

Floods are not going to go away. Here's how we can make them less costly.



Devastating hurricanes in 2017 in Texas, Florida and Puerto Rico, and the recent landfall of Hurricane Florence in the Carolinas show that flood events are likely to affect the US with far greater frequency in the near future. [Beverly A. Cigler](#) takes a close look at why floods have become so much worse in recent years and what we can do to make them less costly both in terms of lives lost and resources. She argues that in addition to promoting green measures, rather than pulling back from flood mitigation as the Trump administration has proposed, the US government needs to do more to help the states to reduce flood hazards as well as promoting measures such as the National Flood Insurance Program.

In 2017, disasters worldwide cost \$330 billion making it the second costliest year in history, second only to 2011 when the Tohoku, Japan earthquake spiked losses. Last year also saw the highest insured losses ever (\$135 billion). Fortunately, fewer lives have been lost to natural hazards in recent years due to better forecasting, warnings, and emergency response. Floods, however, result in disproportionate effects on people and groups in terms of their ability to anticipate, cope with and recover from disaster events, with special needs populations often the most vulnerable.

US disaster losses in 2017 were mostly caused by three major hurricanes: Harvey (Texas); Irma (Florida); and Maria (Puerto Rico). Harvey spawned record rainfall—64 inches that flooded 200,000 homes and 13 toxic chemical sites. Irma's destruction was throughout all of Florida. Puerto Rico had the most extensive power outages in US history. Weather-related disasters are increasing in frequency and severity in the US and around the world – as we have been reminded by Hurricane Florence which has been inundating North and South Carolina.

Floods are the most costly disasters in terms of lives and property lost and people affected in the US. A March 2018 study [claims](#) that the US Federal Emergency Management Agency (FEMA) grossly underestimates flood risk, and finds that 41 million live in flood zones. Floods increasing occur with more severity, especially in the northeast and south-central regions. So called "Billion Dollar Disasters" occurred once every two years in the 1980s but have averaged 10 per year since 2010. The US national government spends about \$400 per household in an average year on extreme weather and spent \$1,100 per household in 2011. Yet another record was set in 2017. Disaster costs are overwhelmingly for response and recovery: only \$1 in \$10 is for mitigation, which can be structural, bricks-and-mortar projects, or non-structural, primarily land-use actions involving planning and zoning, education for risk awareness, and insurance.

So what causes floods, and why are they becoming more common?

Hurricanes and severe storms are a major cause of flooding, with sea level rise due to climate change exacerbating the damages and having devastating cumulative effects on communities. Nuisance flooding, inundation caused more by tides than weather, is a "slow disaster" for cities such as Washington, D.C., Miami, New York City, Seattle, and San Francisco, which keep data on flooding by the hour. Flash flooding occurs inland when rivers and streams receive heavy rains, which have increased since 1950 by 71 percent in the Northeastern US. Stormwater overflows and runoff from rain also cause floods, as do human-induced changes to the earth's surface from urbanization, farming and deforestation, careless building in hazard-prone areas, poor watershed management, and other human actions. It's important to remember that floods are natural occurrences, but they become costly disasters when people put people and property in harm's way.

Population and related changes directly increase flooding. Nearly 50 percent of the US population is within 50 miles of a coastline and the US has 3.5 million miles of shoreline on its oceans, lakes and rivers. Dozens of US communities face chronic inundation caused by high tides flooding 10 percent of usable non-wetlands 26 weeks per year. As population and population density increase, the severity of flooding and the number of communities affected are expected to rise significantly in future decades. For example, about 60 percent of all oceanfront communities on the East and Gulf coasts will fall under a high inundation scenario by 2100.

There is also more building in disaster-prone areas than in the past. More exposure results in greater economic loss because of more wealth. Insurable assets on US coastal areas, estimated to be \$10 trillion in 2012, have increased by about 15 percent since 2007. We “build to the past” and not for the future. Sea level rise and stronger hurricane winds cause greater storm surge and coastal inundation than previously. Half of the nation’s gross domestic product, \$4.5 trillion, is generated in the coastal counties and adjacent ocean waters.

The federal government is pulling back from flood mitigation

Current national government spending on floods is viewed as no longer sustainable. The national government pays 75 percent of disaster costs, arguably promoting moral hazard since state and local governments and their residents appear to be willing to take more risks, believing they will be protected. Since 2007, there have been more than 22,700 floods in the US. Presidential Disaster Declarations as current laws and regulations make it easier for local and small-scale events to qualify for national funds, leaving less money for large-scale disasters.

The Trump Administration seeks to reduce Federal Emergency Management Agency (FEMA) funding for mapping and grants, Community Development Block Grants for housing recovery, weather forecasting, and environmental justice. Executive Orders have been issued that reduce requirements to take into account the best available science on sea level rise when designing new buildings and public works and to elevate infrastructure in flood risk areas. Advisory committees on climate assessment have been disbanded. Proposals for renewing the National Flood Insurance Program (NFIP), the major mitigation tool in the US, suggest more cost-shifting to state and local governments. The NFIP was nearly \$25 billion in debt but Congress recently relieved it of \$16 billion of this debt. Still, subsidized premiums can’t keep pace with disaster payments and there is a large flood insurance gap that leaves many people and businesses exposed to flood risk but not covered by flood insurance.



