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The oceans are advancing. The result threatens communities not only on the beach, but far from it, too

RISING TIDES

BY MATT ALDERTON
ILLUSTRATION BY YUTA ONODA

THE MUD IN FOLSOM LAKE, NEAR SACRAMENTO, IS DRY and chapped, like cracked heels. The bottom of the reservoir, once under water, is largely barren, save for its shallow center and a smattering of stray puddles.

That's because California is in the midst of one of the worst droughts in state history. Conditions are so bad that Gov. Jerry Brown declared a state emergency in January. He urged state residents to voluntarily reduce personal water consumption by 20 percent.

In the context of having so little water, it might seem strange to worry about having too much. And yet, that's exactly the dilemma facing California today. Even as it reels from drought, it must begin planning for floods. And make no mistake: Floods are coming. Not only to California, but to coastal cities across the country and around the world, which face a certain influx of water as oceans rise under the specter of climate change. »

RISING TIDES

MORE FLOODS, MORE OFTEN

Multiple forces are colluding to make the oceans swell.

One is warming oceans. “Because of that, you have an expansion of ocean waters, and the only place they can go is up,” says Rachel Cleetus, a senior economist in the Climate and Energy Program at the Union of Concerned Scientists, an alliance of citizens and scientists who collaborate on solutions to global problems.

Another is melting glaciers and ice sheets. “You’re adding volume to the world’s oceans, and that’s causing them to rise,” Cleetus says.

Because the rate of ice loss is accelerating, oceans are rising faster than ever before. Cleetus says sea levels could rise anywhere from 8 inches to 6.5 feet by the end of the century. Some scientists put estimates as high as 10 or 15 feet. That’s on top of approximately 8 inches of sea level rise already logged in the last century.

“Those 8 inches of sea level rise from climate change are already making every single coastal flood bigger, deeper and more damaging,” says Dr. Ben Strauss, director of Climate Central’s Program on Sea Level Rise.

Although scientists project sea level rise through the year 2100, communi-

ties likely will be affected sooner. The culprit? Incremental storm surges.

“It’s not like it’s going to be business as usual until 2099, when you have to sell your house because next year the whole thing is going to be under water,” says Dr. Andrew Kemp, assistant professor of coastal processes and climate change at Tufts University. “Long before that happens, you’re going to see smaller and smaller storms that cause floods more and more frequently.”

And that’s to say nothing of big storms, which likely will be more frequent in a warmer climate.

Last year, the National Oceanic and Atmospheric Administration released a study of how climate change contributed to Superstorm Sandy. The findings were stunning: “If you have the amount of sea level rise that we are expecting to see, 50 years from now you’ll see flooding like that experienced by New York and New Jersey during Sandy every other year,” says Rob Moore, head of the Water & Climate team at the Natural Resource Defense Council.

A RIVER RUNS THROUGH IT

By 2100, sea level rise could threaten an average of 9 percent of the land within 180 U.S. coastal cities, according to a 2011 report from the University of »



Parts of Ronald Reagan Washington National Airport across the Potomac River from Washington, D.C., could be swamped in a few decades. Also at risk: some of the major D.C. monuments.

SURGING SEAS

Scientists are already attempting to predict where rising water will have the most impact. Climate Central, a nonprofit organization dedicated to communicating the science and effects of climate change, has estimated the threat from sea level rise for more than 3,000 communities in the continental U.S.

“We analyzed 55 different water level stations throughout the United States and found that for about two-thirds of them, sea level rise from climate change has already more than doubled the risk of extreme flooding,” says Dr. Ben Strauss, director of the organization’s Program on Sea Level Rise.

Based on the analysis, Climate Central developed Surging Seas, an interactive website (sealevel.climatecentral.org) that maps the flood threats from sea level rise and storm surges. The map shows how the coastal communities would be affected if sea levels were to rise from 1 foot to 10 feet.

“Sea level rise is already happening, and its continuation is inevitable,” Strauss says. “At some point it will be obvious to every family living in a coastal area, and every community will be looking to protect itself.”

— Matt Alderton

RISING TIDES

Arizona. The report names Miami, New Orleans, Tampa and Virginia Beach, Va., among the most vulnerable U.S. cities.

If you think that sea level rise affects only oceanfront homes on beaches and islands, think again. In fact, sea level rise promises to impact inland neighborhoods, too, particularly in low-lying areas near rivers and streams.

In Boston, sea level rise could bloat the Charles and Mystic rivers, endangering Cambridge and Everett, Mass. In the mid-Atlantic, the Potomac River could swallow parts of Alexandria, Va. Even parts of Seattle could be sopping wet at high tide in a matter of decades.

“There are pockets of vulnerability around the whole nation,” Strauss says.

One of the most surprising pockets is Sacramento, 25 miles southwest of drought-stricken Folsom Lake. At least 80 miles inland, it sits at the nexus of the Sacramento and American rivers, both of which flow into the Pacific Ocean by way of San Francisco.

“Sacramento was a river delta, and the way they secured the land 150 years ago was to build levees and let the land dry out,” explains oceanographer John Englander, author of *High Tide on Main Street: Rising Sea Level and the Coming Coastal Crisis*. “Of course, nobody thought sea level would change that much in a century, so now the design of those levees is insufficient.”

The Sacramento neighborhood of North Natomas is a window to the potential impact of sea level rise. In the early 2000s, the area blossomed. Building was prolific, businesses were growing and home values were rising.

Then came Hurricane Katrina. Because Sacramento has the same levee system as New Orleans, the U.S. Army Corps of Engineers decided to inspect it in 2006. Deficiencies, it found, were rampant and levee failure imminent. The Federal Emergency Management Agency (FEMA) declared North



Chris Lattuada stands next to a drainage canal near his home in Sacramento. He's one of many homeowners required to carry flood insurance because they live in a low basin surrounded by deteriorating river levees that are being repaired.

Natomas an immediate flood risk and began requiring flood insurance of all local mortgage holders. Soon after, in 2008, it put a moratorium on new construction in North Natomas that won't be lifted until the levees are repaired, a project that's still ongoing while FEMA awaits federal funding.

“Everything came to a stop,” says North Natomas real estate agent Joan Dunn. “Builders moved out, land became vacant and the market started to crash. Everything went downhill.”

Homeowner and general contractor Chris Lattuada bought his North Natomas home in 2000. Because he had already purchased flood insurance, he was grandfathered in at a low annual premium of approximately \$300 when FEMA made it mandatory. Other families, however, have seen premiums quadruple to \$1,300 annually, he says.

“Home values went way up when there was a boom, but now they've gone back down to where they were when we purchased,” Lattuada says. “What troubles us is: Are values going to stay stagnant because of the flood

issue? They were going to build more schools, more houses, more businesses. But now it's all stopped. What does our neighborhood look like in the end?”

The answer depends largely on the condition of the levees. “If the levees aren't fixed, and we have a disaster, we're screwed,” Dunn says.

A PAINFUL COST

The pain points of living in a flood plain — stringent building restrictions, low home values, high insurance premiums — will only become more painful as water levels rise. And although it may sound harsh, that's kind of the point.

“I really sympathize with people,” Cleetus says. “This is not an easy conversation to have. People have lived in certain places for a long time, and there's a lot of emotional attachment. ... But you want people to understand that there's a cost to living in high-risk areas.”

Back in North Natomas, Lattuada's staying put. “There's risk everywhere,” he says. “I'm not worried. We don't plan to leave any time soon.” ●