

Study suggests US droughts, rainy extremes are becoming more severe

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Severe drought in the American Southwest and Mexico and more severe wet years in the Northeast are the modern norm in North America, according to new research—and the analysis suggests these seasonal

patterns will be more extreme in the future.

The middle of the United States, meanwhile, can expect bigger swings between wetter wet periods—high-rainfall years known as pluvials—and drier summers through the rest of this century, the study predicts.

Researchers at The Ohio State University say the findings, based on modern precipitation data, historical tree rings and climate models spanning the years 850 to 2100, suggest climate change has shifted precipitation patterns across North America to extremes that were not experienced before industrialization began around the mid-1800s.

"It's very much a tale of Southwest versus the Northeast for most of the seasons," said senior author James Stagge, assistant professor of civil, environmental and geodetic engineering at Ohio State. "Mexico and the American Southwest tend to get drier across more or less all seasons, whereas we're seeing in the Northeast—and Ohio is included in that—a trend toward wetter, particularly in the winter and early spring."

The combination of drier droughts and wetter pluvials in much of the nation's midsection won't necessarily occur in a predictable way.

"So you might be going from, say, this year our drought is really bad, and in five years or so we might see the wettest pluvial we've had in a while," Stagge said. "That variability is concerning because it changes how we might need to manage water to prepare for more extremes in both ways. Trying to plan for that is a real challenge.

"This is all part of the same pattern moving into the future. It's only going to get worse."

Former Ohio State graduate student Kyungmin Sung, now a research fellow at the Korea Environment Institute, is first author of the paper.

The research is [published](#) in *Geophysical Research Letters*.

In contrast to attribution studies that examine whether or how human-associated climate change has influenced [extreme weather events](#), this work focused on documenting centuries-long trends in pre- and post-industrial drought and pluvial extremes across North America.

The researchers compared changing climate patterns observed in the past 20 years to the pre-industrial era and then predicted how periods of low and high precipitation will trend through the year 2100.

"What we can say is, 'here is the scale of change we've seen in the past 100 years under an increase in greenhouse gas concentration, and here's what we saw in the previous 700 years,'" Sung said. "And the scale of the change we're seeing now and into the future is dramatically larger in many areas than any [natural climate variability](#) we saw prior."

The researchers merged data from five sources: two modern compilations of precipitation observations, tree ring reconstructions from the distant past, and two [climate models](#)—each covering the same historical period as the tree ring analyses and continuing to predict future extreme dry and wet trends with increasing greenhouse gases.

The integration of different data types lends credibility to the findings, Stagge said: "A benefit of having very different types of data is they can fill in each other's gaps. We consider trends to be significant only when they're showing up across multiple data sets—so that increases our confidence."

Maps of the changing climate patterns show the method produced smooth spatial transitions and obvious boundaries, suggesting that "what we're seeing is real," he said.

While the drying of the West is a well-known phenomenon, the team was surprised to see how extensive the precipitation increase has been and will be in the Northeast and how dramatic the heightened variability from droughts to pluvials is going to be in the center of the country.

These patterns of water shortages and gluts could affect industries ranging from farming to construction and [city planning](#), and are likely to strain management efforts to maintain household water-source reservoirs at optimum levels.

"Planners, [government agencies](#) and engineers want to do the right thing and plan for a potentially changing climate, but oftentimes they don't necessarily have the numbers or the broader picture of what's going to be happening where," Stagge said. "This puts regions on notice. In the Southwest, you're going to have less water to deal with, and if you're managing a farm in the middle of the country you might be seeing wider swings between droughts and pluvials.

"Certainly, we'd like to arrest further [climate change](#), but it takes a long time to turn that ship," he said. "In the meantime, we should be planning on where we're headed to decrease the impacts on people, the economy and the environment."

More information: Kyungmin Sung et al, Centennial-scale intensification of wet and dry extremes in North America, *Geophysical Research Letters* (2024). [DOI: 10.1029/2023GL107400](https://doi.org/10.1029/2023GL107400)

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