counties filing 3.5 times more claims and receiving \$1 billion more in NFIP payments between 1998 and 2008 than the poorest counties.

The NFIP has helped shape the country, for good and for ill. To tackle long-term challenges, both budgetary and environmental, it must be phased out.



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INDEPENDENT INSURANCE AGENTS AND
BROKERS OF AMERICA

FROM TESTIMONY BEFORE THE SUBCOMMITTEE ON
ECONOMIC POLICY, SENATE COMMITTEE ON BANKING,
HOUSING AND URBAN AFFAIRS, MAY 9, 2012

the Independent Insurance Agents and Brokers of America (IIABA) believes that the NFIP provides a vital service to people and places that have been hit by a natural disaster. The private insurance industry has been, and continues to be, largely unable to underwrite flood insurance because of the catastrophic nature of these losses. Therefore, the NFIP is virtually the only way for people to protect against the loss of their home or business due to flood damage.

Prior to the introduction of the program in 1968, the federal government spent increasing sums . . . on disaster assistance to flood victims. Since then, the NFIP has saved disaster assistance money and provided a more reliable system of payments for people whose properties have suffered flood damage. It is also important to note that for almost two decades, up until the 2005 hurricane season, no taxpayer money had been used to support the NFIP; rather, the NFIP was able to support itself using the funds from the premiums it collected every year. . . .

Despite our strong support of the NFIP, we also recognize that the program is far from perfect, which was made . . . clear by the devastating 2005 hurricane season. . . . While IIABA is confident that the NFIP will recover, it is important that Congress shore up the NFIP's financial foundation and use this opportunity to enact needed reforms to ensure the long-term sustainability of the program. . . .

Some observers have argued that the program should be eliminated or completely privatized. These arguments center on the assumption that the private market could step in and offer flood insurance coverage. However, the IIABA has met with many insurance carriers who categorically state that the private market is simply unable to underwrite this inherently difficult catastrophic risk, especially in the most high-risk zones where it is needed.

IIABA would always prefer to utilize the private market, and our members would almost certainly prefer to work directly with private insurance carriers rather than a government agency. However, where there is a failure in the marketplace, as there is in the case of flood insurance, we believe it is imperative that the government step in to ensure that consumers have the protection they need. . . . We see no evidence that the private marketplace is any more prepared or capable of underwriting flood risk in 2012 than . . . in 1968.

Continued from p. 196

a more moderate option: reducing to 50 percent the federal share of aid for communities that don't require storm mitigation. The aid helps pay for measures to reduce harm from future disasters, such as installing flood control barriers or raising the height of homes.⁵⁶

A New FEMA

One positive aspect of the response to Sandy was FEMA's performance. The agency was harshly criticized for reacting slowly and feebly in 2005 when Hurricane Katrina inundated New Orleans. But under its current administrator, W. Craig Fugate, FEMA appears to have regained credibility.

Since its creation in 1979, FEMA has struggled to define clear goals and respond efficiently to large-scale disasters. Reorganization in 1993 brought some improvements, but over the next decade FEMA was widely criticized for employing political appointees lacking relevant experience.⁵⁷

When Hurricane Katrina breached several levees and flooded New Orleans in August 2005, trapping 70,000 people who had not evacuated, FEMA did not have enough food, water, medicine or transportation to help residents. Several days into the crisis, with Louisiana officials pleading for help, FEMA Administrator Michael Brown (who had previously been commissioner of the International Arabian Horse Association) asked the Defense Department to take over logistics. Nonetheless, President George W. Bush told him publicly, "Brownie, you're doing a heck of a job" — demonstrating to critics that Bush did not understand conditions on the ground in New Orleans. Brown resigned a week later.⁵⁸

Congress overhauled FEMA in 2006, directing it to improve its logistics

and information systems and requiring that all future administrators have knowledge of emergency management and five years of executive experience.⁵⁹ Fugate is a former volunteer firefighter and paramedic who ran Florida's emergency management agency for eight years before being appointed in 2009.

