

May 13, 2015

## Coastal Flood Resilience: Policy, Roles, and Funds

Congress and other policymakers are faced with how to cost-effectively reduce coastal flood risk. Issues include how to coordinate action and assign responsibilities for preparedness, mitigation, response, and recovery; who bears the cost of impacts and long-term adjustments; and how to finance actions to improve coastal flood resilience.

States largely determine whether the approach to coastal flooding is to protect (e.g., constructed dunes, gates), accommodate (e.g., elevate structures and infrastructure), or avoid and retreat (e.g., rolling easements that allow the shore to migrate inland). A state's approach can have implications for disaster resilience (including for public infrastructure), demand for federal assistance, and patterns and rates of recovery. Federal programs and policies can provide incentives or disincentives for nonfederal investment in coastal planning and risk reduction. The past decade has been marked by increased federal emergency funding for areas hit by coastal storms and increasing federal aid as a share of hurricane damages: 6% in 1955, 50% in 2005, 69% in 2008, and more than 75% in 2012 (see National Research Council, *Reducing Coastal Risk*, 2014). To what extent various federal programs and funds promote resilience (i.e., ability to recover from disruptions and adapt to changing conditions) is the subject of debate.

### Coastal Flood Development and Risk

U.S. coastal development historically was dominated by urban areas with ports and defense installations, such as Miami and Tampa–St. Petersburg, Florida; New York City/Newark, New York and New Jersey; New Orleans, Louisiana; and Virginia Beach, Virginia. More recently, smaller settlements have transformed into higher-density resorts and urban complexes. The resulting trend is for coastal flooding to threaten greater proportions of the nation's population, infrastructure, and investments. The flood hazard is shaped by a locale's meteorologic, hydrologic, and geologic conditions and by broader trends in sea levels and conditions. Flooding occurs with not only storms but also regular high tides that produce "nuisance" flooding. In 2014, the National Oceanic and Atmospheric Administration (NOAA) identified nonlinear increases in coastal nuisance flooding.

Flood vulnerability and consequences are shaped by land use and building code practices and investments in nonstructural protection (e.g., natural dunes, wetlands) and structural measures (e.g., barriers/gates, engineered dunes). Considerable variation exists across states and among local jurisdictions in the adoption, use, and enforcement of these measures. Variation also exists in the effort to maintain functional and intact wetlands and coastal forests as defenses from erosion and flooding. One 2014 study estimated the potential future economic impacts of storm

surge and sea-level rise on U.S. coasts cumulatively during this century at \$1 trillion (nominal 2005 dollars, undiscounted), assuming use of economically efficient protective responses (J. Neumann et al., "Joint effects of storm surge and sea-level rise on U.S. Coasts: New economic estimates of impacts, adaptation, and benefits of mitigation policy," *Climate Change*, 2014). Awareness of flood risk and its long-term fiscal impact historically has proven insufficient to motivate pre-disaster land use changes and investments in mitigation and protection.

### Federal Assistance

Most coastal flood-related federal spending since 2005 has consisted of emergency funds concentrated on storm-damaged areas, rather than competitively distributed. Support through the annual federal appropriations process typically has been for planning and technical assistance, with some cost-shared investment in mitigation and protection. For most years, annual spending for these activities has totaled less than \$200 million nationally for agencies with related missions: NOAA, Federal Emergency Management Agency (FEMA), and U.S. Army Corps of Engineers (Corps), as described below. State and local spending data on coastal flood activities is not available.

### National Oceanic and Atmospheric Administration

NOAA's primary role in coastal resilience has been to support planning and provide technical assistance, traditionally through Coastal Zone Management Act (CZMA; 16 U.S.C. 1451-1464) activities and more recently through the Digital Coast initiative. The CZMA concentrates on protecting, restoring, and developing coastal communities and resources. Under CZMA's voluntary program, coastal states and territories develop management plans. Once these plans are federally approved, states become eligible for grants, and federal actions in the coastal zone are required to be consistent with state plans. Managing development in high-hazard areas is a key element of most state plans. Coastal resilience has become one of NOAA's funding priorities, and CZMA grant program funding is used to support state efforts to reduce damages caused by coastal hazards (\$17 million in FY2014). In 2015, NOAA established the Regional Coastal Resilience Grants program to build community, ecosystem, and economic resilience, and it requested \$50 million for the program in FY2016. NOAA uses Digital Coast and its partnerships to provide state and local coastal managers with data, mapping services, training, and case studies.

