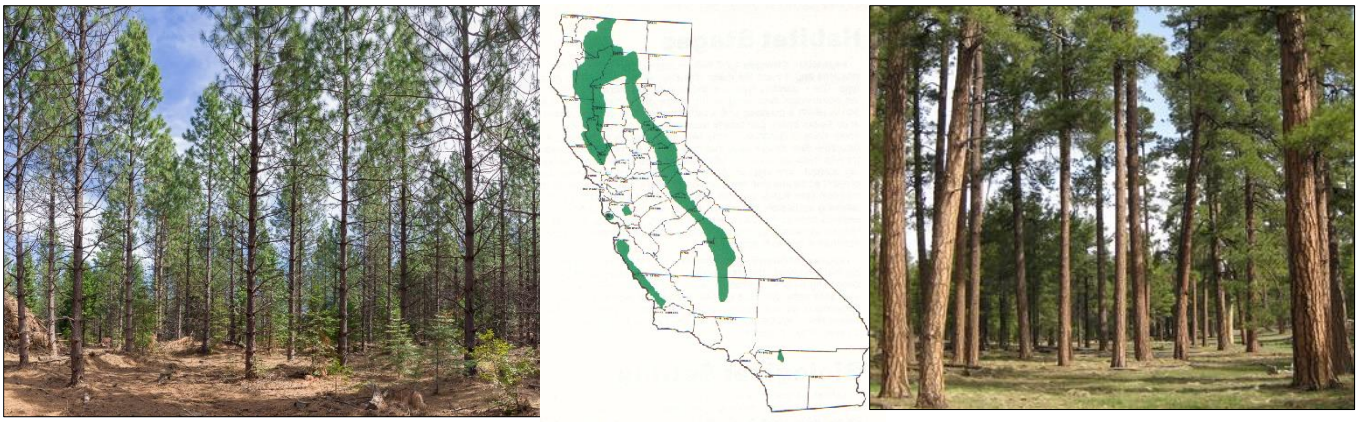
HEALTHY FORESTS: PONDEROSA PINE

This brief is part of the Healthy Forests series, authored by the Science Advisory Panel of the California Governor's Forest Management Task Force in collaboration with the USDA Climate Hubs and USGS Climate Adaptation Science Centers. The series is intended characterize healthy forest attributes, their ecological function, and key stressors.



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PONDEROSA PINE FORESTS DISTRIBUTION IN CALIFORNIA

WHAT DO HEALTHY PONDEROSA PINE FORESTS LOOK LIKE?

Today, ponderosa pine forests in California contain a mosaic of densities, from very dense to open stands. Historically, ponderosa pine forests generally consisted of widely spaced individual trees (30 to 45 feet between trees)[1]. Older forests had 10 to 35 large pines per acre, with trunks wider than an adult's arm span (~ 50"). Younger forests were dominated by smaller and more closely spaced pines, with 150 to 450 ten-inch diameter trees per acre[2].

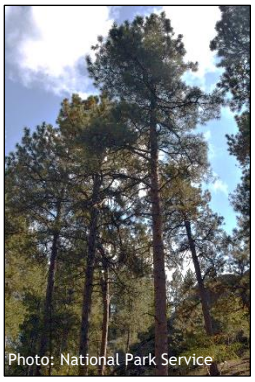

Photo: National Park Service

In more resilient ponderosa pine forests, abundant light reaches the forest floor, which consists of grasses and a smattering of short shrubs, such as thimbleberry and *Ceanothus* spp., as well as a light layer of needles[3]. Few, if any, logs are downed, though dead trees often remain standing, providing habitat for a variety of birds and animals.

Visitors to this forest may be surrounded by trees averaging 300 yrs. old. Younger pine trees often grow in thicker patches and tend to sprout under canopy gaps and after an event like a fire[4]. Eventually the patch will thin as a few saplings outcompete their fellows, growing wider and taller. Older ponderosa pine forests can often withstand ground-level fires, droughts, and other threats with low mortality. Heights of these stands depend on age and local climate conditions; drier locations produce shorter trees on average.