Under Fugate, many officials say, FEMA's response to disasters has become faster and more effective. "I've been very impressed with the dedicated professionals FEMA has put on the ground here in Tuscaloosa," Mayor Walter Maddox said after tornadoes killed 238 people in Alabama in April 2011.⁶⁰

As Sandy moved up the Atlantic coast last October, FEMA pre-positioned water, meals, cots, blankets, generators and other equipment at support bases in Massachusetts and New Jersey; set up five staging areas in New York and deployed more than 1,000 personnel in advance of the storm.⁶¹ Thousands more FEMA staff followed to help displaced residents find shelter and provide other services. Within six weeks of the storm, the agency had distributed more than \$1 billion in cash assistance to victims, mostly in New York and New Jersey.⁶² Reviews were largely positive: New Jersey Gov. Christie called FEMA "outstanding."⁶³

Fugate has called for more frank discussion about risks to communities from climate change. "We cannot afford to continue to respond to disasters and deal with the consequences under the current model," he said last year. "We don't have a good way of communicating and managing risk at the national level. When we undervalue risk, we tend not to plan for it."⁶⁴

Rising Seas

Estimating how quickly sea-level rise will accelerate in coming

decades due to climate change has been a highly complex issue for climate scientists in recent years.

When the Intergovernmental Panel on Climate Change (IPCC, the international scientific body that evaluates climate science) published its last major assessment in 2007, it estimated that warming of Earth's surface would raise global sea levels 7 to 24 inches by 2100.⁶⁵ But more recent studies indicate that these numbers were too low.

A peer-reviewed article published by a German research team late last year found that the world's oceans were rising 60 percent faster than the IPCC's projections, which did not take into account the full effects of the melting of ice sheets in Greenland and Antarctica. Based on this finding, the lead author estimated that sea levels would rise between 20 inches and three feet by 2100.⁶⁶

Other research shows that sea levels are not rising uniformly. Last summer the U.S. Geological Survey reported that sea levels along the U.S. East Coast, from North Carolina to Massachusetts, were rising 2 to 3.7 millimeters (0.08 to 0.15 inches) per year — three to four times faster than globally — due to changes in ocean circulation patterns. Cities in this zone would be highly vulnerable to flooding during storms, the authors said.⁶⁷

"We've learned in the past several years that impacts are more severe than we previously thought," says Columbia University climate scientist Radley Horton. "Now the worst-case scenario projects that global sea levels could rise as much as six feet by 2100. The biggest remaining uncertainty is what will happen to that land ice in Greenland and West Antarctica. We know it won't all melt, but even if 5 to 10 percent melts, that will have a big impact."

OUTLOOK

Resilient Coastlines

Although the long-term impacts of Sandy are still unfolding, scientists and environmentalists say the giant storm may lead to new thinking about coastal development — if leaders and communities recognize that Sandy was not a fluke.

“This is a teachable moment, and it could make people start rethinking unsustainable practices before the next storm,” says Stiles of Wetlands Watch.

To drive lasting change, experts widely agree that laws and policies should be amended to reduce incentives for coastal development. “We should end subsidies for rebuilding in the most vulnerable coastal areas, including programs like beach nourishment,” says Western Carolina University’s Young. “You could do it in an organized way — for example, by tapering off funding over a decade, or giving people one or two strikes [before making them ineligible for money to rebuild]. If communities had to deal with these issues themselves, they would make better decisions.”

Flooding in New York City during Sandy was a warning for coastal cities. “We need to find ways to make cities livable in the aftermath of big storms,” says Beatley of the University of Virginia. “People may have to live without power or water for some time, so we should be designing structures with features like natural day lighting and ventilation. That will make them more resilient.”

Some states and cities are already taking Sandy as a warning. For example, Mayor Thomas Menino of Boston recently announced steps to better prepare the city for Sandy-like storms, including surveys of all buildings and subway lines in flood zones

and a requirement for developers to address climate change risks when applying for building permits.⁶⁸

Many other areas are less prepared. According to the Natural Resources Defense Council, an environmental advocacy group, by mid-2012 only nine states had comprehensive plans to address flooding and other water-related climate change effects. Some extremely vulnerable states — including Florida and Virginia, whose governors do not see climate change as a threat — lag far behind.⁶⁹

In fact, coastal experts say reducing risky practices makes political sense. “This ought to be an issue where environmentalists and fiscal conservatives can agree on doing things differently,” says Young. “Rebuilding in flood zones is an easy decision when owners are spending other people’s money. We shouldn’t be taking all the economic risk for them.”

And, experts warn, states that fail to plan for rising seas will pay in the long run. “There are three ways to respond to climate change: You can adapt, mitigate or suffer,” says Fugate of Rhode Island’s Coastal Resources Management Council. “The less mitigation you do, the more adaptation and suffering you’ll have to do. And the longer you wait, the more expensive mitigation and adaptation become.” ■

Notes

¹ Sandy set records for low pressure (measured in millibars) in Atlantic City and other nearby locations. Lower pressure at the center of hurricanes and tropical storms corresponds to stronger storms. See Andrew Freedman, “Statistics Show Hurricane Sandy’s Extraordinary Intensity,” *Climate Central*, Nov. 1, 2012, www.climatecentral.org/news/statistics-show-just-how-intense-hurricane-sandy-was-15196.

