As temperatures rise, more California forests will burn

5 September 2019, by Bill Chaisson

A 2018 wildfire burns in Ukiah, California. Credit: Bob Dass/Flickr

On August 5, a *Washington Post* headline announced, "This year's fire season in California could be 'very active.'" In spite of the wet winter, the Golden State was expected to face "an above-normal chance for large wildfires as [it] heads into late summer and fall." After a slow start, a heat wave at the end of July seemed to "flip a switch." Over 4,000 fires have broken out since.

Post reporter Diana Leonard sought out 2016 Center for Climate and Life Fellow and Lamont-Doherty Earth Observatory associate research professor Park Williams to explain why California is expected to burn in 2019—albeit not as much as last year—despite wetter weather. "A heat wave today," Williams told the Post, "is going to have a much more potent influence on flammability than one 150 years ago when temperatures were 3.5 degrees cooler." The increase in California temperatures associated with anthropogenic climate change, Williams has found, will affect forested areas more than grass and shrub landscapes.

In July, Williams and several co-authors published a paper in Earth's Future that marshaled evidence to explain the role of anthropogenic climate change in the expansion and intensification of California wildfires. Williams and his colleagues went back to the original data that chronicle the dates, weather, acreage burned, and other factors associated with all California wildland fires going back to the early 1970s.

California government officials have kept track of fires on state-owned land since the 1930s, said Williams in a recent interview, but since 1972 they have monitored fires in the entire state. Since 1984, more precise data has been available from satellite imagery. Williams decided to base his work on post-1972 data rather than on published research. Some papers presented models that did not seem to explain observations well, in part, he found, because they didn't distinguish between fires in forested versus non-forested areas.

"Some work had been done," he said, "but no one had put it all in one place. We need to have informed debates. The missing piece of work was to put the answers all in one place, so we looked at the data, not the papers."

Williams, a California native, explained that the state fire season has two parts. The biggest fires tend to occur during the summer, and smaller, but fast-moving ones occur in the fall. The most important factor contributing summer fires is heat, while in the fall the intensity and duration of the Santa Ana winds is the most potent driver.

Williams and co-workers have found that there is a good correlation between the annual burned area of forests and the aridity of the atmosphere, and that aridity is greater when temperatures are higher. "Forests are the most sensitive," he said, "because there is plenty of fuel, and they are fairly cool compared to un-forested areas. All you have to do is dry them out."

Richard Seager, a research professor at Lamont and a member of the Center for Climate and Life advisory board, is an expert on drought in the American West and has worked with Williams on rising temperature as a driver of forest mortality. He has been studying climate variability out west for many years, but "Park allowed us to get into the ecosystem impacts," he said. "We came down from the atmosphere to the forests and fire. He made the correlation between wildland fire and climate."

Seager said Williams identified the vapor pressure deficit as the "most explanatory tool." It is the difference between how much moisture is in the air and how much it can hold. As temperatures increase, Seager explained, the warmer air can hold even more moisture. Therefore, during hotter years, more moisture is evaporated from vegetation. Hence the correlation between high temperatures and burning forests.

Some have attributed the rise of forest fires to the growth in the number of people living in forested areas of rural California. Others have blamed the century-old fire suppression policy, which has caused fuel to accumulate in the forests. The enormous amount of data Williams and his colleagues have collected does not bear out either of these suppositions. Instead, he said, the strongest statistical correlation is clearly with drying. Furthermore, since both population and fuel densities have steadily increased over time, if they were significant factors, they should have changed the relationship between aridity and forest fire, but they have not.

What are the next steps? Now that Williams has good data and statistical relationships, he plans to develop "process-based models" that recreate fires burning at small scales, and account for vegetation changes after fires and changes in human activities, like fire suppression and logging. He was recently awarded a grant through the Center for Climate and Life from the Ziegler Family Foundation to fund this phase of his research.

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