“Flooding in Minot [Image 4 of 13]” by DVIDSHUB is licensed under CC BY 2.0

State and local governments are important to mitigating floods but do not have the tools to do so

State and local governments likely will bear more costs and responsibilities in the future because of cost-shifting and also because of what I call the “intergovernmental paradox of emergency management”: the governments least likely to perceive the threat of disaster as a very high priority (local governments) will bear the greatest responsibility, whereas the national government is concerned with the aggregate threat of disaster nationwide and has the most resources. Most local governments lack financial, managerial, technical, and political capacity to deal effectively with flood mitigation. The American states have been relatively weak capacity builders of their local governments and most play a weak regulatory role in land use, mapping, building codes, zoning, subdivision regulations, and other mitigation approaches.

There are massive problems confronting greater use of mitigation tools but the current mismatch between government powers and responsibilities and fiscal realities is likely to change dramatically as floods increase in frequency and severity. The national government does not possess the key powers needed to control land use, local transportation and economic development policies. It is in those policy areas that the policy tools best equipped to reduce flood hazards can be found. Land use and economic development policies, especially can affect where residential, commercial, and industrial entities are located, thus reducing risk to life and property in vulnerable flood hazard areas.

So, how can we reduce the costs of flood disasters?

No one “silver bullet” can deal with flood reduction and there are numerous structural and non-structural approaches. Structural mitigation involves engineered structures of concrete and cement—dams, seawalls, levees, floodwalls, etc. These are usually very costly large-scale public works or engineering efforts but they can offer a false sense of safety because human-built structures can fail. That was the case with the levees in New Orleans during Hurricane Katrina.

The American Society of Civil Engineers (ASCE) provides a report card for US infrastructure across 16 categories, including drinking and wastewater systems, levees, dams, bridges, ports, rail, and transit. The most recent US infrastructure overall grade was a “D+.” Non-structural mitigation—the array of land use tools, economic approaches, insurance, taxes, and incentives that can reduce flood occurrences and mitigate their impacts—can help infrastructure withstand many effects of flooding.

The National Flood Insurance Program (NFIP) is the most significant non-structural tool. This subsidized insurance program requires local governments that participate to use an array of specific mitigation tools and affects 56 states and territories and 22,000 US communities. Participating communities must meet some minimum standards before their residents become eligible for disaster assistance. If a community is in the NFIP it can be a voluntary participant in the Community Rating System program (CRS) that offers residents eligibility for premium discounts on their NFIP policies in exchange for taking flood mitigation activities. The highest rating for a community means that its property owners are eligible for a 45 percent discount on their insurance premiums.

Increasingly, natural defenses, which are mostly non-structural tools, are used for mitigation. Wetlands, green infrastructure and floodplain restoration are examples. Wetlands offer billions of savings each year in reducing storm surge damages and in providing other flood protection. Large green infrastructure projects are under current development in many locations along the Gulf Coast, South Florida, San Francisco Bay, New York City and the Carolina's.

Going green can reduce flood hazards

Green infrastructure is becoming especially important as a flood mitigation strategy. Single purpose gray infrastructure—the engineered conventional pipe drainage and water treatment systems, with pumps, ditches, manholes, and detention ponds—move stormwater away from the built environment. These systems are costly, but flooding caused by stormwater overflow in urban areas continues to increase. Techniques as simple as rain barrels or rain gardens move water away from the built environment at the source, thus reducing and treating stormwater and also lessening the flooding of roads, basements and other areas.

Communities can create stormwater authorities to assess fees for stormwater management. Natural areas, rooftop gardens, rain barrels, green landscaping techniques, and other approaches working together create a green infrastructure system as part of an overall stormwater management plan. Permeable pavements can be used, but most of the green approaches are non-structural land use techniques—landscaping, bioswales or vegetated and mulched channels; protected natural areas, conservation easements, stream buffers, protected wetlands; planting of trees. Blue landscaping through pond systems, swales or artificial buffer basins create green-blue infrastructure.

Mitigation works. Recent research from the National Institute of Building Sciences examined 23 years of federally funded mitigation grants and [found](#) that the US can save the nation \$6 in future disaster costs, for every \$1 spent on hazard mitigation. The research also found that using model building codes can save the nation \$4 for every \$1 spent. Implementing mitigation strategies related to just these two findings would prevent 600 deaths, 1 million nonfatal injuries and 4,000 cases of post-traumatic stress disorder (PTSD) in the long term. Designing new buildings to exceed the current international building codes would result in 87,000 new, long-term jobs and have an approximate 1 percent increase in utilization of domestically produced construction material.

Floods are natural occurrences that become costly disasters when people and property are placed in harm's way. And, people can mitigate the effects of flooding, but multiple efforts are needed to address the "intergovernmental paradox" and to reduce the unsustainable financial costs of flooding. Successful mitigation relies on basic good management techniques: planning, partnerships, collaboration, capability- or capacity-building, etc. Most significant is the realization that ultimately, building resilience through mitigating is both a community and a personal responsibility.

- *This article is based on the paper "[U.S. Floods: The Necessity of Mitigation](#)" in State and Local Government Review.*

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