² *Ibid.*

³ See Eric S. Blake, *et al.*, “Tropical Cyclone Report: Hurricane Sandy,” National Hurricane Center, Feb. 12, 2013, p. 14, and Tables 8, 9,

p. 120, www.nhc.noaa.gov/data/tcr/AL182012_Sandy.pdf.

⁴ *Ibid.*

⁵ “Report: Sandy Was USA’s Second-Costliest Hurricane,” The Associated Press, Feb. 12, 2013, www.usatoday.com/story/weather/2013/02/12/hurricane-sandy-weather-katrina/1912941/.

⁶ For background, see Adriel Bettelheim, “Coastal Development,” *CQ Researcher*, Aug. 21, 1998, pp. 721-744.

⁷ “The NFIP Floodplain management Requirements,” Federal Emergency Management Agency, www.fema.gov/pdf/floodplain/nfip_sg_unit_5.pdf. A 100-year flood is one that has a 1 percent chance of flooding in any given year.

⁸ “Understanding the Stafford Act: Its Effect on Public Entities,” Public Risk Management Association, www.primacentral.org/resources/Stafford%20Act%20FAQs.pdf.

⁹ “Disaster Declarations,” Federal Emergency Management Agency, www.fema.gov/disasters.

¹⁰ For background, see Pamela M. Prah, “Disaster Preparedness,” *CQ Researcher*, Nov. 18, 2005, pp. 981-1004.

¹¹ Russell Goldman, “Chris Christie Calls ‘Disgusting’ Boehner’s Decision to Yank Sandy Funds,” ABC News, Jan. 2, 2013, <http://abcnews.go.com/Politics/chris-christie-calls-disgusting-boehners-decision-yank-sandy/story?id=18114029>.

¹² J. Wylie Donald, “Will Climate Change Considerations Affect Rebuilding After Sandy?” *ClimateLawyers.com*, Nov. 27, 2012, <http://climatelawyers.com/post/2012/11/27/Will-Climate-Change-Considerations-Affect-Rebuilding-After-Sandy-The-Short-Answer-is-Yes.aspx>.

¹³ For example, see Serge Dedina, “Hurricane Sandy, Climate Change, Sand Replenishment and Surf,” *Encinitas Patch*, Oct. 31, 2012, <http://encinitas.patch.com/articles/hurricane-sandy-climate-change-sand-replenishment-surf>; and Kate Spinner, “Beach Renourishment May Harm Ecosystem,” *Sarasota Herald-Tribune*, Feb. 19, 2012, www.heraldtribune.com/article/20120219/ARTICLE/120219439/2416/NEWS.

¹⁴ For background, see Chanan Tigay, “Extreme Weather,” *CQ Researcher*, Sept. 9, 2011, pp. 733-756; Reed Karaim, “Climate Change,” *CQ Global Researcher*, Feb. 1, 2010, pp. 25-50; and Colin Woodard, “Curbing Climate Change,” *CQ Global Researcher*, Feb. 1, 2007, pp. 25-48.

¹⁵ “Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future,” National Research Council, 2012, p. 4, www.nap.edu/catalog.php?record_id=13389. (Figures are converted from centimeters.)

¹⁶ Melanie Gade, "Sea-Level Rise Accelerating on U.S. Atlantic Coast," *Sound Waves* (U.S. Geological Survey), September/October 2012, <http://soundwaves.usgs.gov/2012/10/research.html>.

¹⁷ For example, see Kerry Emanuel, *What We Know about Climate Change*, second edition (MIT Press, 2012); and "Storm of the Century May Become 'Storm of the Decade,'" *Science Daily*, Feb. 23, 2012, www.sciencedaily.com/releases/2012/02/120223133216.htm.

¹⁸ Orrin H. Pilkey, "We Need to Retreat From the Beach," *The New York Times*, Nov. 15, 2012, www.nytimes.com/2012/11/15/opinion/a-beach-front-retreat.html.

¹⁹ Anna Sale, "Christie and Cuomo's Dueling Visions for Post-Sandy Rebuilding," WNYC Radio, Nov. 23, 2012, www.wnyc.org/articles/its-free-country/2012/nov/23/christie-and-cuomos-dueling-visions-post-sandy-rebuilding/.

