



## Mitigation Matters: Policy Solutions to Reduce Local Flood Risk

Devastating floods are on the rise. Since 2000, flood-related disasters have cost the United States more than \$845 billion in damage to homes, businesses, and critical infrastructure, according to the National Oceanic and Atmospheric Administration.<sup>1</sup> The expense of adapting to more frequent and severe storms is projected to increase over the next several decades, placing a premium on the need to take action now to reduce flood impacts in the future.

Research from the National Institute of Building Sciences shows that every dollar spent on risk reduction measures—such as creating green space to help absorb floodwaters, buying out residents in at-risk areas who want to move out of harm's way, and adopting the most up-to-date building codes and standards—saves an average of \$6 in disaster costs.<sup>2</sup> Efforts to take advantage of this return on investment are beginning to gain traction at all levels of government.

At the national level, the Disaster Recovery Reform Act signed into law by President Donald Trump in 2018 dedicated a significant percentage of disaster-related spending toward helping communities prepare before storms strike. Congress is considering going further, with proposals that would provide communities with funds or incentives to reduce their risk of flooding. And the Federal Emergency Management Agency recently launched the Mitigation Investment Moonshot, which has a goal of quadrupling mitigation spending by federal, state, local, and tribal governments; corporations; nonprofits; and private foundations by 2022.

Many states and localities are also being proactive. Governors from South Carolina, Tennessee, and Texas, among others, have recently tasked officials in their administrations with improving natural disaster planning with local governments and recommending actions to minimize future flood impacts. Elected officials in other states are exploring effective ways to fund flood mitigation measures.

Noting the recent increase in such efforts, The Pew Charitable Trusts—in partnership with Dewberry—examined policies across the country and identified 13 states or cities that have adopted measures resulting in effective flood mitigation activities. Detailed in this set of 13 briefs, the policies fall into three categories: 1) using existing funds for mitigation by redirecting revenue and spending, 2) creating revenue sources for mitigation, and 3) establishing smarter regulations to reduce flood risk.

## Using existing funds for mitigation by redirecting revenue and spending

The research found that state and local governments are making long-term commitments to support flood mitigation efforts by establishing programs that draw from their annual budgets, such as grant and rebate programs, or by offering tax credits to help fund projects.

**Washington state's** Legislature has provided more than \$115 million in grants since 2013 for the state's Floodplains by Design program. The grants support projects to restore rivers and their flood plains and remove dams and other engineered systems that are no longer operating effectively. Grant programs such as **Wisconsin's** have funded the purchase of repeatedly flooded properties to allow people to relocate. The village of **South Holland, Illinois**, offers rebates to help residents afford mitigation projects that reduce risk to their properties, such as installing drain tile systems that move water away from their homes. To date, 1,172 households in South Holland—with a population of just 8,200—have used the rebates.

This type of government commitment to flood resilience is not limited to payouts. Some states are incentivizing projects by offering tax credits; **Arkansas**, for example, allows income tax credits for property owners who restore or create wetlands that absorb floodwaters.

And **Vermont**, through its Emergency Relief and Assistance Fund (ERAF), rewards communities that take mitigation actions by giving them more funds for recovery assistance when flooding occurs, while communities that have not taken such steps must pay more of their recovery costs.

