Many coastal communities are flooding more than we thought, researchers find

Researchers installed sensors inside stormwater drains and cameras above them in three North Carolina communities. They found a startling amount of flooding.

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By Brady Dennis

Fast-rising seas have forced some coastal communities to endure flooding far more frequently than previously thought, and much more often than federal tide gauges would suggest, according to a new findings from researchers in North Carolina.

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"I view it as a harbinger of what's to come," said Katherine Anarde, an assistant professor of coastal engineering at North Carolina State University and one of the lead authors of the study, published Monday in the journal Communications Earth & Environment.

To document the true prevalence and duration of flooding, researchers installed sensors inside stormwater drains and cameras above them in three North Carolina communities — Beaufort, Carolina Beach and Sea Level.

What they found was startling.

During a single year, from May 2023 through April 2024, they logged 26 days of flooding in Beaufort, 65 days in Carolina Beach and 128 days in Sea Level. Many of those floods — defined as water getting on a nearby road — happened on sunny days, and very few were associated with large storm events.

The frequency of flooding was "an order of magnitude greater" than the official number of what are known as high-tide flooding days projected by the National Oceanic and Atmospheric Administration, which maintains a network of tide gauges along the coastlines.

The reason tide gauges are "poor indicators of flooding," the authors write, is not any fault with the instruments, which have long measured water levels in the ocean and serve various purposes. Rather, the existing tools often underestimate the true extent of flooding on land because they "do not measure rainfall runoff, groundwater contributions to flooding, or the effects of local drainage infrastructure," the study found.

Monday's study offers insights into a reality that a growing number of coastal communities will face, or already are facing: that infrastructure built for another time and another climate is not equipped to handle the higher tides and persistent flooding fueled by rising seas.

The researchers also argue that many places would benefit from more measurement of water on land, where flooding actually occurs, rather than relying primarily on tide-gauge-based estimates that can miss the nuanced factors that influence localized flood frequency and duration.

"If you don't know where it's flooding and why it's flooding, you might create expensive designs for infrastructure that are counterproductive," Anarde said.

While the study focused on three low-lying communities in North Carolina, its authors say the findings have relevance for many places along the nation's coastlines, particularly throughout the Southeast.

Roads, sewer systems, stormwater outfalls and drainage ditches in such places were often "designed for sea levels 100 years ago or more," said Miyuki Hino, a University of North Carolina at Chapel Hill environmental social scientist and another of the lead authors.

But as seas have risen in recent decades and land in many places has subsided, or sunk, communities throughout the Gulf and Southeast Atlantic coasts have grappled with more persistent flooding. "The problems we are seeing here are extremely likely to be problems we are seeing elsewhere," Hino said.

In a series of articles last year, The Washington Post documented how the American South has experienced one of the most rapid rates of sea-level rise on Earth since 2010. At more than a dozen tide gauges spanning from Texas to North Carolina, sea levels are at least six inches higher than they were in 2010 — a change similar to what occurred over the previous five decades.

That shift has forced a reckoning in more and more places, from drowning wetlands in Louisiana to waterlogged septic systems in Florida. Some roads are increasingly falling below the highest tides, leaving drivers stranded or delayed. Insurers have raised rates or scaled back coverage in vulnerable places, creating angst about future home values in flood-prone corners of the United States.

Such problems are likely to proliferate over time, as sea levels continue to rise and coastal flooding becomes more frequent and pervasive.

"We are already seeing the start of permanent inundation," Hino said.

Already, high-tide floods have happened in the Southeast about five times as often as they did in 1990, NOAA oceanographer William Sweet told The Post last year. "We're seeing flooding in a way that we haven't seen before," said Sweet, who leads the agency's high-tide flooding assessments.

That figure could be modest compared with what lies ahead. High-tide floods in the region are expected to strike 15 times more frequently in 2050 than they did in 2020, Sweet said.

As sea levels continue to rise, the impacts of repeated flooding will continue to worsen, Hino said. And communities need a more granular understanding of their specific vulnerabilities — to plan not only for what lies ahead, but also for what is already happening.

“The physical forces are heading in one direction. What we do [about it] is an open question,” Hino said. “This is not a problem for decades into the future, or generations in the future. This is a problem of today.”