

## **Flooding could become a daily problem in North Carolina by 2045, report says**

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North Carolina's coast will see more frequent and more destructive floods at high tide over the next 30 years, several studies say - even on mild, sunny days - as rising sea levels shove the Atlantic Ocean higher onto our shores.

A 2014 report from the Union of Concerned Scientists warns that minor tidal flooding will become a near-daily event in the Wilmington area by 2045.

And worse flooding is expected for the Outer Banks, where the sea level is rising faster. Today it takes a tropical storm or nor'easter to kick up serious floods that can damage buildings and endanger lives on the low-lying barrier islands. But this is changing.

The Union of Concerned Scientists study says these disruptive, moderate-to-major floods will become more likely in calm weather as well, during cyclical "spring" tides and "king" tides when the sun and moon align to produce extreme high tides.

That's because the seas are expected to rise by as much as 12 inches in the next 30 years, lifting high tide that much higher on the northern Outer Banks.

"If you just raise the sea level by that much, it's going to push the water deeper inland," said Melanie Fitzpatrick, a climate scientist and co-


author of the Union of Concerned Scientists study.

Old Dominion University and the National Oceanic and Atmospheric Administration published similar reports last year, also pointing to increased tidal flooding as a consequence of a warming climate that is causing the seas to rise.

More flooding will close roads, clog storm sewers and damage streets and other public structures that aren't made to hold up against inundation and salt-water exposure, NOAA said. Even moderate floods can hurt businesses, isolate neighborhoods and disrupt transportation.

When the N.C. Coastal Resources Commission's advisory science panel aired its new forecast for sea-level rise last month, the report made note of the accelerated tidal flooding.

The science panel's work is intended to help government planners come to grips with the prospect that in 30 years the seas will rise by up to 12.1 inches on the Dare County coast, and up to 8.5 inches around Wilmington.

Major flooding is rare in Wilmington. But minor floods - with backed-up storm drains on Market Street and standing water in the Battleship North Carolina parking lot  have grown much more frequent since 1990.

In the 1980s, the Wilmington tide gauge hit minor-flood stage an average 9 times per year. That grew in the 1990s to 26 times per year - about once every two weeks - according to the National Weather Service.

The 2014 Union of Concerned Scientists report warns that this nuisance flooding will become an "incessant," almost daily problem for

Wilmington by 2045, with a predicted 343 minor floods per year.

Farther north at the Duck ocean tide gauge on the Outer Banks, the National Weather Service marks the minor-flood stage at 5.5 feet above average low tide. That's a nuisance flood, just enough to spill water onto low-lying roads.

But a storm or a steady offshore wind can push flood waters farther inland on these gently sloping barrier islands, by adding heavy rain or lifting the ocean a few inches higher on the shore.

The dangerous, major-flood mark - enough water to wash out roads, damage buildings and put people at risk - is 6.5 feet at Duck, only 12 inches higher than minor-flood stage.

And with the Outer Banks facing that 12-inch sea-level rise over the next three decades, today's minor floods could turn into moderate or major floods by 2045. That means a higher risk of damage in surrounding areas, too.

"Wherever it's flat - which is a lot of northeastern North Carolina - as soon as the (land elevation above high tide) is gone, it's going to flood way far inland," said coastal engineer Bill Birkemeier of Dare County, a Coastal Resources Commission science panel member who retired after a 26-year career on the Army Corps of Engineers research pier at Duck.

Sea-level rise already has intensified flooding that washes sand and water across roads and undermines buildings at low-lying spots on Topsail and Hatteras islands.

"Ocean water is reaching Highway 12 in Buxton almost every day," Carol Dawson, a Hatteras Island motel owner, said Thursday by email. "I drove through salt water tonight coming home. It's worse than I have

ever seen it."

The recent reports on tidal flooding are pegged to tide gauges along the entire East Coast. Other studies have shown that sea level is rising faster between Cape Hatteras and the northeastern United States because this part of the continent is subsiding in response to ancient geological forces. Most of the worst tidal flooding is expected in Maryland, Virginia and North Carolina.

And there's a second factor. Oceanographers have discovered a link between fluctuations in the Gulf Stream - its speed and position offshore - and variable rates of tidal flooding along our part of the East Coast.

"If you head east in a boat from Cape Hatteras to the Gulf Stream, you're actually going uphill," said Larry Atkinson of Old Dominion University, co-author of a 2014 tidal flooding study. "Over the 50 miles you travel offshore, you're actually going up about 3 feet."

When the Gulf Stream slows down periodically, Atkinson said, that elevation falls to about two feet - and the tides rise higher on the Outer Banks and Virginia shores.

Sandy Sanderson, Dare County's emergency management director, said it's hard for coastal officials to make long-range plans around specific forecasts.

"If you live on the Outer Banks, you're in a flood-prone area, period," Sanderson said.

But local governments are adapting to [sea-level rise](#) by increasing the elevation requirements for new buildings and weighing the flood risks when they make public construction plans. Dare County also is proposing a beach nourishment project to stave off erosion and flooding

at Buxton.

Sanderson's agency is planning a new emergency operation center at one of the highest spots on Roanoke Island, about 10 feet above [sea level](#), near Croatan Sound.

"That area has never flooded in any storm," Sanderson said. "I don't think there's any way the sound could elevate above 12 feet. So we're going to elevate to 14 feet for the first floor."

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## MORE FLOODING AHEAD

A 2014 report from the Union of Concerned Scientists predicts a sharp increase in the frequency of nuisance flooding along much of the East Coast. Some of the highest numbers are for the coastal areas around tide gauges at Duck, on the northern Outer Banks, and Wilmington on the southern coast.

### Duck

Sea-level rise forecast by 2045: 6.5 to 12.1 inches(ASTERISK)

Floodings per year: 8 today, 32 by 2030, 126 by 2045

### Wilmington

Sea-level rise forecast by 2045: 4.1 to 8.5 inches(ASTERISK)

Floodings per year: 44 today, 133 by 2030, 343 by 2045

Sources: Union of Concerned Scientists and (ASTERISK)N.C. Coastal

## Resources Commission Science Panel

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