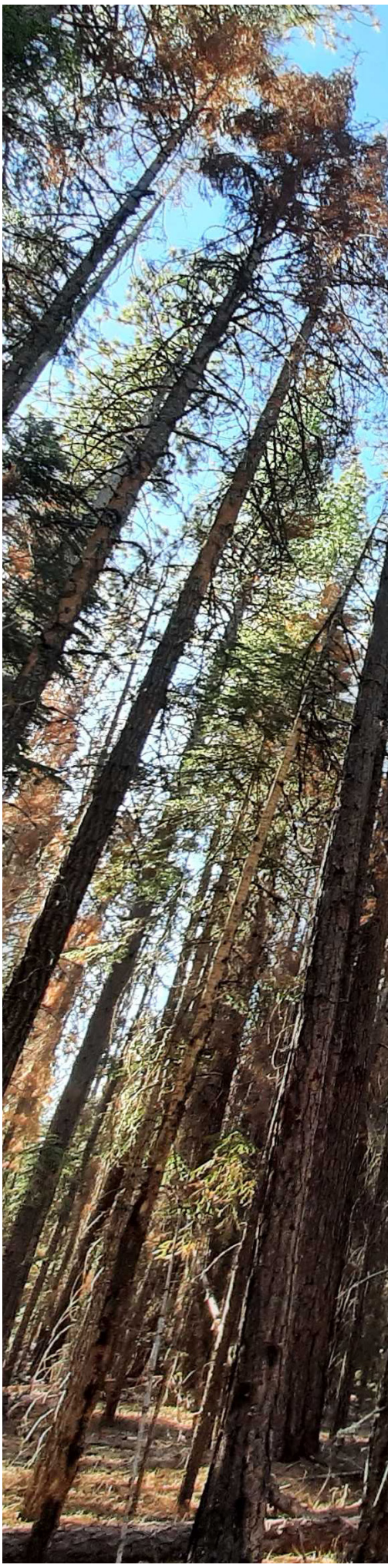

California Forest Pest Conditions 2023

A publication of the
California Forest Pest Council

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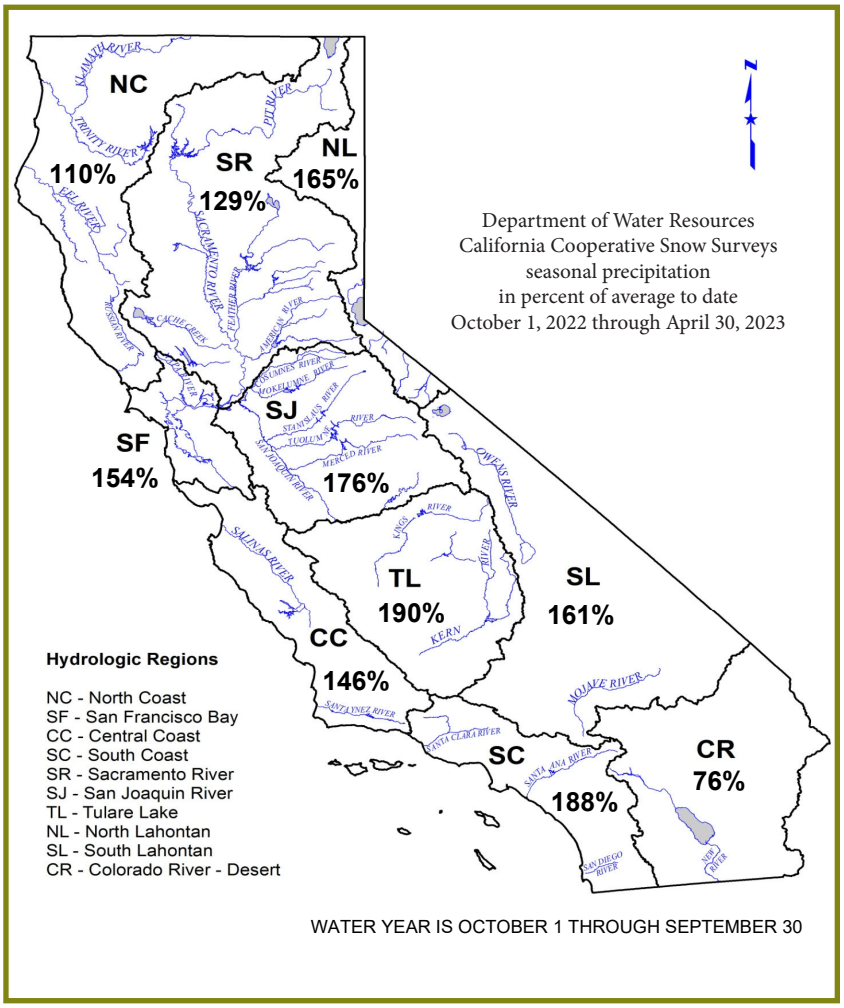
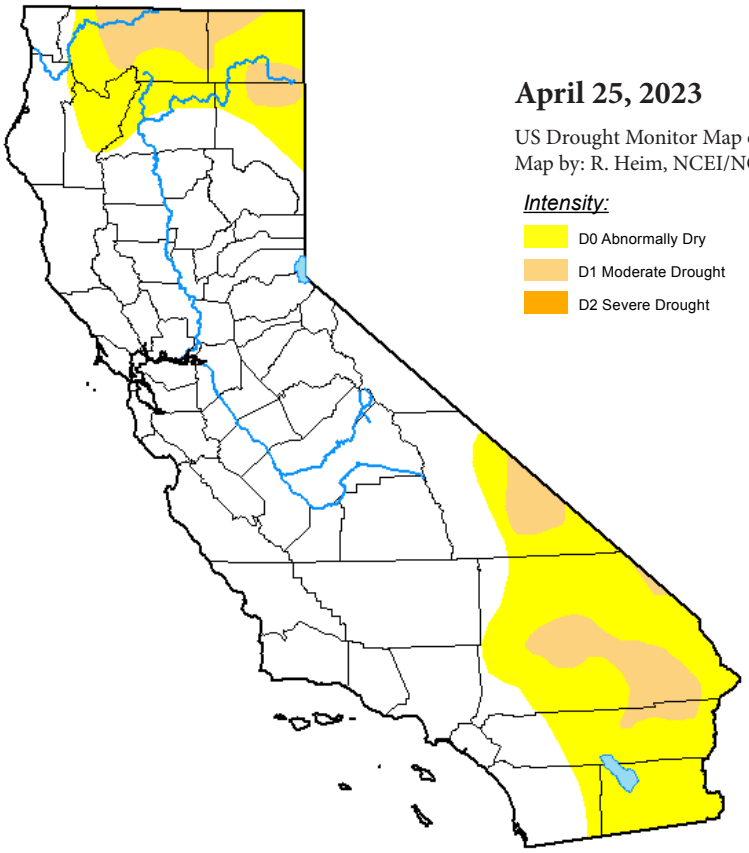
Cover photo:
Need Caption
Photo Credit: B. Bulaon, USDA Forest Service

Statewide precipitation was 141% of average from October 2022 - April 2023, compared to 70% of average for the same time period in 2021 - 2022. In Northern California forested area rainfall totals were 110 - 165% of average, and Southern California areas were 76 - 188% of average (see map on right). The 2022 – 2023 water year (water year is from October 1 – September 30) was the 14th wettest on record (since January 1895). Precipitation was below average in October (11th driest on record), but was followed by a very wet winter. Both March and the four month period of December through March were the 7th wettest on record (4.2" and 10.30" above average, respectively). The exceptionally wet winter brought the majority of the state out of precipitation deficit (see map below).



Statewide temperatures aligned with historical averages (1895 – 2022) with the 2022 – 2023 water year being the 62nd warmest and 67th coolest on record. While October 2022 was the 7th warmest, it was followed by an exceptionally cool winter. November was the 10th coldest, March was the 5th coldest, and the five month period of November through March was the 12th coldest on record (3.0°F, 4.6°F, and 1.9°F below average, respectively). Summer temperatures warmed with July being the 5th warmest, and the two month period of June to July being the 7th warmest (4.2°F and 3.2°F above average, respectively) (https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/statewide/rankings).

