

Bark Beetle Outbreaks & Conifer Mortality in the North Coast Region



Figure 1. Conifer mortality in Lake County. Photo by Chris Lee, CAL FIRE.

Noticeable decline of several conifer species in the North Coast region was first observed in 2020. Field observations detected extensive evidence of bark beetle activity in declining conifers and subsequent increases in conifer mortality suggested the area was at the incipient stage of a bark beetle outbreak. Monitoring and aerial flight surveys conducted by CAL FIRE Forest Health Specialists in spring 2022 confirmed a landscape scale outbreak (Fig. 1).

Trees Impacted

The trees impacted by the current outbreak include most of the conifer species common to the interior coastal forests. Sampling of infested trees detected several native bark beetle species.

- Ponderosa pine (*Pinus ponderosae*) – western pine beetle (*Dendroctonus brevicornis*), red turpentine beetle (*D. valens*), California five-spined ips (*Ips paraconfusus*)
- Douglas-fir (*Pseudotsuga mensizeii*) – flatheaded fir borer (*Phaenops drummondii*) and Douglas-fir engraver (*Scolytus unispinosus*)
- Knobcone pine (*P. attenuata*) and grey pine (*P. sabiniana*) – *Ips* species, notably California five-spined ips (*I. paraconfusus*) and *Orthotomicus spinifer*

Outbreak Dynamics

- Bark beetle populations likely established in areas with an abundance of fire damaged conifers, which provided ideal host material.
- The outbreak likely started due to drought conditions which helped bark beetle populations spread from burned areas as water stressed trees became more abundant and susceptible to attack.
- The outbreak is well-established and will continue to expand, with significant increases in conifer decline and mortality expected this summer (Fig. 2).
- High bark beetle populations could mean relatively healthy conifers may also become susceptible to bark beetle attacks, due to a behavior called “mass attack”.

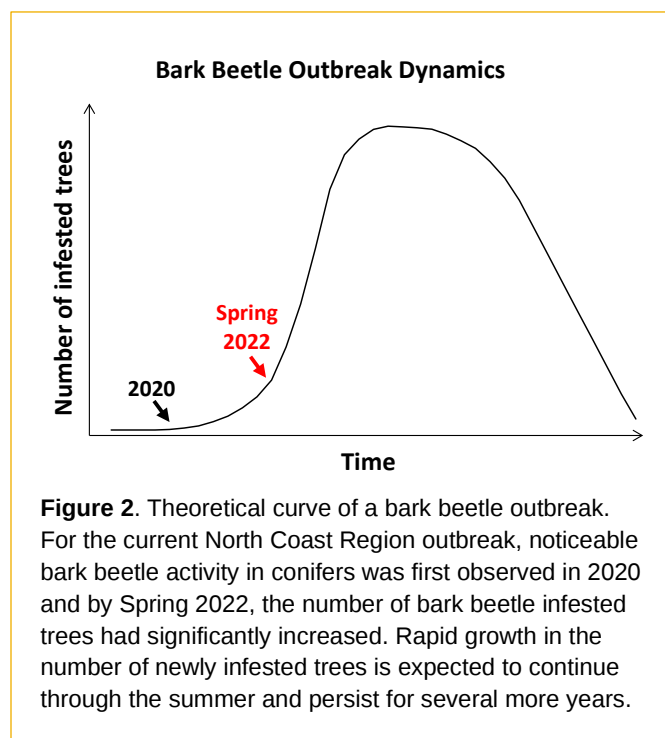


Figure 2. Theoretical curve of a bark beetle outbreak. For the current North Coast Region outbreak, noticeable bark beetle activity in conifers was first observed in 2020 and by Spring 2022, the number of bark beetle infested trees had significantly increased. Rapid growth in the number of newly infested trees is expected to continue through the summer and persist for several more years.

Bark Beetle Mass Attacks



Pitch tubes from multiple bark beetle attacks.
Photo by Mark McGregor, USDA Forest Service.