²⁰ Todd B. Bates, "N.J. Sandy Rebuilding Rules: Go Higher or Pay More," *USA Today*, Jan. 25, 2013, www.usatoday.com/story/news/nation/2013/01/25/sandy-rebuilding-flood-maps/1863761/.

²¹ Ken Lovett, "NY Could Buy Out Flood Zones' Hurricane Sandy Victims: Gov. Cuomo," *New York Daily News*, Jan. 24, 2013, www.nydailynews.com/blogs/dailypolitics/2013/01/state-could-buy-out-flood-zones-hurricane-sandy-victims-gov-cuomo?print=true.

²² Thomas Kaplan, "Cuomo Seeking Home Buyouts in Flood Zones," *The New York Times*, Feb. 3, 2013, www.nytimes.com/2013/02/04/nyregion/cuomo-seeking-home-buyouts-in-flood-zones.html?hp.

²³ For background, see Kenneth Jost, "Property Rights," *CQ Researcher*, March 4, 2005, pp. 197-220.

²⁴ Rob Young, "Shoot the Messenger: Carolina's Costly Mistake on Sea Level Rise," *Yale Environment 360*, June 18, 2012, http://e360.yale.edu/feature/north_carolina_costly_mistake_on_climate_change/2543/;

Alan I. Leshner and William L. Chameides, "N.C. Can't Outlaw Global Climate Change," *Raleigh News & Observer*, Aug. 1, 2012, www.newsobserver.com/2012/08/01/2234915/nc-cant-outlaw-global-climate.html.

²⁵ Sue Sturgis, "NC Coastal Planning Faces Tide of Campaign Cash," *Charlotte Business Journal*, July 20, 2012, www.bizjournals.com/charlotte/print-edition/2012/07/20/coastal-planning-faces-tide-of.html?page=all.

²⁶ See Jessica Grannis, "Analysis of How the Flood Insurance Reform Act of 2012 (H.R. 4348) May Affect State and Local Adaptation Efforts," Georgetown Climate Center, Aug. 1, 2012, www.georgetownclimate.org/sites/default/files/Analysis%20of%20the%20Flood%20Insurance%20Reform%20Act%20of%202012.pdf.

²⁷ Justin Gillis and Felicity Barringer, "As Coasts Rebuild and U.S. Pays, Repeatedly, the Critics Ask Why," *The New York Times*, Nov. 18, 2012, www.nytimes.com/2012/11/19/science/earth/as-coasts-rebuild-and-us-pays-again-critics-stop-to-ask-why.html?pagewanted=all.

²⁸ David M. Halbfinger, "Post-Storm Cost May Force Many From Coast Life," *The New York Times*, Nov. 28, 2012, www.nytimes.com/2012/11/29/nyregion/cost-of-coastal-living-to-climb-under-new-flood-rules.html?pagewanted=all.

²⁹ For details see Texas A&M University, "Ike Dike," www.tamug.edu/ikedike/.

³⁰ Eric Berger, "Ike Dike May Be Among Sandy's Casualties," *Houston Chronicle*, Nov. 4, 2012, www.chron.com/news/houston-texas/houston/article/Ike-Dike-may-be-among-Sandy-s-casualties-4005871.php.

³¹ "Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure," NYS 2100 Commission, January 2013, p. 121, www.rockefellerfoundation.org/uploads/files/7c012997-176f-4e80-bf9c-b473ae9bbb3f.pdf.

³² New York City Panel on Climate Change, "Climate Change Adaptation in New York City: Building a Risk Management Response," *Annals of the New York Academy of Sciences*, vol. 1196, 2010, p. 76, <http://onlinelibrary.wiley.com/doi/10.1111/j.1749-6632.2009.05318.x/pdf>.

³³ "Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure," *op. cit.*, p. 123.

³⁴ Alan Feuer, "Protecting the City, Before Next Time," *The New York Times*, Nov. 3, 2012, www.nytimes.com/2012/11/04/nyregion/protecting-new-york-city-before-next-time.html?pagewanted=all.

³⁵ Jeffrey D. Sachs, Andrew D. Mellinger and John L. Gallup, "The Geography of Poverty and Wealth," *Scientific American*, March 2001, www.earth.columbia.edu/sitefiles/file/about/director/documents/sciam0301.pdf; Jared Diamond, "What Makes Countries Rich or Poor?" *New York Review of Books*, June 7, 2012, www.nybooks.com/articles/archives/2012/jun/07/what-makes-countries-rich-or-poor/?pagination=false.

