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DISASTERS

A Year After Sandy, Living Dangerously by the Sea

Sea-level rise amplified the devastating coastal flooding caused by Superstorm Sandy. Climate change and population growth will raise the risk — unless we act soon

By Bryan Walsh | Oct. 29, 2013



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Mario Tama / Getty Images

Homes built near a bridge sit destroyed due to Superstorm Sandy in Mantoloking, New Jersey October 31, 2012.

Earlier this month I stood outside the Babbio Center at the Stevens Institute of Technology in Hoboken, N.J., looking out over the Hudson River toward Manhattan. When [Hurricane Sandy](#) struck the [New York](#) area on Oct. 29 of last year, the storm pushed the river over its banks, and the narrow streets of the New Jersey city filled with water like a bathtub. Standing next to me that day were Alan Blumberg and Tom Herrington, ocean engineers at Stevens. Before Sandy hit, Blumberg and Herrington had predicted the massive extent of the

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flooding that would result from the storm and the damage that would be done to Hoboken, which at its border along the Hudson sits just 4 or 5 ft. above the river — even less at high tide, which happens to be when Sandy made landfall.

Today the scientists and their colleagues at Stevens are trying to improve those coastal-flooding models to better predict the precise flow of floodwater for the next storm, in an effort to aid future evacuation plans. But Blumberg and Herrington are painfully aware that, thanks to [climate change](#) and rising sea levels, coastal cities like Hoboken and New York will be in even greater peril when the next Sandy hits. “Many of the bulkheads and seawalls here are only about 3 ft. above the water,” says Herrington. “If you raise the sea level and the bulkheads stay the same, you have more and more flooding for your infrastructure. Everything we’ve built is too low.”

Here’s a fact about Sandy that might surprise you: when the storm made landfall in New Jersey on Oct. 29, it [wasn’t actually](#) a hurricane. Its wind speed had fallen below the 74 m.p.h. sustained velocity that’s needed to change a tropical storm into a hurricane. Instead Sandy was officially a “post-tropical cyclone.” And while the storm certainly [dropped a lot of water](#) on the belt of heavily affected states between South Carolina and New York — 7 in. or more in many places — it wasn’t the precipitation alone that led to the devastating floods that followed in its wake, causing more than \$68 billion in damages. What made Sandy devastating was its size, covering more than 1,000 miles, the coastal storm surges it caused, and the way the force of the cyclone — which took an unusual path almost directly at the East Coast — pushed the sea and rivers up and over onto land, spilling out into streets and inundating nearby infrastructure. At the Battery at the southern end of Manhattan, [storm surges](#) of 9 ft. above normal were recorded. All told, Sandy broke 16 records for the highest storm tide ever. Just about everything that followed — the flooded homes and hospitals, the blackout that denied power to half of Manhattan, the transportation mess — could be traced back to those surges.

And that's what makes the threat of another Sandy so grave. The storm was the inevitable consequence of piling more and more people along coasts that are threatened by rising seas.

(PHOTOS: Before and After Sandy, a Year of Recovery)

Scientists disagree on exactly how climate change will affect future tropical storms. (See this year's [hurricane season](#), which has featured virtually no storms after dire [forecasts](#) in the spring.) But here's something we know for sure: [123 million Americans](#), more than a third of the entire country, live in coastal counties, a number that increased by 39% from 1970 to 2010. About 3.7 million Americans [live](#) within just a few feet of the sea at high tide, putting them at even more extreme risk for coastal flooding. And the ocean they live next to is rising. In New York, seawaters have risen by about 16 in. since 1778, [according to research](#) by Tufts University geologist Andrew Kemp, while global sea levels [have risen](#) by a little over 7 in. on average over the past century. That translates to more devastating flooding. "For every ~~inch~~ foot of sea-level rise, you have an additional 300 ft. of reach inland for floods," says Leonard Berry, director of the Florida Center for Environmental Studies at Florida Atlantic University.

