Researchers forecast longer, more extreme wildfire seasons

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Credit: CC0 Public Domain

In California, a changing climate has made autumn feel more like summer, with hotter, drier weather that increases the risk of longer, more dangerous wildfire seasons, according to a new Stanford-led study.

The paper, published in *Environmental Research Letters*, provides insights that could inform more effective risk mitigation, land management and resource allocation.

"Many factors influence wildfire risk, but this study shows that long-term warming, coupled with decreasing autumn precipitation, is already increasing the odds of the kinds of extreme fire weather conditions that have proved so destructive in both northern and southern California in recent years," said study senior author Noah Diffenbaugh, the Kara J Foundation professor at Stanford's School of Earth, Energy & Environmental Sciences.

Since the early 1980s, the frequency of autumn days with extreme fire weather conditions has more than doubled in California. Rainfall during the season has dropped off by about 30 percent, while average temperatures have increased by more than 2 degrees Fahrenheit or more than 1 degree Celsius. The most pronounced warming has occurred in the late summer and early autumn, resulting in tinder-dry conditions in forests and grasslands to coincide with the strong, dry "Diablo" and "Santa Ana" winds that typically occur during the autumn in northern and southern California.

These conditions have fed large, fast-spreading wildfires across California in recent years. The region's single deadliest wildfire, two largest wildfires, and two most destructive wildfires all occurred during 2017 and 2018, killing more than 150 people and causing more than $50 billion in damage.

Conspiring conditions

The paper includes analysis of the conditions surrounding the November 2018 Camp Fire in the Northern Sierra Nevada foothills and the Woolsey Fire around the same time near Los Angeles. In both cases,

seasonal strong winds conspired with landscapes dried out following the state's hottest summer on record, stretching limited emergency response resources across the state.

Wildland firefighters in Kern County, California rest after working 24-hour shifts during the Thomas Fire of 2017. Credit: Kern County Fire Department

Historical weather observations from thermometers and rain gauges showed that the risk of extreme wildfire conditions during autumn has more than doubled across California over the past four decades. Using a large suite of climate model simulations archived by government research centers around the world, the authors revealed evidence that human-caused global warming has made the observed increases in these meteorological preconditions more likely.

"Autumn is of particular concern since warmer, drier conditions may coincide with the strong offshore wind events which tend to occur in the September to November period," said Michael Goss, the study's lead author and a postdoctoral scholar in Diffenbaugh's Climate and Earth System Dynamics Group.

The authors emphasize that there are a number of opportunities for managing the intensifying risk of wildfires in California and other regions. They show that the reduced emissions target identified in the United Nations' Paris agreement would likely slow the increase in wildfire risk. However, even with those reductions, much of California is still likely to experience rising risk of extreme wildfire weather in the future.

"It's striking just how strong of an influence climate change has already had on extreme fire weather conditions throughout the state," said study coauthor Daniel Swain, a research fellow at UCLA, the National Center for Atmospheric Research and The Nature Conservancy, and a former Ph.D. student with Diffenbaugh at Stanford. "It represents yet another piece of evidence that climate change is already having a discernable influence on day-to-day life in California."

Strained resources

The findings come at a time when California's firefighters are facing

significant pressures. Because firefighting resources and funding have been traditionally concentrated during the peak summertime fire season, the recent spate of autumn fires burning in both northern and southern California has put particular strain on the response. The ongoing COVID-19 pandemic could further strain emergency resources, including impeding efforts to prepare for the upcoming summer and autumn seasons that are likely to be intensified by low spring snowpack and a dry winter in northern California.

The consequences are not restricted to California. In particular, fire-prone regions have historically shared wildfire-fighting resources throughout the year, including movement of people and equipment between the northern and southern hemispheres between the respective summer seasons. Recent autumn wildfires in California have coincided with the onset of wildfires in Australia, creating strain on limited global resources.

The authors emphasize that there are many steps California and other regions can take to increase resilience to the rising risks of wildfire. In addition to curbing the trajectory of global warming, risk management options include prescribed burning to reduce fuel loads and improve ecosystem health, upgrades to emergency communications and response systems, community-level development of protective fire breaks and defensible space, and the adoption of new zoning rules and building codes to promote fire resilient construction, according to the researchers.

More information: Michael Goss et al, Climate change is increasing the risk of extreme autumn wildfire conditions across California, *Environmental Research Letters* (2020). DOI: 10.1088/1748-9326/ab83a7

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