³⁶ "Becoming American: The British Atlantic Colonies, 1690-1763," National Humanities Center, <http://nationalhumanitiescenter.org/pds/becomingamer/growth/text2/text2read.htm>.

³⁷ See "Unit 2: National Flood Insurance Program," Federal Emergency Management Administration, pp. 2-3, www.fema.gov/pdf/flood/plain/nfip_sg_unit_2.pdf.

³⁸ Sen. Tom Coburn, "Washed Out to Sea: How Congress Prioritizes Beach Pork Over National Needs," May 2009, pp. 9-10, www.coburn.senate.gov/public/index.cfm?a=Files.Serve&File_id=e12c6935-f034-4d9e-b7b3-093cf98a4ff9.

³⁹ "Hurricanes: Science and Society," www.hurricanescience.org/history/storms/1960s/betsy/.

⁴⁰ Facts on Hurricane Agnes from "Hurricane Agnes," National Oceanic and Atmospheric Administration, www.nhc.noaa.gov/outreach/history/#agnes.

⁴¹ U.S. Census Bureau figures.

⁴² "Coastline Population Trends in the United States: 1960 to 2008," U.S. Census Bureau, p. 24, www.census.gov/prod/2010pubs/p25-1139.pdf.

⁴³ For background, see "Mary. H. Cooper, 'Threatened Fisheries,'" *CQ Researcher*, Aug. 2, 2002, pp. 617-648.

⁴⁴ "Our Nation and the Sea: A Plan for National Action," Commission on Marine Science, Engineering and Resources, January 1969, pp. 49-57, www.lib.noaa.gov/naoinfo/heritage/stratton/title.html.

⁴⁵ "Coastal Barrier Resources Act Fact Sheet," Federal Emergency Management Agency,

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www.fema.gov/library/viewRecord.do?id=3818.

⁴⁶ “Statement on signing the Coastal Barrier Resources Act,” Oct. 18, 1982, www.presidency.ucs.edu/ws/index.php?pid=41879.

⁴⁷ Erwann O. Michel-Kerjan, “Catastrophe Economics: The National Flood Insurance Program,” *Journal of Economic Perspectives*, vol. 24, no. 4 (Fall 2010), p. 169, <http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.24.4.165>.

⁴⁸ See reports for hurricanes Katrina and Rita at www.nhc.noaa.gov/pdf/TCR-AL122005_Katrina.pdf and www.nhc.noaa.gov/pdf/TCR-AL182005_Rita.pdf.

⁴⁹ “Federal Emergency Management Agency: Ongoing Challenges Facing the National Flood Insurance Program” GAO-08-118T, U.S. Government Accountability Office, Oct. 2, 2007, p. 6, www.gao.gov/assets/120/117930.pdf.

⁵⁰ David W. Chen and Mireya Navarro, “For Years, Warnings That It Could Happen Here,” *The New York Times*, Oct. 30, 2012, www.nytimes.com/2012/10/31/nyregion/for-years-warnings-that-storm-damage-could-ravage-new-york.html; “New York Superstorm Warnings Went Unheeded for Decades, Observers Say,” *The Associated Press*, Dec. 9, 2012, www.insurancejournal.com/news/east/2012/12/09/273239.htm.

⁵¹ “FEMA Climate Change Adaptation Policy Statement,” Jan. 23, 2012, p. 2, item IV.A.2, <http://stormsmart.org/wp-content/blogs.dir/1/files/group-documents/22/1328980794-FEMACCA-PolicyStatement12312.pdf>.

⁵² Grannis, *op. cit.*, p. 5.

⁵³ Current guidance is at <http://planning.usace.army.mil/toolbox/library/ECs/EC11652212Nov2011.pdf>.

⁵⁴ Bruce R. Lindsay and Francis X. McCarthy, “Stafford Act Declarations 1953-2011: Trends and Analyses, and Implications for Congress,” Congressional Research Service, Aug. 31, 2012, pp. 8-13, www.fas.org/sgp/crs/homesec/R42702.pdf.

⁵⁵ Matt A. Mayer, “Hurricane Sandy: Disaster Aid Request Too Big,” *Heritage Foundation*, Dec. 13, 2012, www.heritage.org/research/reports/2012/12/hurricane-sandy-disaster-aid-request-too-big.

⁵⁶ Lindsay and McCarthy, *op. cit.*, p. 25.

⁵⁷ See Patrick Roberts, “FEMA After Katrina,” *Policy Review*, June 1, 2006, www.hoover.org/publications/policy-review/article/7897.