When foraging bark beetles find a suitable host tree, they release aggregation pheromones that attract more beetles to the tree. The beetles collectively attack the tree to overwhelm its natural defenses and successfully colonize the tree.

Forest Health

Native bark beetles are a natural biotic disturbance that helps maintain healthy forests.

- They are secondary pests that help cull senescent and dying trees from the forest.
- They help recycle nutrients, create heterogenous forest structure, facilitate tree growth and regeneration, serve as food for wildlife, and create habitat for wildlife.
- When multiple disturbances (e.g., wildfire, drought, fire suppression, and poor forest management practices) occur simultaneously and under the right conditions, landscape scale outbreaks can occur.
- Bark beetle populations can grow exponentially due to high reproductive success and the completion of multiple generation each year.

Management

Eradication or control of bark beetle populations at the landscape scale is not feasible.

Integrating multiple management practices will provide the best options for responding to the outbreak.

- Short-term management objectives should focus on community safety by removing hazardous dead trees that could cause damage should they fail and reducing fuel loading in strategic areas.
- For conifer stands that are lightly infested, removing declining trees (where most bark beetle populations occur) and destroying slash (cut vegetation) can help mitigate the build-up of local populations.
- In stands where bark beetles have not established, thinning can improve the vigor of trees by reducing competition.
- Supplemental watering and insecticides can be options for protecting high-value trees.
- Post-disturbance management considerations should include planting non-host species that are suitable for the site or more drought tolerant species (such as oaks) in marginal sites.

Conclusions

Native bark beetles are an important part of a healthy forest ecosystem. However, when landscape scale outbreaks occur, the associated mass tree mortality can have significant economic and ecological impacts on forest ecosystems by altering forest structure and composition, changing water quantity and quality, shifting forest carbon balances, influencing fire behavior, and impacting timber resources and forest recreation.

The current bark beetle activity in the North Coast region has become a landscape scale outbreak.

Lake county is currently experiencing the most extensive conifer decline and mortality, with noticeable increases in tree decline in other areas of the region (including Napa, Sonoma, and Mendocino Counties), as well as in the Northern Sierra. There will be significant increases in conifer mortality through the summer and potentially for several years.

The outbreak will likely run its course until bark beetle populations run out of host material, favorable weather conditions return, or other natural control factors such as predators and competitors help reduce bark beetle populations.

Short-term management objectives can focus on mitigating hazards to life and property. However, long-term management goals should focus on creating healthy and sustainable forest structure that is resilient to future disturbance.

RESOURCES

Bark Beetle Outbreaks in Western North America: Causes and Consequences

https://www.fs.fed.us/rm/pubs_other/rmrs_2009_bentz_b001.pdf

UC ANR Mass Tree Mortality, Fuels, and Fire: A Guide for Sierra Nevada Forest Landowners

<https://anrcatalog.ucanr.edu/pdf/8683.pdf>

US Forest Service Bark Beetles in California Conifers: Are your trees susceptible?

https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5384837.pdf

UC IPM Bark Beetle Management

<http://ipm.ucanr.edu/PMG/PESTNOTES/pn7421.html>

US Forest Service FIDL – western pine beetle

<https://www.fs.fed.us/foresthealth/docs/fidls/FIDL-01-WesternPineBeetle.pdf>

US Forest Service western pine beetle management guidelines

https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5188577.pdf

US Forest Service pine Ips species management

https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5299326.pdf

California Forest Pest Council

<https://www.caforestpestcouncil.org/>

US Forest Service - Forest Health Protection

<https://www.fs.fed.us/foresthealth/>

More information about forest health issues in northern coastal forests can be found on the UCCE Mendocino - Forest Health web page (<https://cemendocino.ucanr.edu/Forestry/ForestHealth/>). More information on forest management can be found on the UCCE Mendocino - Forest Resources web page (<https://cemendocino.ucanr.edu/Forestry/ForestryResources/>).