### Federal Emergency Management Agency

FEMA's most prominent roles in coastal resilience are through the Hazard Mitigation Grant Program (which is funded based on a formula derived from individual declared

disaster expenditures) and the Pre-Disaster Mitigation program (PDM, which is annually appropriated). In recent years, the PDM program has been funded at \$25 million to \$30 million annually. After years of not requesting PDM funds, the Administration requested \$200 million for FY2016, signaling its increasing support for mitigation. Other efforts to support resilience through mitigation include FEMA's incorporation of sea-level rise into the benefit-cost analyses used to evaluate mitigation projects. Also, pursuant to the 2013 E.O. 13653, FEMA in 2015 updated guidance to require that state hazard mitigation plans (which are required for mitigation funding eligibility) as of 2016 consider long-term risk probabilities of future hazard events as well as changing future conditions.

### U.S. Army Corps of Engineers (Civil Works)

Since the 1950s, Congress has authorized the Corps to construct specific coastal storm damage reduction projects. The Corps also provides flood risk reduction technical assistance through various authorities. It leads the interagency Silver Jackets program, which is operating in 44 states; Silver Jackets consists of state-specific partnerships that focus federal assistance on state flood risk management priorities. In response to congressional direction, the Corps published a concept for a comprehensive response for the North Atlantic coast in 2015. The broad vision, strategy, and priorities for the federal role in coastal storm damage reduction projects nonetheless remain ill-defined. There is no guiding policy for categories of projects—shoreline protection, erosion control, and tide-related measures—although at congressional direction the agency constructs such projects.

Since 2005, the Corps coastal storm damage reduction funding has been dominated by the \$20 billion in emergency funds concentrated on projects in areas affected by Hurricanes Katrina and Sandy. The demand for Corps construction projects is much greater than annual appropriations. The Corps coastal storm damage reduction annual appropriations for FY2009 to FY2015 totaled \$0.6 billion (nominal dollars). The 113<sup>th</sup> Congress (P.L. 113-121) authorized expanded flexibility and opportunities for financing Corps projects (e.g., public-private partnerships, loan guarantees). What role these new federal authorities may play in enabling investments in coastal resilience infrastructure projects remains unknown.

### Other Federal Assistance and Activities

Timely and accurate information on coastal flooding can alter the near-term human impacts (e.g., by informing local evacuation) and long-term property losses (e.g., by providing estimates of combined effects of sea-level rise and storm surge). In 2015, the National Hurricane Center is to test new storm surge watch and warning maps. Coastal flood science relies on federal investments in data from remote observations (e.g., satellites), surface observations, and complex models. Notable gaps remain in understanding current and future coastal flood risks.

Significant public infrastructure is vulnerable to coastal floods. Flood resilience efforts are under way for highways and transit through the Department of Transportation; water

utilities through the U.S. Environmental Protection Agency; and energy systems through the Department of Energy. In 2014, the Department of Housing and Urban Development initiated a \$1 billion National Disaster Resilience Competition using Hurricane Sandy supplemental funding in which state and local government applicants engage in risk assessment and planning activities. Winning applicants are to be selected for design and implementation funds. Another federal funding source for Gulf of Mexico coastal infrastructure projects derives from the Deepwater Horizon oil spill settlement.

Many Obama Administration coastal resilience actions are related to climate change efforts. E.O. 13690 established a federal flood risk management standard for federal real property and actions. The State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience has recommended how to remove barriers to resilient investments and modernize federal grants and loans.

### Policy Challenges and Questions

In 2014, the National Research Council recommended developing a unifying policy on coastal risk and assessing the nation's risk, and the American Society of Civil Engineers published *Flood Risk Management: Call for a National Strategy*. In 2013, the Association of State Floodplain Management Foundation recommended a holistic coastal approach to achieve resilience. Such recommendations raise a basic question: How can local conditions and state and local autonomy be respected while attempting to both control federal disaster costs and create consistent, equitable policies that promote accountability and reward proactive resilience actions? To address this challenge, some stakeholders are pursuing innovations in project financing, especially for projects that integrate natural and built coastal environments that cut across traditional federal agency missions and programs. Others are concerned with more clearly defining federal and nonfederal responsibilities.

Other challenging policy questions include the following: What role could federal, state, and local tax reform and flood insurance have in eliminating incentives that increase coastal flood risk? Are federal policies promoting appropriately resilient adaptations for long-term community resilience? What would a coastal risk management assessment identify as priority data and mitigation investments? What are the coastal flood liability concerns associated with federal projects and activities? How will the federal government address the financing challenge of protecting federally owned properties, assets, and their functions? Would changes to federal involvement in disaster response and recovery alter state and local decisions and investments so that coastal resilience is a local enterprise receiving national assistance?

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