⁵⁸ Spencer S. Hsu and Susan B. Glasser, “FEMA Director Singled Out by Response Critics,” *The Washington Post*, Sept. 6, 2005, www.washingtonpost.com/wp-dyn/content/article/2005/09/05/AR2005090501590.html.

FOR MORE INFORMATION

Federal Emergency Management Agency, 500 C St., S.W., Washington, DC 20472; 202-646-2500; www.fema.gov. Part of the Department of Homeland Security that helps federal, state and local governments, private organizations and the public prepare for and respond to natural and manmade disasters; manages National Flood Insurance Program.

Independent Insurance Agents and Brokers of America, 127 South Peyton St., Alexandria, VA 22314; 800-221-7917; www.iiaba.org. A national alliance of independent insurance agents and brokers.

Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, 1305 East-West Highway, Silver Spring, MD 20910; 301-713-3155; <http://coastalmanagement.noaa.gov>. An office of the federal government’s “oceans agency” that helps keep America’s coastlines healthy and resilient.

Program for the Study of Developed Shorelines, Western Carolina University, Belk 294, Cullowhee, NC 28734; 828-227-7519; www.wcu.edu/1037.asp. Analyzes coastal management issues and advocates for the long-term sustainability of coastal ecosystems.

Wetlands Watch, P.O. Box 9335, Norfolk, VA 23505; 757-623-4835; www.wetlands-watch.org. Nonprofit advocacy group working to save wetlands in Virginia.

⁵⁹ Keith Bea, *et al.*, “Federal Emergency Management Policy Changes After Hurricane Katrina: A Summary of Statutory Provisions,” Congressional Research Service, Nov. 15, 2006, pp. 9-10, 22-23, <http://training.fema.gov/EMIWeb/edu/docs/Federal%20EMP%20Policy%20Changes%20After%20Katrina.pdf>.

⁶⁰ Jeff Bliss and Mark Niquette, “Almost Six Years After Katrina Debacle, FEMA’s Reputation Stages Recovery,” *Bloomberg News*, May 27, 2011, www.bloomberg.com/news/2011-05-27/almost-six-years-after-katrina-debacle-fema-s-reputation-stages-recovery.html.

⁶¹ “Testimony of FEMA Administrator Craig Fugate before the House Transportation and Infrastructure Committee,” Dec. 4, 2012, www.dhs.gov/news/2012/12/04/written-testimony-fema-administrator-house-committee-transportation-and.

⁶² Eric Lipton and Winnie Hu, “Sandy Victims Get Generous Boost from FEMA,” *The Boston Globe*, Dec. 18, 2012, www.bostonglobe.com/news/nation/2012/12/18/sandy-victims-get-generous-boost-from-fema/cj0P4INhs7TGDJrVYjyGSL/story.html.

⁶³ Steve Vogel “Officials and Experts Praising FEMA for its Response to Hurricane Sandy,” *The Washington Post*, Nov. 1, 2012, articles.washingtonpost.com/2012-11-01/politics/35505866_1_natural-disasters-fema-federal-disaster-response.

⁶⁴ “Speech by FEMA Administrator Craig Fugate before the U.S. Green Building Council,” Feb. 29, 2012, <http://vimeo.com/37815679>, and Q&A, <http://vimeo.com/37822838>.

⁶⁵ Intergovernmental Panel on Climate Change, *Climate Change 2007: Synthesis Report*, table SPM 1, www.ipcc.ch/publications_and_data/ar4/syr/en/spms3.html#table-spm-1. The increase is relative to levels in the period 1980-1999.

⁶⁶ Miguel Llanos, “Sea Level Rise 60 Percent Faster Than UN Projections, Study Finds,” *NBC News.com*, Nov. 28, 2012, http://worldnews.nbcnews.com/_news/2012/11/28/15512957-sea-level-rose-60-percent-faster-than-un-projections-study-finds?lite; Anil Ananthaswamy, “Projections of Sea Level Rise Are Vast Underestimates,” *New Scientist*, Nov. 29, 2012, www.newscientist.com/article/dn22561-projections-of-sea-level-rise-are-vast-underestimates.html.

⁶⁷ Melanie Gade, “Sea-Level Rise Accelerating on U.S. Atlantic Coast,” *Sound Waves*, U.S. Geological Survey, Sept./Oct. 2012, <http://soundwaves.usgs.gov/2012/10/research.html>.

⁶⁸ “Mayor Menino Announces Comprehensive Actions to Better Prepare Boston for Storms Like Sandy,” Feb. 5, 2013, www.cityofboston.gov/news/default.aspx?id=5959.

