

# Study: Warming future means more fire, fewer trees in western biodiversity hotspot

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The 2002 Biscuit Fire reburns the area of the 1987 Silver fire. Credit: Thomas Link

Increasing fires and summer droughts caused by global warming are drastically changing a globally unique bio-region of northern California

and southwestern Oregon, according to new research funded by the National Science Foundation and published today in the journal *Scientific Reports*.

The Klamath, as the region is known, is a pocket of the Pacific Northwest known for its rugged mountains, wild rivers, and Mediterranean climate. The area is a hotspot of biological diversity and a storehouse of carbon—home to an astonishing 29 species of conifers and many rare plants that exist only in this small region of the world.

These forests are well-adapted to wildfire, but more severe fires—like the region's record-breaking Biscuit Fire of 2002, which burned 500,000 acres—have a greater impact on the area's biodiversity. As plants recover, the iconic conifers must compete with a host of more [fire](#)-resilient shrubs and other species, which sweep through the understory and begin to grow quickly.

Jonathan Thompson, Senior Ecologist at the Harvard Forest and co-author on the study, explains, "If the fire-free interval is too short or if the growing conditions are too dry, the shrubs can persist indefinitely, and the iconic conifers are squeezed out."

The research team, composed of scientists from the Harvard Forest, Smithsonian Conservation Biology Institute, and Portland State University, simulated the next 100 years of forest dynamics in the Klamath according to five potential climate futures. One climate future was simply a continuation of recent climate trends (1949-2010); the others projected shifts, from conservative to extreme, in warming and seasonal precipitation.



The Bear Fire 1994 shows shrubs in the understory. Credit: Alan Tepley

Every [climate change](#) scenario led to increased summer drought, which reduced plant survival overall. Climate change also increased the size, intensity, and frequency of wildfires, which can kill even the largest trees, reduce the survival rate of new tree seedlings, and pave the way for growth of those low-growing shrubs, which in turn create more fuel for future fires. Because of this shift in the plant population, the warmest climate simulations created fires that would break all records of burned area size for the region.

The most surprising result? Shrubs swept into the forest even in the absence of intensified climate change. Even with a continuation of recent climate, the region can expect at least 1/3 of the iconic cone-bearing trees to be replaced by shrubs over the coming century.

The researchers believe that this is due in part to legacy of fire suppression that initially gave the conifers an edge over shrubs during the 20th century.

Looking to the future, Thompson adds, "As the [climate](#) continues to warm, big severe wildfires will be more frequent, and the dry conditions that follow will increasingly favor shrubs over conifers. The combination will mean less of the [conifer forest](#) that make the Klamath so distinct."

Provided by Harvard University

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