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Capital Weather Gang

The western U.S. is locked in the grips of the first human-caused megadrought, study finds

Only one drought in the past 1,200 years comes close to the ongoing, global warming-driven event

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A vast region of the western United States, extending from California, Arizona and New Mexico north to Oregon and Idaho, is in the grips of the first climate change-induced megadrought observed in the past 1,200 years, a study shows. The finding means the phenomenon is no longer a threat for millions to worry about in the future, but is already here.

The megadrought has emerged while thirsty, expanding cities are on a collision course with the water demands of farmers and with environmental interests, posing nightmare scenarios for water managers in fast-growing states.

A megadrought is broadly defined as a severe drought that occurs across a broad region for a long duration, typically multiple decades.

Unlike historical megadroughts triggered by natural climate cycles, emissions of heat-trapping gases from human activities have contributed to the current one, the study finds. Warming temperatures and increasing evaporation, along with earlier spring snowmelt, have pushed the Southwest into its second-worst drought in more than a millennium of observations.

The study, published in the journal Science on Thursday, compares modern soil moisture data with historical records gleaned from tree rings, and finds that when compared with all droughts seen since the year 800 across western North America, the 19-year drought that began in 2000 and continued through 2018 (this drought is still ongoing, though the study's data is analyzed through 2018) was worse than almost all other megadroughts in this region.

The researchers, who painstakingly reconstructed soil moisture records from 1,586 tree-ring chronologies to determine drought severity, found only one megadrought that occurred in the late 1500s was more intense.

Historical megadroughts, spanning vast regions and multiple decades, were triggered by natural fluctuations in tropical ocean conditions, such as La Niña, the cyclic cooling of waters in the tropical Pacific.

“The megadrought era seems to be reemerging, but for a different reason than the [past] megadroughts,” said Park Williams, the study’s lead author and a researcher at the Lamont-Doherty Earth Observatory at Columbia University.

Although many areas in the West had a productive wet season in 2019 and some this year, “you can’t go anywhere in the West without having suffered drought on a millennial scale,” Williams said, noting that megadroughts contain relatively wet periods interspersed between parched years.

“I think the important lesson that comes out of this is that climate change is not a future problem,” said Benjamin I. Cook, a NASA climate scientist and co-author of the study. “Climate change is a problem today. The more we look, the more we find this event was worse because of climate change.”

The study is part scientific grunt work, involving sifting through drought records to find past instances of comparable conditions, and part sophisticated sleuthing that employs computer models to determine how climate change is altering the likelihood of an event like this one.

Cook said the researchers analyzed climate models for the region, which showed warming trends and changes in precipitation. They compared soil moisture with and without global warming-induced trends, “and we were able to determine that 30 to 50 percent of the current drought is attributable to climate change.”

That conclusion is a first, says Jonathan Overpeck, a climate researcher at the University of Michigan who did not participate in the new study.

“They are the first to show conclusively that we’re experiencing our nation’s first megadrought of the instrumental era,” he said via email.

“The real take home,” Overpeck said, “is that the Southwest is being baked by the burning of fossil fuels and other human activities, and the future implications are dire if we don’t stop climate change.”

Looking for a megadrought, only to find it’s already here

In 2015, Cook took part in a study that predicted a megadrought would grip the American Southwest starting about 2050 and persist for 35 years, with a few wet years to break long dry spells.

At the time, California was experiencing a severe four-year drought. As it dragged past a fifth year, Cook and others asked a question: “Are these changes in drought patterns that we expected in the future already beginning to happen?”

They then set out to answer that question.

For the study, the authors started from scratch, analyzing tree-ring data rather than relying solely on archived information. They took apart calculations already in the record and modified them where needed. Not only was a megadrought happening, they concluded, it had been in progress since the turn of the century.

The same year that Cook and other researchers published their first study, a Stanford University scientist, Noah Diffenbaugh, led a separate study that said rising temperatures and significant declines in snow and rainfall will parch California for years to come.

Diffenbaugh, a professor and senior fellow who studies the Southwest, had also analyzed data showing that the region was becoming hotter and drier. He said Thursday's study, which he was not involved with, is a breakthrough because of its comparison of droughts in the past two decades to those in the previous thousand years.

"Placing the two-decade period in the whole region in the context of the last millennium is very striking, very powerful," Diffenbaugh said. "We can conclude that without the warming, this period would not have produced such a severe, regionwide drought."

What this means for the West

Valerie Trouet, a researcher at the Laboratory of Tree-Ring Research at the University of Arizona, says that the megadroughts of the past brought about major societal impacts, particularly those that persisted for decades.

For example, the megadrought seen in the late 800s is thought to have instigated the downfall of the Mayan civilization. The severe drought in the 16th century may have contributed to the Chichimeca War in Mexico, during which Native Americans and European settlers fought for decades.

"All of these past megadroughts have had severe impacts," Trouet said in an interview. "We can expect there to be societal impacts now, too."

These effects may not be as devastating in the future, however. Modern humans have more ways to adapt, Cook said.

"There are a lot of things we can do about it. People in the West are dealing with this drought in a number of ways," Cook said.

California has already provided a model for living in a warmer and drier region, although it has involved sacrifice at times. Amid its drought in 2015, the state took aggressive steps to preserve water and limit wildfires on thirsty land with varying success. Former governor Jerry Brown (D) imposed the first water restrictions in state history and declared that watering lawns was going to be "a thing of the past" in California.

Water utilities essentially rationed supply, telling residents to dramatically cut the minutes they showered to no longer than 12 and all but mandating more efficient machines for laundry and dish washing. Utilities encouraged homeowners to purchase new appliances with rebates subsidized by the state, water bills spiked and penalties were imposed on any household that went over their limits. Neighbors spied on neighbors who washed cars, watered grass and sprayed driveways, all outlawed.

East Porterville, Calif., in the Central Valley became a town without water. A church set up a shower trailer so residents whose wells went dry could wash. The state placed water tanks outside homes so their toilets would flush. Laundering clothes, washing hands and brushing teeth became luxuries.

The drought and the drive to save water had environmental consequences, as well. It resulted in the death of trees that improved air quality, provided animal habitats and beautified urban areas across California. Urban trees joined about 12.5 million wild trees that died in dry California forests during 2015's drought, according to the U.S. Forest Service.

Such serious drought effects happened with only about 1 degree Celsius of warming since the industrial revolution, Diffenbaugh said. "The impacts we've already seen from one degree of warming really highlights the intensification of what's coming," he said.

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