



## *Observations*

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# **How Cities Can Protect Themselves from Rising Waters**

Climate change is already leading to unprecedented flooding, but urban planners have many tools to help them keep things dry

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By Ziqian (Cecilia) Dong on March 28, 2019



Credit: Dennis K. Johnson *Getty Images*

Across the U.S., policymakers are scrambling to protect their communities from the effects of climate change.

In January, Massachusetts Governor Charlie Baker proposed real-estate tax increases to fund dam and drainage system upgrades, which would help residents cope with future floods and storms. Meanwhile, a few months earlier, officials from several Florida counties agreed to work together to minimize the damage caused by rising sea levels.

Adaptation efforts like these are crucial. Four in 10 Americans live in coastal areas, and this population will surge in the coming years. Sustained flooding can cripple homes and infrastructure like roads, bridges, subways and wastewater treatment plants.

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Policymakers have limited time and resources, so they should rely on the latest computer modeling and other technologies to identify and implement the most efficient adaptation strategies.

Rising water levels have already wrought havoc across the country. From 2000 to 2015, coastal "sunny day flooding," or flooding caused by high tides rather than storms, more than doubled on the Southeast's Atlantic coast, according to the

National Oceanic and Atmospheric Association. And it increased 75 percent on the Northeast's coast.

Climate change is also making storms more destructive and frequent by heating up ocean waters, increasing flooding. The United States experienced its most expensive hurricane season in history in 2017; storms caused more than \$300 billion in damages. Flooding and other damage from Hurricane Harvey alone forced 37,000 Texans into shelters in September 2017. Last year, Hurricane Michael caused at least 45 deaths and more than \$12 billion in losses.

Worse still, our country is losing natural defenses against flooding. Between 2004 and 2009, 80,000 acres of U.S. coastal wetlands—which soak up flood waters—disappeared each year, largely as a consequence of development. Mangrove forests—which help block sea waters—are also declining, thanks to human activity. Mangrove acreage at Lake Worth near West Palm Beach, for example, has plummeted 87 percent within the past four decades, according to government data.

Floods and storms will grow more intense in the coming decades. Computer modeling and visualization tools can help us identify the weakest links and plan strategically.

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Consider work by researchers at Texas A&M University. They conducted a simulation of Southeast Florida that demonstrated how rising seas will damage the road network. It found that installing water pumps now would save money in the long run. Another analysis showed the effects of saltwater intrusion on water wells and identified which wells were in need of upgrades.

Or take [IN-SOURCE](#), a 3-D modeling framework and visualization tool that my team at New York Institute of Technology, along with partners in the U.S., Germany and Austria, is developing. This visualization tool will enable utility companies and government officials to identify areas that are most vulnerable to extreme weather events and assess the effectiveness of potential infrastructure improvements.

Various emerging technologies can help communities get the most out of their investments. For one, [microgrids](#): the tiny electric grids that can supply a single building or neighborhood with electricity, usually generated from renewable energy sources. These distributed power sources can operate independently and don't rely on miles of power lines, so they're less vulnerable to extreme weather events.



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Putting critical food or water distribution centers on their own microgrids could help people and their cities be more resilient to future superstorms. The Hunts Point food-distribution center in Bronx, New York, for example, which provides 60 percent of metro New York's produce, meat and fish, is located in a flood zone. With a microgrid, this center could keep running even if power lines go down.

Spending money up-front to evaluate adaptation initiatives saves money in the long run. Consider one project in St. Paul, Minnesota. Storm water runoff caused frequent local flooding in the Capitol Region Watershed District. Officials evaluated several plans and decided on a strategy that utilized green infrastructure and special techniques like rain gardens—in which shrubs and plants capture rain water. Thanks

to these improvements, flooding decreased dramatically. And the plan was found to be cost-effective.

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Meanwhile, in Portland, Oregon—which was ravaged by a monstrous flood in 1996—officials have taken many steps to improve flood management using green infrastructure. They reported that putting just \$9 million into such initiatives saved \$224 million in sewer overflow costs—so far.

Communities—both in the U.S. and worldwide—must prepare now for severe storms and rising seas. New technology can help them invest their resources wisely. And with the right infrastructure upgrades, communities can minimize future damages and save lives.

*The views expressed are those of the author(s) and are not necessarily those of Scientific American.*