⁶⁹ “Ready or Not: How Water-Ready Is Your State Or City?” *Natural Resources Defense Council*, www.nrdc.org/water/readiness/.

Bibliography

Selected Sources

Books

Helvarg, David, *The Golden Shore: California's Love Affair with the Sea*, St. Martin's Press, 2013.

A journalist and ocean conservation advocate recounts the history of California's scenic 1,100-mile coastline and steps that Californians are taking to protect it.

Kahrl, Andrew W., *The Land Was Ours: African American Beaches from Jim Crow to the Sunbelt South*, Harvard University Press, 2012.

A professor of history at Marquette University describes how coastal development in mid-Atlantic and southern states after 1950 pushed many African Americans off their land.

Pilkey, Orrin M., et al., *The World's Beaches: A Global Guide to the Science of the Shoreline*, University of California Press, 2011.

Four prominent academic experts in earth science and coastal studies explain waves, tides, winds and other forces that make and alter beaches.

Articles

"Shifting Sands: Sandy's Lessons in Coastal Geology," U.S. Geological Survey, Nov. 15, 2012, www.usgs.gov/blogs/features/usgs_top_story/shifting-sands-sandys-lessons-in-coastal-geology/?from=textlink.

Damage from Hurricane Sandy left large sections of the East Coast more vulnerable to future storms. Adapting to those changes by relocating buildings may be more effective than trying to rebuild dunes that move naturally.

Florida, Richard, and Sarah Johnson, "Making Our Coastal Cities More Resilient Can't Wait," *The Atlantic Cities*, Nov. 1, 2012, www.theatlanticcities.com/jobs-and-economy/2012/11/making-our-cities-more-resilient-cant-wait/3758/.

Coastal cities are critical economic engines, so making them more resistant to natural disasters is urgent.

Frazier, Ian, "The Toll," *The New Yorker*, Feb. 11-18, 2013, www.newyorker.com/reporting/2013/02/11/130211fa_fact_frazier.

Staten Island bore much of the force of Sandy, and was the site of 23 deaths.

Klinenberg, Eric, "Adaptation," *The New Yorker*, Jan. 7, 2013.

Rotterdam and Singapore offer lessons for U.S. cities in flood-proofing.

Rudolf, John, et al., "Hurricane Sandy Damage Amplified by Breakneck Development of Coast," *The Huffington Post*, Nov. 12, 2012, www.huffingtonpost.com/2012/11/12/hurricane-sandy-damage_n_2114525.html.

New York and New Jersey had allowed intensive development in areas that were heavily damaged by Hurricane Sandy, despite known risks from direct storm hits.

Salkeld, Luke, and Ray Massey, "Thames Barrier Shuts for the First Time in Two Years to Prevent Flooding in London as Fresh Atlantic Storm Promises Yet More Rain," *Daily Mail*, Dec. 27, 2012, www.dailymail.co.uk/news/article-2253624/Thames-Barrier-shuts-time-years-prevent-flooding-London-fresh-Atlantic-storm-promises-rain.html.

Britain's wettest year on record led to activation of London's floodgates in late December.

Wallack, Todd, "Homeowners Question the Use of Storm Models," *The Boston Globe*, Jan. 6, 2013, www.bostonglobe.com/business/2013/01/06/air-worldwide-tracked-sandy-now-says-monster-storm-will-strike-new-england-someday/NrEB3QX7RxOxY30GmXXhvK/story.html.

Weather-modeling companies generate storm risk estimates that insurers use to set rates for homeowners.

Reports and Studies

"Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure," NYS 2100 Commission, January 2013, www.rockefellerfoundation.org/uploads/files/7c012997-176f-4e80-bf9c-b473ae9bbb-f3.pdf.

An expert panel convened by Gov. Andrew Cuomo after Hurricane Sandy to guide rebuilding and preparation for future disasters lists short-, medium- and long-term priorities to guide rebuilding.

Burkett, Virginia, and Margaret Davidson, eds., *Coastal Impacts, Adaptations, and Vulnerabilities: A Technical Input to the 2013 National Climate Assessment*, Island Press, 2013, http://downloads.usgcrp.gov/NCA/technicalinput/reports/Burkett_Davidson_Coasts_Final_.pdf.

A review by the U.S. Global Change Research Program, part of a periodic national climate study, finds that coastal U.S. communities will face many challenges adapting to climate change in the coming years.

Kousky, Carolyn, and Erwann Michel-Kerjan, "Hurricane Sandy, Storm Surge, and the National Flood Insurance Program: A Primer on New York and New Jersey," Issue Brief 12-08, Resources for the Future/Wharton Risk Center, November 2012, www.rff.org/RFF/Documents/RFF-IB-12-08.pdf.