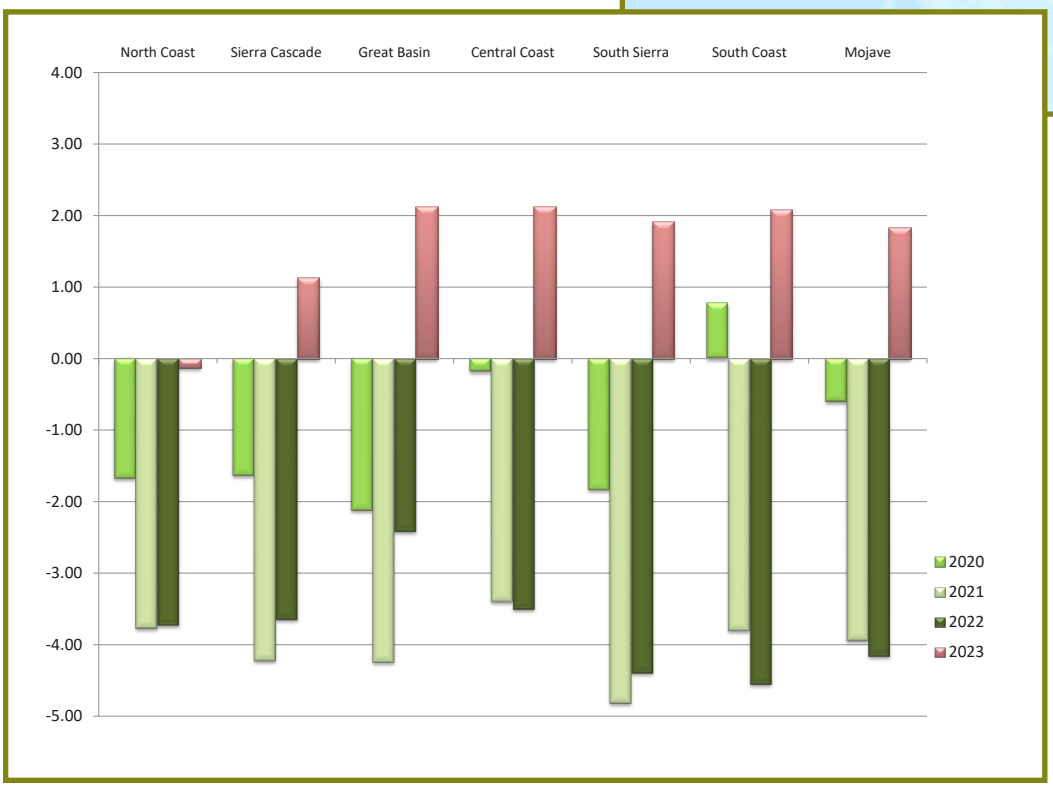


Palmer Drought Index

The Palmer Drought Severity Index (PDSI) is an indicator of drought and moisture excess, with negative values denoting degree of drought. For the 2022 – 2023 water year, the yearly average PDSI values ranged from -0.13 in the North Coast (driest zone) to 2.12 in the Central Coast (wettest zone) (see map). The majority of the state of California had a precipitation surplus as of Sept. 30, 2023.

Climate Divisions for the Palmer Drought Severity Index. Map by: M. Woods, USFS

Palmer Drought Severity Index (PDSI) for California, 2020 - 2023



Source: National Climatic Data Center, U.S. Department of Commerce, https://www.ncei.noaa.gov/pub/data/cirs/climdiv

