

Tree Mortality in Northern California: Questions and Answers

May 2022

Where is increased tree mortality located?

In terms of the overall landscape, increased conifer mortality has been identified primarily in areas of northern California, including the following: Mendocino County; Lake County; Sonoma County; Napa County; Contra Costa County (Mt. Diablo); Shasta County; Trinity County; Siskiyou County; small portions of Santa Cruz County; and portions of the northern Sierra Nevada, from roughly Placerville north.

In terms of specific sites, most mortality is being observed in areas with little capacity for extended soil water storage. This includes sites with a very thin soil layer (i.e., short distance from soil surface to bedrock); sites where historically oak and chaparral shrub species have flourished, maybe with later encroachment of conifers; sites with coarser-textured (i.e., sandier) soils; and sites located on the southern and western faces of hills and ridges. Mortality on a north or east slope may indicate that the makeup of the subsoil in that location (e.g., a hardpan layer) or a human-made structure shunts water rapidly away from most roots on that slope.



Ponderosa pine mortality near Clear Lake (Lake County)

How does this mortality compare to recent catastrophic tree mortality in the central and southern Sierra Nevada?

The long-term drought from roughly 2011-2016 is estimated to have killed at least 130 million trees. This year's tree mortality in northern California represents only a small fraction of that number. However, bark beetle-caused mortality first noticed during the winter typically increases greatly during the dry summer and fall months.

As of May 2022, dead trees already present a clear problem for several northern California neighborhoods and communities. The ultimate scale of the problem will depend on the timing and duration of future precipitation. Cascading, catastrophic bark beetle outbreaks leading to regional-scale mortality tend to occur when droughts are prolonged for several years running.

What tree species are being killed?

As of May 2022, the primary species with increased mortality include the following: ponderosa pine, Douglas-fir, knobcone pine, and, to a lesser extent, incense-cedar and gray pine. Scattered mortality of true fir has been observed in the northern Sierra Nevada. It is likely that some species located in remote mountainous locations not yet surveyed are also experiencing elevated mortality levels.

What is responsible for the mortality?

The primary agents directly responsible for tree death are, by and large, various species of bark beetles native to California. The exception is incense-cedar, which instead appears to be suffering from a complex of fungal pathogens that thrive when water stress weakens individual trees. All these biotic agents are attacking trees now because water stress has diminished the trees' ability to produce defensive chemical compounds.

What are the primary concerns with this increase in tree mortality?

The immediate concerns are the possibility that mounting numbers of dead trees will become hazards that could fall on power lines, roads, homes, other infrastructure, and even people. Another concern is that the trees will provide fuels for wildfires during the summer and fall months. In some areas, it is possible that the trees that die will not regenerate in adequate numbers to re-occupy their sites, which could lead to those sites' changing to other vegetation types. For example, some areas currently occupied by pine species may become chaparral shrubfields, or some areas with a forest canopy of conifers and oaks may revert to being oak woodlands. This type of change could ultimately be beneficial to oak woodlands where conifers encroached during the 19th and 20th centuries.

Land- and homeowners should recognize that even on parcels of land with no dead trees, wildfire risk may substantially rise in California during summer and fall 2022. 2021 featured record levels of reduced moisture content in the living vegetation in many parts of the state. Many homes in California are built near vegetation that is adapted to frequent wildfire or to high-severity wildfire. For example, even if there is no tree mortality, those living near stands of knobcone pine or near extensive fields of chaparral should maintain increased vigilance. See <https://www.readyforwildfire.org/> for more information on how to do this.

How do I manage this mortality on land near me?

Unfortunately, by the time a tree is going brown, the bark beetles have already done their job, and in many cases they have all left the tree to find the next one. Management to maintain tree health is best considered in the long-term, and anytime is the right time to begin, even (and especially) when environmental conditions for tree health are great. For more information, see this University of California website: https://ucanr.edu/sites/forestry/Forest_Stewardship/.

After trees are dead, management is largely a matter of removing dead trees that will either cause a hazard of falling on people and infrastructure, dead trees that may provide fuels for future wildfires, or dead trees that will interfere with the next generation of growing trees. Besides considering the desired future condition for a given site's vegetation, the land- or homeowner should consider how best to install and maintain defensible space and breaks in fuel across the landscapes for which they are responsible. In many cases, this can be done as part of a cooperative effort led by a fire safe council, a local government, or another nonprofit entity. See <https://cafiresafecouncil.org/> for one possible resource.



Douglas-fir mortality near Ukiah (Mendocino County)



Is assistance available for affected landowners?

Technical assistance and information about the causes of mortality and managing forest landscapes are abundant and available in California; financial assistance may be harder to come by and is best sought either as a partnership with an agency that administers a cost-share program or as part of a wider effort led by local government. See the pages of any Forestland Steward newsletter (<https://placerrcd.org/placer-resource-conservation-district/forestland-steward-newsletters/>) for a list of specialists across the state who can help. For more information and a good list of further resources, see the UCCE Mendocino Forest Health Blog: <https://cemendocino.ucanr.edu/Forestry/ForestHealth/?blogpost=51877&blogasset=130441>.

Knobcone pine mortality on Mt. Konocti (Lake County)