A Washington, D.C., think tank and the Wharton School of Business estimate that the National Flood Insurance Program will need to increase its borrowing authority to pay claims in New York and New Jersey from Hurricane Sandy.

The Next Step:

Additional Articles from Current Periodicals

Climate Change

Gillis, Justin, "Sea Level Rise Seen as Threat to 3.7 Million," *The New York Times*, March 14, 2012, p. A1, www.nytimes.com/2012/03/14/science/earth/study-rising-sea-levels-a-risk-to-coastal-states.html.

Nearly 4 million Americans are at risk of being hit by more frequent coastal flooding in coming decades, says the research group Climate Central.

Spotts, Pete, "Surging Storms: Can the US Adapt in Time to Avert Coastal Damage?" *The Christian Science Monitor*, Nov. 13, 2012, www.csmonitor.com/Environment/2012/1113/Surging-storms-Can-the-US-adapt-in-time-to-avert-coastal-damage.

Experts say rising sea levels will make surge floods a lot more frequent in certain coastal "hot spots."

Tam, Donna, "Coastal Commission Exec Looks at Challenges Ahead," *Eureka (Calif.) Times Standard*, April 27, 2012.

Climate change will challenge future coastal developments, says the executive director of California's coastal panel.

National Flood Insurance Program

Ryan, Joe, "Homeowners on Insurance: That's Just Low," *Newsday* (N.Y.), Nov. 28, 2012, p. A4, www.newsday.com/business/in-oceanside-painful-insurance-lesson-on-base-ments-1.4266757.

The federal National Flood Insurance Program, unlike regular homeowner insurance, covers damage caused by flooding.

Spoto, MaryAnn, "Christie Demands Insurers Expedite Flooding Claims," *Star-Ledger* (N.J.), Feb. 6, 2013, p. 8, www.nj.com/news/index.ssf/2013/02/christie_unhappy_with_resoluti.html.

Republican Gov. Chris Christie of New Jersey says he is frustrated with how long it's taking the National Flood Insurance Program to process Superstorm Sandy claims.

Zito, Salena, "Rothfus Defends Vote Against Sandy Legislation," *Pittsburgh Tribune Review*, Jan. 17, 2013, triblive.com/news/adminpage/3239127-74/rothfus-bill-vote#axzz2Kicf6JuL.

Rep. Keith Rothfus, R-Pa., says the National Flood Insurance Program can't afford the best relief for Sandy's victims.

New York City

Peltz, Jennifer, and Peter Svensson, "NYC Urged to Build \$6B Barrier After Sandy," *The Associated Press*, Nov. 2, 2012, bigstory.ap.org/article/storm-invigorates-proponents-nyc-sea-barrier.

The damage caused by Hurricane Sandy has renewed calls

for the construction of a \$6 billion sea wall to protect New York City from storm surges.

Rosenthal, Elisabeth, "Hurricane Exposed Flaws in Protection of Tunnels," *The New York Times*, Nov. 10, 2012, p. A15, www.nytimes.com/2012/11/10/nyregion/hurricane-sandy-showed-vulnerability-of-citys-tunnels.html.

Many engineers have criticized New York City for not installing floodgates in its tunnels to safeguard against hurricanes.

Wells, Ken, and Mark Drajem, "Billions on Flood Barriers Now Might Save New York City," *Bloomberg*, Nov. 9, 2012, www.bloomberg.com/news/2012-11-09/billions-on-flood-barriers-now-might-save-new-york-city-1.html.

Putting floodgates at key points near Manhattan could cut future flooding by 25 percent, say engineers.

Regulations

Latini Jr., Charles, and James Rausse, "We Can't Afford More Sandys, So Let's Rebuild Intelligently," *Star-Ledger* (N.J.), Dec. 9, 2012, p. 5, blog.nj.com/njv_guest_blog/2012/12/we_cant_afford_more_sandys_so.html.

Coastal communities should require new developments to be more storm-proof, say two American Planning Association officials.

Loftis, Randy Lee, "Risks on the Rise for Texas," *Dallas Morning News*, Aug. 30, 2012, p. A1, www.dallasnews.com/news/state/headlines/20120829-scientists-warn-of-increased-risks-to-texas-from-hurricanes-and-tropical-storms.ece.

Inadequate building codes are reducing the ability of Texas coastal communities to handle natural disasters, says a Texas A&M landscape architecture professor.

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