Palmer Classifications

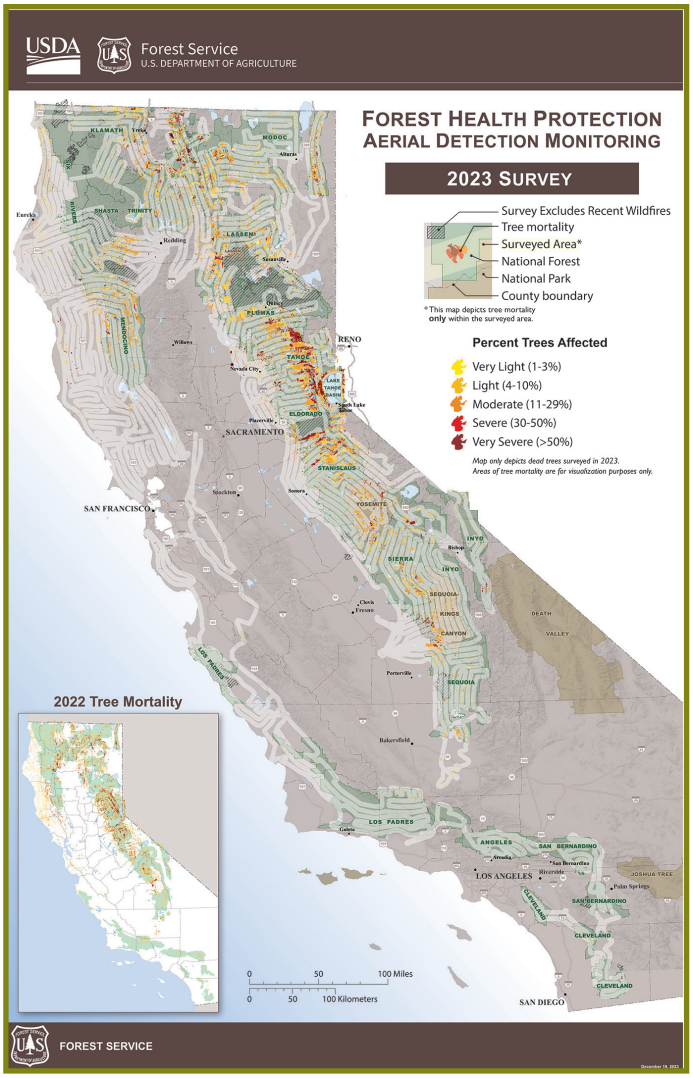
4.0 or more	extremely wet
3.0 to 3.99	very wet
2.0 to 2.99	moderately wet
1.0 to 1.99	slightly wet
0.5 to 0.99	incipient wet spell
0.49 to -0.49	near normal
-0.5 to -0.99	incipient dry spell
-1.0 to -1.99	mild drought
-2.0 to -2.99	moderate drought
-3.0 to -3.99	severe drought
-4.0 or less	extreme drought

Survey Summary
Acres aerially surveyed 2023: 38.2 million acres
Acres aerially surveyed 2022: 39.6 million acres

The USDA Forest Service, Pacific Southwest Region, State and Private Forestry staff conducts annual aerial surveys throughout forested areas of California to detect recent tree mortality, defoliation, and other damage. Aerial Detection Surveys (ADS) are flown in small, fixed-wing aircraft on a 4–5-mile grid pattern with two observers recording from opposite sides of the plane. Most National Forests (NF) and National Parks (NP) in California are surveyed, along with other federal, state, and private forested lands.

Approximately 38.2 million acres were surveyed during the 2023 flight season (June - September). Several large areas were excluded from surveys in 2023 due to large wildfires that were active or occurred within the previous two years. Insect and disease activity is difficult to discern in forests that have burned recently. Active fires late in the 2023 season prevented survey in northern parts of the Coast Range.

Elevated levels of tree mortality (i.e. more than 1% of forested area affected) caused primarily by insects or diseases were recorded on more than 2.4 million acres, totaling an estimated 28.8 million dead trees. Most of the trees killed were recorded as fir (*Abies* spp.), followed by ponderosa pine (*Pinus ponderosa*), and Douglas-fir (*Pseudotsuga menziesii*). The following information was collected for each area with tree mortality or damage: a) damage type (mortality, top kill, defoliation, branch flagging, dieback, or discoloration), b) percent of area affected (see below for severity scale), c) affected tree species or genus, and d) probable damage agent (root disease, bark beetles, etc.).



USDA Forest Service Aerial Detection Survey Results, California, 2023.
Map by: M. Woods, USDA Forest Service

Not all trees in reported acres are dead or damaged. Tree mortality and damage were recorded on a severity scale based on the percent of trees affected within a given area. Severity of mortality and damage was rated as follows: very light (1-3% of mapped area affected), light (4-10%), moderate (11-29%), severe (30-50%) and very severe (>50%). Below we report the estimated number of acres affected, the severity of mortality or damage within those acres, and estimated number of trees affected within those acres.

