

Subalpine forest density

The highest elevation forests in the Sierra Nevada have more small trees and fewer large trees today than they did in the early decades of the 20th century.

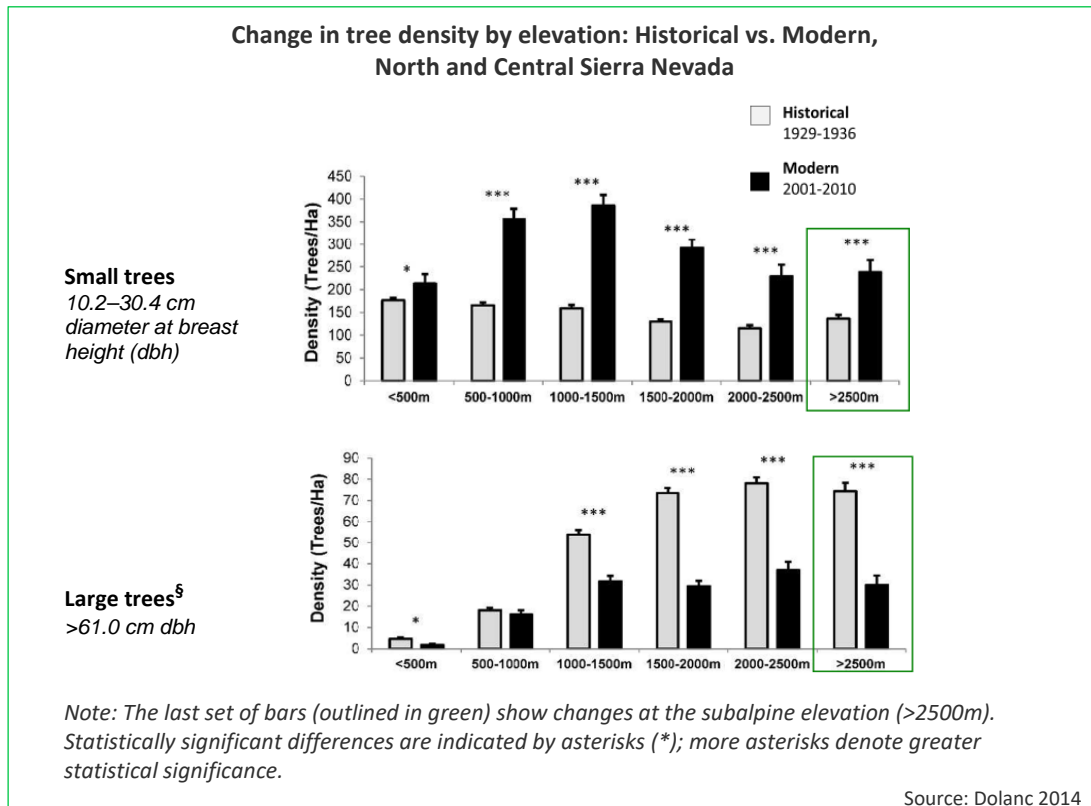


Consistent with a trend affecting California’s forests and woodlands in general, the state’s high-elevation subalpine forests have more small trees and fewer large trees than in the 1930s. Subalpine forests in the Sierra Nevada Mountains occupy the highest elevations – up to the tree line, where cold temperatures do not support tree growth. Changes in tree densities alter the structure of the forest and the ecology of the Sierra Nevada. This change has also been observed in lower elevations in other parts of California (see *Changes in Forests and Woodlands* indicator). Increased forest density could increase the risk of insect outbreaks, disease and wildfires.

At subalpine elevations, deep spring snowpack and low summer moisture limit the development and survival of seedlings. However, over the past several decades, regional climate changes have created favorable conditions for young trees. At the same time, large trees, which have a higher water demand, may be dying off due to insufficient moisture from reductions in snowpack. These elevations are relatively free from the influence of forest management and timber harvesting, and may therefore present a clearer picture of the impacts of climate change on California’s forests.

What does the indicator show?

The graphs below compare historical and modern tree densities at different elevations in the North and Central Sierra Nevada. Historical data are from a 1930s survey of California’s vegetation (documented in the Wieslander Vegetation Type Map). Modern data are from the U.S. Forest Service survey from 2000-2010 (conducted as part of the Forest Inventory Analysis). The density of small trees has increased at all elevations, while the density of large trees have decreased at all but one. The subalpine zone is the last set of bars in both graphs.





Why is this indicator important?

The changing densities observed at subalpine elevations could have detrimental effects on the ecology of the Sierra Nevada. Large trees store considerable amounts of carbon, provide soil nutrients, barriers to water runoff, and nests and shelters for wildlife. Younger and smaller trees cannot provide these functions to the same extent, if at all, as large trees.

Though much of California's vegetation is adapted to frequent fire, fire in the subalpine zone has historically been infrequent and isolated. Recently, wildfires have been occurring in increasingly higher elevations in Sierra Nevada. Subalpine forests have historically been sparse, with insufficient accumulation of dead, woody residue on the forest floor to act as fuel to carry a fire very far. However, an increasing number of smaller trees will naturally provide increased fuel and could ultimately lead to larger and more frequent fires. This could result in lower-elevation, fire-adapted species becoming increasingly dominant at this elevation, as most species native to subalpine regions are not adapted to fire. Densification of forests and warming temperatures could also make conditions more favorable for insect outbreaks and disease, leading to increased tree deaths.



Whitebark pine, a major component of upper subalpine forests, grows at the top of the tree line in Yosemite National Park.

Photo: US National Park Service

For more information about this and other climate change indicators, visit:

<https://oehha.ca.gov/climate-change/report/2018-report-indicators-climate-change-california>

