Climate change didn't cause Calif. drought, experts say

Gayathri Vaidyanathan, Environment & Energy Publishing, 3-3-15

The ongoing California drought, which has left 93 percent of the state parched, is not caused by global warming, experts said yesterday, despite news headlines to the contrary.

The headlines were based on a study in the *Proceedings of the National Academy of Sciences* that links climate change and drought, finding that high temperatures can exacerbate the severity of a drought during a dry year.

"It does not say this current drought was caused by global warming," said Richard Seager, a climate scientist at Columbia University's Lamont-Doherty Earth Observatory, who was not affiliated with the study. "It is just saying that the background warming trend is making severe droughts more likely."

That is a statement of probabilities. It is similar to a person at a casino who throws dice and finds the same numbers come up repeatedly, which suggests the dice may be loaded. In this case, global warming is loading the climate and making severe droughts more likely.

Global warming does this by raising temperatures, which increases the rate of evaporation and dries out already-parched soil.

"Years that are both dry and hot are more likely to be severe drought years, and higher temperatures exacerbate moisture deficits caused by a lack of precipitation," said Kevin Anchukaitis, a geologist at Woods Hole Oceanographic Institution, who is not affiliated with the study.

Anchukaitis found in a study last year that temperatures during this drought are particularly high compared with droughts over the past 1,200 years.

Future rainfall vs. high temperatures

In the *PNAS* study, Noah Diffenbaugh of Stanford University and his colleagues find that high temperatures have made severe droughts twice as likely in the past two decades compared with the previous century. They tie the high temperatures to human-caused climate change.

Whether this effect on drought will persist into the future is unknown. Climate models suggest that the state will receive more rainfall in the future, which would lower the probability of severe droughts.

The *PNAS* study does not tackle the origins of any single drought, such as the one that has been tormenting Californians since 2011.

But it does confirm findings by scientists at the National Oceanic and Atmospheric Administration that this drought's trigger -- a rainfall deficit -- was caused by natural variability.

The last three winters have been extremely dry in California, primarily because of inherent quirks in the climate system. The tropical western Pacific Ocean has been abnormally warm, which created a high-pressure ridge off California. The "ridiculously resilient ridge" blocked storms from delivering their rainfall loads over the state. Much of California's annual precipitation is delivered by these storms.

"The main cause of this drought that California is still having -- it is in year four now -- is the huge drop in precipitation," Seager said.

The *PNAS* study confirms that climate change has not affected rainfall patterns in California since 1886. This implies that the rainfall deficits since 2011 are due to natural causes.

The abnormally high temperatures in 2014 were also mostly due to natural causes, Seager said. Global warming only accounts for about a third of how hot it was, he added.

A century of data

Climate modeling suggests that rainfall patterns will change in the future, with more rain in the winter. The impacts of this shift are not addressed by the *PNAS* study, Martin Hoerling, a research meteorologist at NOAA's Earth System Research Laboratory, said in an email.

"What will be the net effect of more precipitation in a warmer world is not addressed in this paper," he said.

That rainfall deficits lead to drought, which is worsened by heat, may seem like common sense, but the *PNAS* study uses more than a century of data to prove this link. The scientists examined drought, temperature and rainfall in California from 1886 onward.

Anchukaitis said the study confirms that temperature will affect future droughts, and its effect on soil moisture ought to be considered. NASA recently launched a satellite called SMAP that will make comprehensive measurements of soil moisture from around the world.

Anchukaitis said that drought is caused by the interplay between water supply and demand. The latter part of this dynamic often goes unaddressed.

"Addressing drought as a present and future hazard for human society will have to understand changes in supply but also anticipate and manage the demand side of that equation," he said.