That rise has already had an effect on storms. A recent [study](#) published in the *Bulletin of the American Meteorological Society* found that existing sea-level rise had already doubled the annual probability of a Sandy-level flood in the New York region since 1950, and areas outside the city, including the New Jersey shoreline, face an even higher risk. "Today's coastal infrastructure ... is steadily losing ground due to relative sea-level rise," said William Sweet, an oceanographer at the National Oceanic and Atmospheric Administration and a co-author of the study. As temperatures continue to rise thanks largely to man-made carbon emissions, so will sea level. In its most recent report, the Intergovernmental Panel on Climate Change [predicted](#) that sea level could rise 20 to 38 in. by the end of the century if nothing is done to slow the pace of carbon emissions. Absent better coastal protection, higher seas make even relatively weak storms a danger — and turn big storms like Sandy into catastrophes. "It's like you're trying to dunk a basketball, and someone just raised the court by a few feet," says Blumberg. "That's how sea-level rise works."

The costs will add up, especially if we keep adding people and property to those threatened coasts. A recent [study](#) in *Nature Climate Change* predicted that average global flood losses could rise from approximately \$6 billion per year in 2005 to \$60 billion to \$63 billion per year by 2050, thanks to the multiplying effects of population and economic growth as well as climate-change-driven sea-level rise. "There's been just remarkable development along the coast," says Scott Knowles, a professor at Drexel University and author of *The Disaster Experts: Mastering Risk in Modern America*. "It's not that the storms are necessarily worse in any objective way. It's that we have put more people and property in harm's way."

(MORE: As Tropical Storm Karen Dissipates, the Debate Grows Over a Quiet Hurricane Season)

The easiest way to reduce the danger from future storms is to reverse that shift to the sea, and move people and property away from the coast. That's happening in some places. New York City's \$648 million Build It Back program [will support](#) homeowners of flooded properties who don't want to rebuild, and instead want to move, while New York Governor Andrew Cuomo has a separate plan to [buy out property](#) in hard-hit Staten Island and return it to nature. But so-called coastal retreat is likely to remain a last-resort choice, though the [rising cost of flood insurance](#) could change the calculation for some. We're not moving New York City or New Orleans, and threat of floods doesn't seem to be enough to overcome the temptations of living by the water, even after Sandy showed how

destructive that water can be. “Let me be clear,” New York City Mayor Michael Bloomberg [said](#) in Sandy’s aftermath. “We are not going to abandon the waterfront. We are not going to leave the Rockaways or Coney Island or Staten Island’s South Shore.”

So if we’re going to keep living in harm’s way, we have to do our best to reduce the harm. That means prioritizing resilience, which has replaced adaptation as the term of choice for city planners. Resilience means understanding that disasters like storms and floods will happen — there’s no adapting them away — and what we need to do is build homes, communities, cities and countries that can take the punch of a Sandy without hitting the canvas for the count. It means being creative about the challenges we’ll face, knowing that they’ll evolve in the future. “Cities have a tendency to prepare for the thing they got hit by in the past,” says Mitch Landrieu, mayor of New Orleans. “We have to be ready for anything that might come our way, and be flexible about what we’ll need to respond.”

New York City, which absorbed some of the worst of Sandy’s wrath, has taken that challenge seriously. Bloomberg [proposed](#) a \$20 billion plan earlier this year meant to toughen the city against floods and storm surges. Much of that money would go to build flood walls, levees and bulkheads — though nothing as extensive as the massive seawalls that protect [Dutch cities like Rotterdam](#), which would likely be too expensive and too disruptive for New York. But funds would also go to softer defenses like sand dunes, as well as reinforcing the city’s power grid, which was shown to be vulnerable to storms after Sandy. “If we’re going to rebuild, we should build back new and better,” says Judith Rodin, president of the Rockefeller Foundation and a co-chair of NYS 2100, a New York State panel tasked with providing recommendations for Sandy recovery. “If we spend more on prevention, we can avoid the billions we need to spend on recovery.”

That’s the goal, anyway. But the truth is that there’s no guarantee that Bloomberg’s ambitious vision for a more resilient New York will ever become a reality. The billionaire mayor will be leaving office soon, and the money that plan requires — while much of it would come from federal funds — could hold back his successor. And what’s scary is that New York is far from the only coastal city to face such threats. Low-lying Miami has more than \$416 billion in assets at risk to storm-related flooding and sea-level rise, the largest amount in the world. As Jeff Goodell [described](#) in an excellent piece for *Rolling Stone* earlier this year, Miami as it is now may be doomed. “Superstorm Sandy is a measure of the way things will happen,” says Berry, of the Florida Center for Environmental Studies.

A year after Sandy, the risk from coastal living just keeps rising, while we struggle to keep pace. And we’ll pay the price — one way or another.

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