Though ponderosas dominate this forest, they co-occur with a variety of other conifers (cone-bearing trees) across the wide range of elevations and local climates throughout their range. Blue oaks are present at lower elevations and juniper and pinyon pines occur in drier areas, while at higher elevations the ponderosa neighborhood includes species like Douglas-fir, incense-cedar, white fir, black and interior live oaks, and lodgepole pine[5].

BENEFITS OF A HEALTHY PONDEROSA PINE FOREST

- Home to wildlife including chipmunks, bears, elk, deer, birds, and pollinating insects
- Culturally relevant to Native American tribes; pine resin is a medicinal salve and acorns from associated oaks are a staple food
- Abundant opportunities for recreation and tourism
- Carbon is sequestered in growing trees and below ground in roots and soils
- Highly valued timber species

KEEPING PONDEROSA PINE FORESTS HEALTHY

FIRE


Photo: National Park Service

To maintain biodiversity and resilience, ponderosa pine forests need a mix of fire severities[4]. On average, these forests burn every 5-10 years in the hotter and drier regions – which is why downed logs are often not present.

Low to moderate intensity fires typically don't kill many adult trees but will still thin the undergrowth by killing shrubs and smaller trees. Comparatively, a high-intensity fire can kill adult trees and burn the canopy. Both types of fire can promote the establishment of young pines by easing competition and creating gaps in the canopy. However, too much high-intensity fire creates gaps too large for effective seed dispersal, and promotes transition to shrub communities and increased presence of invasive species.

CLIMATE CHANGE

As the climate becomes hotter and drier, ponderosa pine in lower and drier regions may be locally confined to patches that have suitable microclimates. At higher elevations, which were previously unsuitable due to snow cover and cold temperatures, it may increase in abundance or spread uphill.

Forest changes caused by climate are not unprecedented and don't necessarily indicate an unhealthy forest. It is up to land managers to determine how to react. For instance, to maintain ponderosa on the landscape, a manager could plant seedlings from a hotter and drier area or thin the forest to reduce competition for water. Alternatively, if the priority is to retain any forest and does not have to be a ponderosa forest, managers could plant more drought-tolerant trees. Finally, they might choose to wait and observe the natural responses of the forest.

ADDITIONAL RESOURCES

For photos and videos of a ponderosa pine forest that is considered to be close to historical conditions: ishiwildfire.geog.psu.edu

CITATIONS:

[1]Long, J.N., and J.D. Shaw. 2005. A density management diagram for even-aged ponderosa pine stands. Western Journal of Applied Forestry 20(4): 205-215.

[2]Stephens, S.L., J.M. Lydersen, B.M. Collins, D.L. Fry, and M.D. Meyer. 2015. Historical and current landscape-scale ponderosa pine and mixed conifer forest structure in the Southern Sierra Nevada. Ecosphere 6(5): 1-63. http://dx.doi.org/10.1890/ES14-00379.1

[3]Youngblood, A., T. Max, and K. Coe. 2004. Stand structure in eastside old-growth ponderosa pine forests of Oregon and northern California. Forest Ecology and Management 199: 191-217.

[4]Safford, H. and J. Stevens. 2017. Natural Range of Variation for Yellow Pine and Mixed-Conifer Forests in the Sierra Nevada, Southern Cascades, and Modoc and Inyo National Forests, California, USA. Gen. Tech. Rep PSW-GTR-256. Albany, CA: Pacific Southwest Research Station, Forest Service, US Department of Agriculture: 1-241.

[5]Sawyer, J.O., T. Keeler-Wolf, and J.M. Evens. 2009. A Manual of California Vegetation, Second Edition. California Native Plant Society, Sacramento. 1300 pp. Ponderosa pine alliance, online at http://vegetation.cnps.org/alliance/59