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Warmer Atlantic, Climate Change Presage More, and Worse, Western Wildfires

Historical record suggests the American West is "primed" for climate change-inspired conflagrations

By David Biello

Between 1650 and 1749, fires raged across western North America from what is now British Columbia down into northern Mexico. In contrast, the following century saw scattered, sporadic wildfires. By combining tree-ring records stretching back 450 years as well as fire-scar data from more than 4,700 burned trees, scientists have now created an extended log of the climate in the western U.S. and its attendant wildfires. And this record has revealed that temperature shifts in the waters of the northern Atlantic help determine the scale and intensity of western wildfires.

Forest ecologist Thomas Swetnam of the University of Arizona and a team of international colleagues collected tree-ring and fire-scar data from 241 logging sites across western North America. The scars revealed the dates of at least 33,975 individual fires stretching back to 1550. "We got most of our fire-scar samples from dead trees, stumps and logs. They're cookies," or cross sections, Swetnam explains. "A single tree might have 10 or even 20 different scars on it."

The researchers compared this long fire record with weather patterns: the well-known El Nino and La Nina cycles that occur every two to seven years, as well as longer cycles called the Pacific Decadal Oscillation and the Atlantic Multidecadal Oscillation (AMO). "Fire activity correlated with--as we expect--drought, but also with these interesting oscillations in the Pacific and Atlantic," Swetnam notes. "The North Atlantic, and warming temperatures there, have apparently had some importance in drought occurrence and fire activity."

As weather generally flows from west to east, this is surprising, and the exact mechanism by which Atlantic sea surface temperatures might affect the western continent remains unclear. Possibilities include impacts on circumpolar circulation, which would impact moisture flowing over the continent from the north, and the Bermuda High, which would impact moisture flowing over the continent from the south.

This shift from cool to warm in the North Atlantic has already had an impact; this past year at least 89,000 individual fires burned 9.5 million acres in the western U.S. Worse yet, forest management practices that have increased the number of trees in western woods--as well as relatively wet preceding decades--have put in place an abundance of fuel for future fires.

"The time period from the mid-1970s to the late 1980s was quite wet, one of the wettest periods in the tree-

ring records in centuries," Swetnam says. "We also know that fire suppression, livestock grazing and logging changes the fuel in some forests, like ponderosa pines. That has led to a situation in the West that is primed for conflagrations when climate shifts to a drier mode and hotter condition."

Climate change could also worsen these wildfires. "Whether or not what we're seeing in the western U.S. is mainly a function of the [Atlantic Multidecadal Oscillation] or warming temperatures or some combination of both, we can't see," Swetnam says. "In both cases, the trends are in the same direction. It's warming up, which is likely to lead to more large fires."

Even if the natural variation in temperatures caused by the AMO is the only factor affecting temperatures in the western U.S., that region is set for several decades of warmer, drier conditions, according to Swetnam's paper, published online December 26 in the *Proceedings of the National Academy of Sciences USA.* Using samples from the stumps of giant sequoias logged in preceding centuries, the researchers will be able to push the record back even further. "We have up to 3,000 years of history from those samples," Swetnam adds. "The problem with predicting the future is that we have global warming on top of these natural cycles."

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