Arkansas	Since the 1780s, Arkansas has lost over 70 percent of its wetlands, which absorb water and reduce flooding. <b>In 1995, the Legislature passed a rule to give landowners a tax credit for restoring, enhancing, or creating wetlands on their property.</b> Since then, the state has approved over \$4.5 million in tax credits for projects to protect or create wetlands and riparian zones.
South Holland, IL	South Holland is a small community on the Little Calumet River, 22 miles south of Chicago. Starting in the 1940s, development increased the number of paved surfaces and led to intensified flooding. <b>After a severe storm in 1990, officials launched a rebate program for residents who completed projects to prevent flooding on their property.</b> As of February 2019, 1,172 households have used rebates to install \$2.9 million in flood-proofing projects, with more than \$800,000 rebated to residents.
Vermont	When Tropical Storm Irene slammed into the East Coast in August 2011, flash floods in central and southern Vermont badly damaged many homes as well as roads, bridges, and other infrastructure. <b>The degree of destruction prompted the state’s Legislature to create the Emergency Relief and Assistance Fund, which gives more post-disaster assistance to cities and towns that have taken actions to prepare for floods, and less to those that haven’t.</b> Enticed by the promise of more aid, many communities in Vermont are taking steps to lessen the impacts of future storms.
Washington	Washington state is taking a holistic approach to flood mitigation. <b>The state created a grant program to help communities collaborate across entire watersheds to restore flood plains and let rivers return to their natural flow.</b> In 2013, a group of stakeholders, led by The Nature Conservancy, formed Washington Floodplains by Design and has since led projects to remove levees, reconnect flood plains to their rivers, and acquire land to help residents relocate from flood hazards. Since 2013, Floodplains by Design has distributed more than \$115 million in grants to improve flood resilience, with an additional \$50 million approved this year.
Wisconsin	The Great Flood of 1993 is considered one of the worst natural disasters in U.S. history. From June to August of that year, flooding across the Midwest, including Wisconsin, caused 50 deaths and \$15 billion in damage. To make communities more resilient, <b>Wisconsin’s Legislature created a grant program for local jurisdictions to acquire properties vulnerable to flooding.</b> From 2002 to 2018, the program funded the buyouts of 140 structures. The government then converted the land to open space, including wetlands and recreational areas, to absorb waters from future storms.

## Creating revenue sources for mitigation

Some states and cities are generating new revenue to fund flood mitigation measures by asking residents or the federal government to share the cost. **Minnesota** used bonds as well as a portion of its tax collections: After catastrophic flooding in 2010, the state’s Legislature began using \$50 million in bonds—leveraged partly by revenue from a higher gas tax—to make roads and bridges more resilient.

**Iowa** has established a flood mitigation fund, seeded by a local sales tax, to pay for measures that are designed to prevent significant costs—with one project alone expected to reduce future flood damage by nearly \$600 million. Other states have combined their own funding with financial assistance from the federal government; **Washington state** developed its Floodplains by Design program after using a federal grant to assess and address the root causes of its flood problems.

Both **Indiana** and **Maryland** have established revolving loan funds to help residents and communities pay for flood mitigation projects. Each state seeds its fund with state money, with the fund replenished over time as recipients repay the loans. Maryland’s fund has financed nearly \$3 million in loans to help protect more than 200,000 linear feet of shoreline.

Indiana	From January 2013 to October 2018, Indiana reported 987 floods, with damage exceeding \$10 million; an earlier storm, in 2008, caused over \$1 billion in damage. <b>The state's revolving loan fund allows communities to take out low-interest loans for projects aimed at curbing flooding.</b> Independent of federal revolving loan programs, Indiana's Flood Control Revolving Fund operates entirely with state resources.
Iowa	In 2008, devastating floods left Iowa with \$10 billion in estimated damage. <b>The state used funding from a combination of federal awards and a sales tax increase for projects to reduce flood risk.</b> As of October 2017, Iowa had approved 10 such projects at a cost of \$1.4 billion, with \$596 million from sales tax revenue, \$360 million from local dollars, and \$425 million from federal funds.
Maryland*	Maryland has been battered by six severe storms with associated flooding since 2011. <b>To combat erosion along its 7,000 miles of shores and reduce the impacts of floods, the state created a fund that provides low-interest loans to property owners for installing or restoring "living shorelines" along waterways.</b> These projects consist of plants and other natural elements that help stabilize coastlines and act as barriers against rising seas and storm surge. Since its inception in 2011, the Shore Erosion Control loan program has distributed nearly \$3 million in loans for 475 projects, protecting over 200,000 linear feet of shoreline and creating more than 3.7 million square feet of marsh.
Minnesota	After design failures caused a devastating bridge collapse in 2008, the Minnesota Department of Transportation took a hard look at the resiliency of its transportation networks. <b>The state used bonds, funded through a higher gas tax, for \$50 million in projects to make the state's roadways less vulnerable to severe weather.</b> Since 2011, the funding has supported 34 flood resilience projects, such as raising roadways and bridges.

## Establishing smarter regulations to reduce flood risk

Some jurisdictions have used regulatory strategies to help guide less risky development in order to reduce the impact of flooding. **Norfolk, Virginia**, for example, updated its city zoning ordinance to account for sea level rise, rather than relying solely on historical data; the changes included the creation of a scoring system that encourages development in safer areas.

