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Hurricane Matthew's Destructive Storm Surges Hint at New Normal

The coastal U.S. is highly vulnerable to rising seas, which are expected to surge in the coming years. Will this storm be a wake-up call?

Waves pound a pier on Pompano Beach, Florida, spurred by Hurricane Matthew. The state is ill-prepared for rising seas, experts warn.

PHOTOGRAPH BY GASTON DE CARDENAS, AFP/GETTY

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By **Laura Parker**

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As Hurricane Matthew pushes floodwaters into seaside towns from Florida to the Carolinas, climate scientist Andrea Dutton wonders if the most powerful hurricane to hit the United States in a decade will serve as a wake-up call to the perils of rising seas.

The vulnerable coast needs to pay attention, says Dutton, who teaches geology at the University of Florida in Gainesville.

"Matthew can help to change the conversation, in the way that Katrina did in New Orleans," she says.

"When all these cities were developed, sea level was very stable. Our whole way of life is set up around the concept of having a stable coastline. We are entering a new normal. We need to redefine our relationship with the coastline and that means rethinking a lot of different things."

Yet along the eastern seaboard, in some communities, state and federal lawmakers are still debating the existence of climate change, even as the seas rise incrementally higher on their beaches. (See photos of Matthew's destruction.)

In Florida, where the streets of Miami Beach and Fort Lauderdale flood regularly at high tide, Gov. Rick Scott famously avoids the subject of climate change and Marco Rubio, running for re-election to the U.S. Senate, does not accept climate science. In North Carolina, legislators "outlawed" efforts to study the impact of sea-level rise on the ribbon of barrier islands known as the Outer Banks (which scientists warn are in peril).

Consequently, most planning that is being done occurs at the local level, where few cities and counties have the money to fund the kinds of big projects needed to adapt to their changing circumstances.

"If you look at Louisiana, post-Katrina, they have a very extensive coastal plan," says Dutton. "It's online. They have done different analysis. What projects could they invest in? How long would they last? What benefit would they get out of it? We have nothing like that in the state of Florida and it's just shocking."

Rising Water

The ocean along the East Coast is projected to rise one to four feet, according to the National Climate Assessment, while storms are forecast to become more frequent and more destructive—as Hurricane Matthew showed when it grew into a monster storm that forced more than two million people in the southeastern states to flee to high ground.

Matthew, which left a trail of wreckage in the Caribbean and killed hundreds of people in Haiti and four in Florida, is being called a "generational" event. Even as its winds weakened, Matthew's sheer size and slow-speed trek across the Carolinas saturated the coast with enough rain to cause flooding on top of the storm surge.

St. Augustine, the 511-year-old tourist town in northern Florida, was swamped by a record-breaking nine-foot storm surge, as was Tybee Island off Georgia, where high tide and the storm surge coincided to inundate the low-lying barrier island.

Watch: See how rising seas are swallowing this island.

Florida, with 1,350 miles of coastline and more than 18 million people living in coastal counties, remains one of the most vulnerable places on the planet to sea-level rise—and it grows more vulnerable with each successive binge of coastal real estate development.

In the years since Hurricane Wilma rolled across the Sunshine state in 2005, Floridians settled into a kind of hurricane-free complacency. Millions of dollars have been sunk into new coastal development, and nearly 1.3 million new residents have moved to Florida, most having little experience with how damaging hurricane storm surges are to the fragile sandspit on which they now live.

In South Florida, it has been 24 years since Hurricane Andrew hit, leaving the area with a $25 billion tab (in 1992 dollars) to rebuild. Sea-level rise projections there are not only higher than the national figures—six feet by 2100—scientists are trying to determine if the seas are rising even faster than that.

Dutton has been studying sea levels during the Earth's prior warm periods in search of an answer. The oceans' last high point occurred during the last warm period, about 125,000 years ago, before the last ice age. When the temperatures at the poles were only a few degrees warmer than they are today, the sea level was 20 to 30 feet higher.

"We're not going to reach 20 to 30 feet of sea-level rise overnight," she says. "But when they say we're going to reach three feet at 2100, it's not going to stop. This is the first step in what is going to be a very long journey for many centuries. Instead of investing in development on heavily populated coastlines, perhaps we should be investing in development along corridors of retreat.

"It's a hard concept. But ultimately, the ocean is going to win that battle."

Planning for Disaster

Few want to talk about retreat just yet. Phil Stoddard, the scientist-mayor of suburban South Miami, says it is human nature to stick too long with bad situations and then act precipitously.

"It's like a marriage that's been shaky for a while, and then something upsets that and suddenly, that's it," says Stoddard. "Everything that has been wrong before now is really wrong and that's it. A hurricane makes it all bad."

Long before the slow creep of sea-level rise remakes South Florida's geography, Stoddard thinks a direct hit from a hurricane could be the jolt that prompts an exodus. (See Stoddard talk about these issues in the upcoming documentary film Before the Flood, staring Leonardo DiCaprio, on National Geographic Channels October 30.)

