Climate change has made western megadrought 38 percent more severe, say new estimates

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After years of prolonged drought, Lake Mead's water levels have fallen significantly. Photo taken in 2014. Credit: CEBImagery

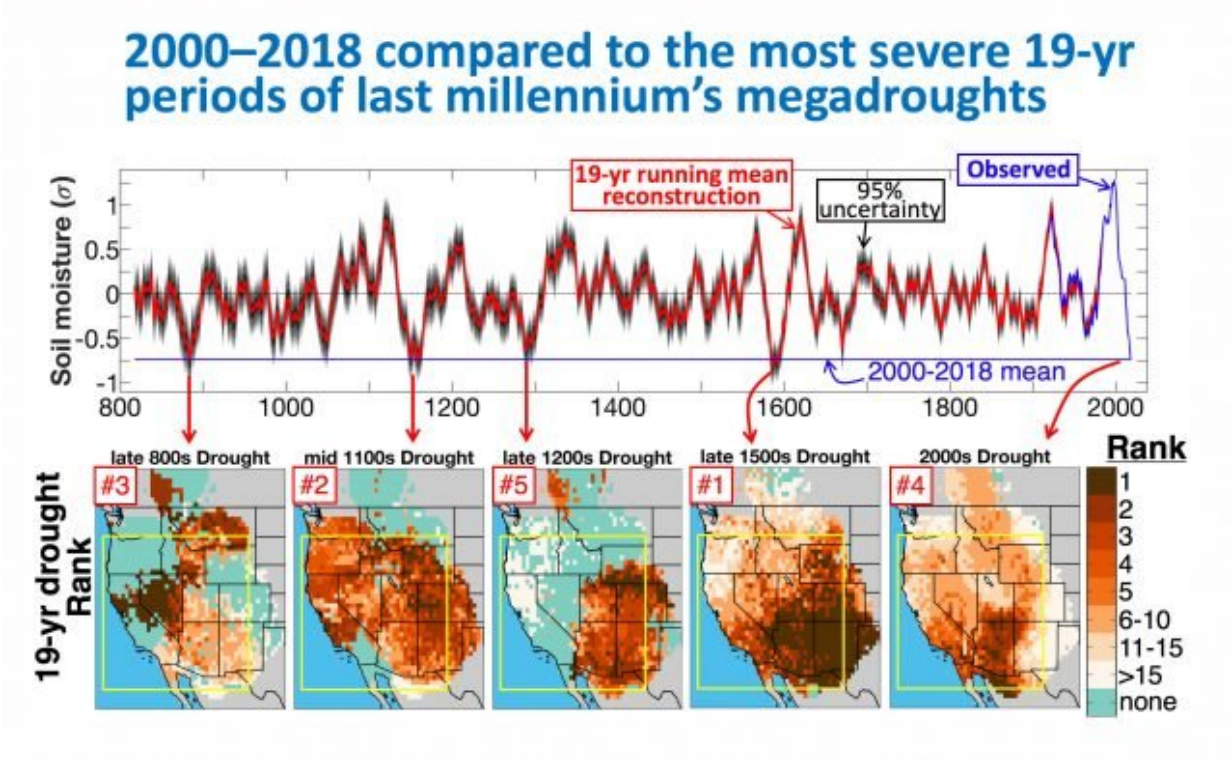
Over the last few decades, the American West has seen major increases in wildfire activity and big decreases in groundwater supply. Warmer temperatures are paving the way for the invasion of destructive bark

beetles, while lower precipitation is drying out lakes and rivers.

Although scientists debate about the definition of 'megadrought,' Park Williams from Columbia's Lamont-Doherty Earth Observatory contends that the West has been in the midst of a megadrought for 19 years and counting. And this wouldn't be the first time. Tree ring records indicate that in medieval times, the region suffered from megadroughts so severe that river beds turned into forests and indigenous societies were forced to relocate.

Compared to those ancient megadroughts, today's 19-year drought remains short (so far—there's no telling how long the dry conditions will endure). But Williams set out to see how the current drought stacks up in terms of severity. He presented his findings, which have not yet been published, at the meeting of the American Geophysical Union on Thursday.

Williams and his colleagues used tree ring records to reconstruct drought conditions in the American West over the past 1200 years. They found that "the drought severity of the last 19 years is almost as bad as the worst 19-year period of the worst megadrought," says Williams. "And it's essentially tied with the worst 19-year periods of a few other megadroughts."



Credit: Columbia University

Because the tree ring record doesn't perfectly replicate soil moisture conditions, the range of uncertainty makes it difficult to say exactly where today's drought falls in the megadrought rankings. "This could conceivably be the worst 19 year period," says Williams. Or it could fall into seventh place—it's a tight race. "So our best estimate is fourth," he says.

The top chart shows a reconstruction of soil moisture over the past 1200 years, based on tree ring data. The plummeting blue line on the right indicates the current drought. Below, maps show the distribution of dry conditions for the five worst megadroughts in this region's history. Image: Park Williams

What's more, today's drought looks different from previous megadroughts. Past droughts were only really dry in a few parts of the West, while the surrounding area had fairly normal conditions; the current drought is very dry in a few parts, but also kind of dry across a huge area. "And that might be a signature of global warming," says Williams.

To measure global warming's fingerprints on the West's megadrought, the team used climate models to estimate what temperatures and precipitation would have been like in the absence of global warming. Then they subtracted the average of those projections from what was actually measured, and found that the long-term warming brought on by climate change likely made the drought 38 percent more severe. In other words, says Williams, climate change "caused what would have been a fairly severe drought to become a drought as severe as the most severe droughts of the last millennium." Without climate change, he estimates that the current drought would rank as the eighth or ninth worst megadrought in the past 1200 years.

The knowledge is grim, but we can use it to better prepare for what the future holds. As global warming increasingly loads the dice toward extreme drought conditions, we can expect more wildfires, declining forest productivity, and more demands on the West's already limited groundwater supply, Williams pointed out. "It indicates that it's very important that we develop more sustainable ways of dealing with water and allocating water across the Western U.S."

Provided by Columbia University