To protect its coasts from sea level rise and storm surge, **Maryland** requires property owners to opt for natural solutions to prevent erosion—instead of using hard structures, such as seawalls and levees—unless they can prove that such methods would not work on their property.

In **Milwaukee**, the city set ambitious permitting goals to help embrace nature-based solutions, supporting projects such as green roofs and native landscaping.

**Brevard, North Carolina**, established one of the nation's most robust flood-related regulations: a no-adverse-impact certification, designed to ensure that building in a flood plain doesn't lead to flood problems for communities downstream. And in Colorado, **Fort Collins** enacted forward-thinking regulations limiting the amount and type of development in flood plains for the Cache la Poudre River. The change helped the city achieve greater resilience during heavy flooding in 2013.

Brevard, NC	Lying in the foothills of the Appalachian Mountains in southwestern North Carolina, the small city of Brevard experiences heavy rains and tropical storms—making it one of the wettest areas in the United States, second only to the Pacific Northwest. <b>To reduce Brevard's vulnerability to flooding, the city requires developers to secure a no-adverse-impact certification for construction in flood plains to help ensure that development projects don't worsen flood risk for other property owners.</b> The regulation has helped lower flood insurance premiums for many residents.
Fort Collins, CO	In July 1997, a storm dumped 14.5 inches of rain on Fort Collins, Colorado, in about 30 hours. Five people died, and damage to homes and businesses totaled more than \$250 million. <b>The event catalyzed city officials to pass regulations prohibiting new residential construction in areas with high flood risk.</b> In September 2013, when floods devastated many parts of Colorado, the city was relatively unscathed: Nearly 14,000 structures had been built in Fort Collins since the 1997 flood, and only eight of those were damaged.
Maryland*	In addition to its loan program, the state established a policy in 2008 requiring shoreline erosion projects to first consider nature-based solutions as a mitigation tactic.
Milwaukee	<b>Wisconsin's largest city uses green infrastructure to curb flooding and treat wastewater.</b> The city has bought land and created natural storage basins, among other measures, to boost its stormwater capacity. In 2014, green infrastructure helped the city capture an additional 12 million gallons of water; in 2019, Milwaukee set a new goal of capturing 50 million gallons.
Norfolk, VA	The second-most populous city in Virginia boasts more than 200 miles of shoreline. In recent decades, changing precipitation patterns and sea level rise have led to recurrent flooding. In 2018, <b>the city revised its zoning ordinance to include tougher standards for construction in flood-prone areas.</b> The ordinance includes requirements that encourage growth in less risky areas.

\* Maryland's mitigation actions fall into both the new or replenished revenue and low-cost regulations categories.

## Lessons learned

States and local jurisdictions plan for and mitigate future risks based on their unique needs and circumstances. Nevertheless, the actions featured in the policy briefs provide a variety of lessons for other jurisdictions to consider as they develop their own mitigation policies.

- **Invest in planning—and understand the risks**

Some of the most effective mitigation policies first took shape following efforts to understand the root of a flooding problem. Officials in Washington state used an Environmental Protection Agency grant to study the state's flooding problem before presenting a solution to the Legislature. Minnesota assessed flood impacts to transportation assets, such as roadways and bridges, and identified projects based on the costliest and most frequent closures of those assets due to flooding. In both cases, officials maximized the effectiveness of limited funding by being deliberate in examining vulnerability to floods and the greatest sources of possible disruption.

In South Holland, Illinois, a resident committee assessed options for combating flooding, leading to a proposal that eventually became the city's rebate program—which has since led to more than 1,000 households strengthening their properties against flood risk. On a larger scale, Iowa dedicated an agency to studying flood models and related patterns.

- **Use regulations and cost-shares as cost-effective options**

Several states and localities are driving down the cost of flood mitigation by using regulations to guide development away from high-risk areas as well as establishing policies that maximize the value of relatively small upfront government investments.

Fort Collins' flood plain regulations, Norfolk's zoning ordinance, and Brevard's no-adverse-impact certifications are helping to ensure that housing, infrastructure, and other assets are located away from vulnerable areas, thus minimizing damage when floods occur. Indiana's revolving loan fund maximizes the impact of a relatively small investment by making low-interest loans for mitigation projects to jurisdictions that then repay them so that others can take out similar loans.