He is not alone in his view. Two years ago, Miami's civic leaders invited a team of Dutch architects, engineers, and water experts to town to give them advice about how to prepare for a wetter future. The Dutch proposed an array of concepts to add amenities to the community, while protecting it from flooding—such as the creation of water-storage ponds that also serve as lakes in new public parks.

These projects could help Miami live with its fate for much longer, protected from inundation, while at the same time living with rising seas. The Dutch, who have been dealing with flooding since the Middle Ages, also recognized the more immediate threat posed by hurricanes and advised their hosts to get on with planning and building.

"The flood will definitely kill your business climate," says Pier Dircke, a water management specialist at Arcadis, the Dutch firm that helped New Orleans recover from Katrina. "The strange thing is, very few people are willing to invest in a protection ahead of the surge. Everybody is willing to do it the day after the flood, which is one day too late."

Laura Parker previously wrote about rising seas affecting Florida for National Geographic *magazine.*

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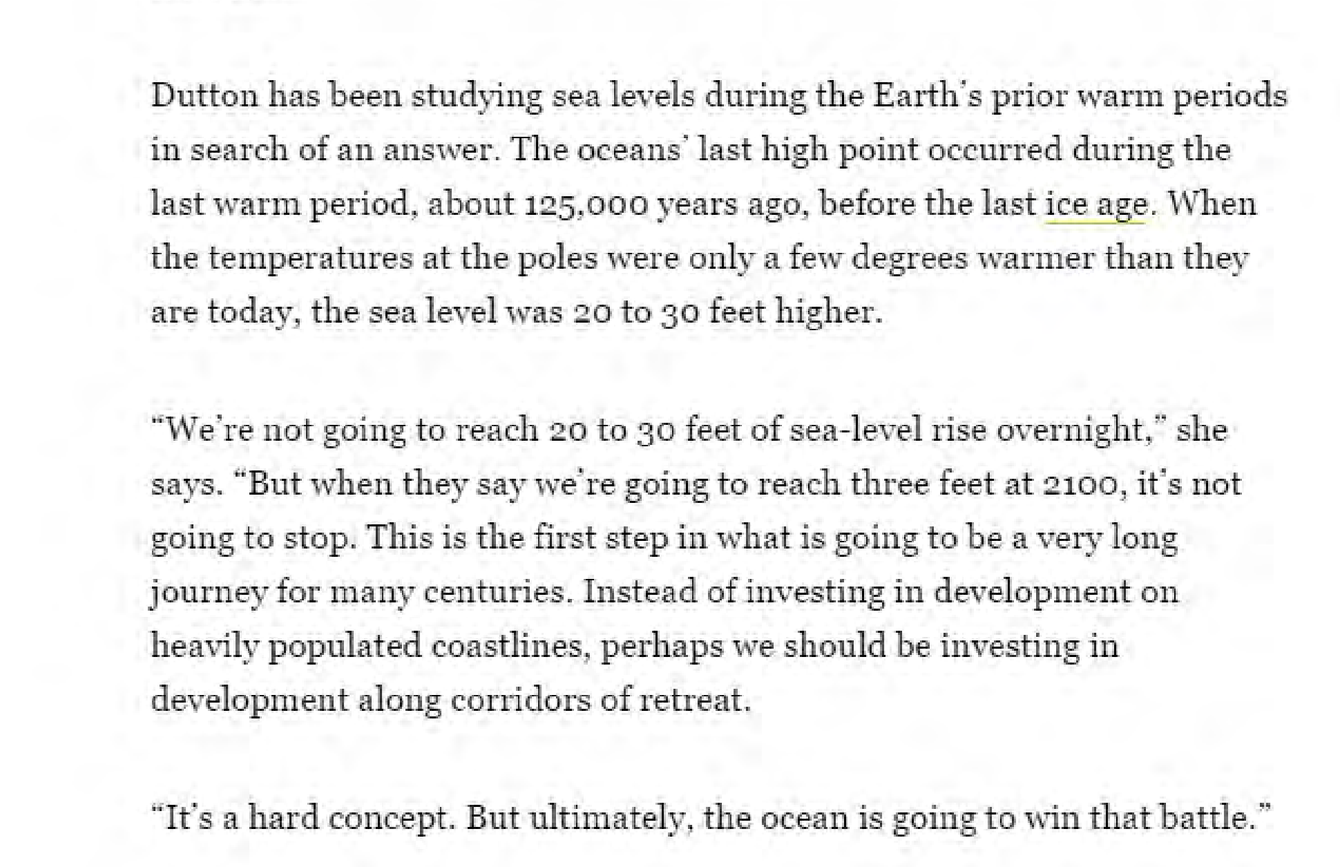

Deep Sea Fishing An elder of the Banjo tribe hunts for fish off the coast of Sampela, Indonesia.

PHOTOGRAPH BY CORY RICHARDS, NATIONAL GEOGRAPHIC

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