

California tree carnage: A decade of drought and fire killed a third of Sierra Nevada forests

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Admirers of California's Sierra Nevada mountains are familiar with the swaths of blackened trees flanking its sprawling green forest ranges. A

new University of California, Berkeley study quantifies that devastation, finding nearly a third of southern Sierra conifer forests have died in the last decade.

California has seen devastating bouts of drought and record-breaking wildfire events in the last several years. From 2011-2020, a combination of [fire](#), drought and drought-related bark beetle infestations killed 30% of forests in the Sierra Nevada mountain range between Lake Tahoe and Kern County, according to the analysis.

"It's kind of a wake up call, even to those of us that are kind of steeped in this field," said Zackary Steel, lead author of the study. "We're moving from knowing this is a problem to quantifying the problem."

On top of the overall decline in total conifer forest in the region, half of mature forest habitat and 85% of high-density mature forests were either wiped out entirely or became low-density forests.

The study also found areas protected as habitat for the California spotted owl, an endangered bird at the center of a historic battle between [environmental activists](#) and the [timber industry](#), saw worse declines in [tree canopy](#) than non-protected areas.

That finding led the study's authors to call for a rejection of traditional conservation methods that preserve forests as-is, before the loss of all mature forests in the Sierras. Using fire as a tool for landscape regeneration and removing low-lying vegetation can keep fires from becoming as devastating.

The research led by Steel analyzed a variety of Forest Service data on forest canopy, tree height and wildfire perimeters, and compared spotted owl protected area data gathered over nine years.

The Sierra Nevada region of California covers almost 27 million acres that provide habitat for thousands of wildlife species and is home to dozens of conifer species. Native redwoods are the world's tallest trees, [giant sequoias](#) are the world's widest, and the Great Basin bristlecone pine is the world's longest-living tree.

'Good fires'

Drought and wildfire are a natural, long-standing part of California's climate. But in the last decade of extreme drought across the West, combined with many of the state's largest wildfires, scientists have watched tree die-offs reach new heights.

Healthy forests support critical biodiversity and ecological function, like storing water that melts into our reservoirs. They also provide key carbon storage in our fight against the extreme weather dangers posed by climate change.

Historically, mature forests were more fire resistant. They were maintained by frequent low-severity "good fires" ignited by California's indigenous peoples for centuries predating colonization and statehood. Prescribed burns have become more common and legally protected by the California legislature.

In early statehood, clear cutting practices of the logging industry left young, regrowing forests less ecologically resilient to wildfire and beetle infestation. For most of the 20th century and after, management of forests heavily relied on fire suppression to avoid destructive and deadly conflagrations.

These practices, coupled with a warming climate, pose an "[existential threat](#)" to remaining mature forests, wrote study authors. Management must transition to prescribed burns and thinning lower parts of the forest

to make natural fires less catastrophic, a perspective now widely held by subject experts.

"The ecological idea is not to take out trees just to take out trees," said Felicia Marcus, former head of the state water board now researching state climate policy at Stanford University. She hopes these and other findings accelerate forest management reform efforts in the state.

"If you take out enough of the smaller trees that snow can get through and hit the ground but you leave enough trees that it stays shaded, we'll be able to maybe slow the rate of loss of snowpack which is perhaps the number one threat to stability in California's water system," she said.

Fires that grow to hundreds of thousands of acres can be catastrophic to efforts to curb climate change. Researchers estimate that California's 2020 fire season effectively wiped out 18 years of carbon pollution reduction achieved by the state.

State and federal government agencies tasked with managing forestland are beginning to rethink old practices, and investing in wildfire resilience and forest health. According to the state legislative analyst, \$900 million will go toward wildfire resilience over the next three years, with \$240 million on [forest](#) health efforts like fuels reduction and prescribed fire.

J. Keith Gilles, chair of the state board of forestry and fire protection, said this kind of loss of large, mature trees in the Sierras is devastating. He is hopeful that state investments will pay off, but the task of reverting forests to what they used to be is going to take a long term shift.

"We need to be clear to the policymakers that this isn't something you go into with a one-shot infusion of money and it's solved," he said. "It's something where you've committed to moving to a different kind of landscape level management, that lets us truly deal with the natural

hazard of wildfires."

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