Other policies leverage cost-sharing, in which jurisdictions combine their own resources with funding from individual homeowners and other levels of government to cover the expense of flood mitigation. Wisconsin's buyout program, for instance, provides up to half the cost for local mitigation projects, and municipalities make up the remainder.

- **Tap into nature-based solutions**

When designing policies to improve disaster resilience, some states are leveraging the benefits of nature-based solutions, such as creating open spaces and restoring wetlands, which serve as buffers between oncoming storms and otherwise vulnerable communities.

Maryland's living-shorelines regulations prioritize the use of native plants and other natural elements that stabilize coastlines, reduce erosion, and mitigate flood damage, as opposed to structures like levees and seawalls. Buyout programs such as Wisconsin's can replace hard surfaces such as concrete with green spaces such as parks and wetlands, which better absorb rainwater and bring additional benefits to communities, including providing places for recreation.

Officials in these states and others are nurturing more sustainable communities by weighing the impacts of development decisions on natural flood plains. And some places are moving to policies that reverse previous actions that manipulated bodies of water, such as Washington state's history of straightening its rivers and Milwaukee's lining of streams with concrete. Some communities have come to realize that these disruptions of natural waterway functions actually increased their flood risk and have since turned to nature-based solutions.

- **Communicate the benefits and engage stakeholders**

Many programs' effectiveness depends on whether communities understand how to take advantage of them, and how well municipalities collect feedback and improve the programs. Arkansas's tax credit incentive has proved immensely popular in communities where awareness has spread through word-of-mouth, but other communities in the state have not seen the same level of interest. And while a significant portion of residents have used South Holland's rebate incentive, program managers believe more would take advantage of it if they better understood the benefits.

In Iowa, officials have used the state's network of Water Management Authorities to bring stakeholders into the conversation about curbing floods and to ensure that their concerns about the state's mitigation program are addressed.

- **Make policy changes part of recovery efforts**

As communities try to recover after flooding, some legislatures have responded by passing forward-thinking laws aimed at lessening the impacts of future floods. For example, after Tropical Storm Irene, lawmakers in Vermont created the ERAF program, which rewards localities that take measures to reduce their future risk.

Likewise, in Norfolk, the persistent problem of sea level rise motivated officials to improve the city's zoning ordinance, buoyed by polls showing that 70 percent of city residents were concerned about flooding. As communities encounter more frequent and widespread damage from storms or rising seas, they can harness residents' awareness and concern to initiate positive change.

## **Conclusion**

Pew's research highlights state and local policies and regulations that have been important catalysts for flood mitigation. As green spaces expand, wetlands recover, natural shorelines are created, infrastructure becomes more resilient, and homes are removed from or not built in vulnerable areas, communities are reducing the impact of future floods.

Although there is no one-size-fits-all solution to the threat posed by more frequent and severe flooding, the 13 policy briefs provide a variety of models for officials to consider when trying to make their own communities more resilient.

## **Methodology**

Pew contracted with Dewberry, a consulting engineering firm, on the 13 briefs. Dewberry conducted a literature survey of jurisdictions across the U.S., identifying a range of state and local policies designed to drive increases in pre-disaster mitigation. Local officials and representatives from 17 expert organizations were consulted to understand the impact of the policies in order to draw a connection between a policy and mitigation activity. Two external reviewers—Nate Woiwode, project manager of The Nature Conservancy's North American Risk Reduction and Resilience team, and Elizabeth Albright, assistant professor of the practice of environmental science and policy methods at Duke University's Nicholas School of the Environment—provided expert insight. Neither they nor their organizations necessarily endorse the findings.

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## Endnotes

- 1 National Oceanic and Atmospheric Administration, National Centers for Environmental Information, “Billion-Dollar Weather and Climate Disasters” (2019), <https://www.ncdc.noaa.gov/billions/events>.
- 2 National Institute of Building Sciences, “Natural Hazard Mitigation Saves: 2017 Interim Report” (January 2018), <https://www.nibs.org/news/381874/National-Institute-of-Building-Sciences-Issues-New-Report-on-the-Value-of-Mitigation.htm>.

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