Acres of mortality or damage may be noted in more than one bullet below as multiple damage agents can occur in the same location.

Bark Beetles and Wood Borers

- California/Shasta red fir (*Abies magnifica*, *A. magnifica var. shastensis*), white fir (*A. concolor*) and grand fir (*A. grandis*) comprised over 84% of the tree mortality recorded in 2023 and was the second largest attributed to fir engraver beetle (*Scolytus ventralis*) ever recorded the Pacific Southwest Region, Region 5.
- Approximately 24.3 million dead firs were recorded across 1.9 million acres, compared to ~28.1 million dead firs across 1.9 million acres recorded in 2022. Both years, mortality was most severe and widespread throughout the central Sierra Nevada Range. Additionally, live trees with dead tops (top killed trees) were uncommon in 2023 unlike the two years prior. Because fir engraver beetle often top or strip kills trees before successive generations kill them outright, mortality should improve.
  - White fir mortality was widespread but generally light to moderate in intensity and associated with heavily stocked mixed conifer conditions.
  - Red fir mortality generally occurred in mature pure high elevation stands at moderate to severe intensities. Mortality was most intense and widespread in the central Sierra Nevada Range from northern Stanislaus to the Southern Plumas NF (southern Plumas County south to northern El Dorado County).
- Pine mortality attributed to western pine beetle (*Dendroctonus brevicomis*) remained elevated with an estimated 2.9 million dead trees across 330,000 acres in 2023, ~3.5 million dead trees across 280,000 acres in 2022 and occurred throughout its

range. Mortality was most widespread in the northern interior, especially north and west of the greater Redding area (Shasta County), and was also detected in high-severity, expanded pockets in the northern Sierra Nevada Range.

- Douglas-fir mortality caused by flatheaded fir borer (*Phaenops drummondi*) in 2023 decreased substantially to an estimated 800,000 dead trees across 93,000 acres, compared to an estimated 3 million dead trees across 190,000 acres in 2022. Mortality was common throughout the northern interior but particularly severe and widespread in the greater Redding area (Shasta County), with a significant reduction of mortality in the Coast Range, especially in Lake County.
- Pine mortality attributed to mountain pine beetle (*D. ponderosae*) remained elevated but decreased from an estimated 390,000 dead trees across 40,000 acres in 2022 to ~270,000 dead trees across 36,000 acres in 2023. Mortality was common throughout the Region but was particularly widespread in areas around Mammoth and Mono County and most severe in limber pine (*P. flexilis*) in the southern White Mountains.
- High-elevation five-needle pine (i.e. limber, whitebark (*P. albicaulis*), western white (*P. monticola*), and foxtail (*P. balfouriana*)) mortality remained elevated but decreased from an estimated 310,000 dead trees across 26,000 acres in 2022 to ~190,000 dead trees across 21,000 acres in 2023. Decreased high-elevation five-needle pine mortality in 2023 may be due to lack of viable hosts for mountain pine beetle in many areas.
- Jeffrey pine (*P. jeffreyi*) mortality attributed to Jeffrey pine beetle (*D. jeffreyi*) or *Ips* spp. decreased from ~350,000 dead trees across 52,000 acres in 2022, to ~170,000 dead trees across 27,000 acres in 2023.
- Goldspotted oak borer (*Agrilus auroguttatus*)-caused oak (*Quercus* spp.) mortality decreased from ~8,000 dead trees across 1,600 acres in 2022 to ~4,300 dead trees recorded across 1,400 acres in 2023. Most mortality detected via aerial surveys occurred in and near the Palomar Ranger District on the Cleveland NF (San Diego County).
- Pinyon pine (*P. monophylla*) mortality attributed to *Ips* spp. decreased to an estimated 77,000 dead trees across 5,700 acres in 2023 from ~220,000 dead trees across 16,000 acres in 2022. Mortality was concentrated primarily in the White Mountains (Mono County) and in the Mt. Pinos Ranger District of the Los Padres NF (Ventura County).

Severe Shasta red fir mortality located south of The Whaleback, Klamath NF. Photo by: N. Stevens, USDA Forest Service

Ongoing severe limber pine mortality west of Mount Inyo, Inyo County. Photo by: J. Moore, USDA Forest Service

Defoliation

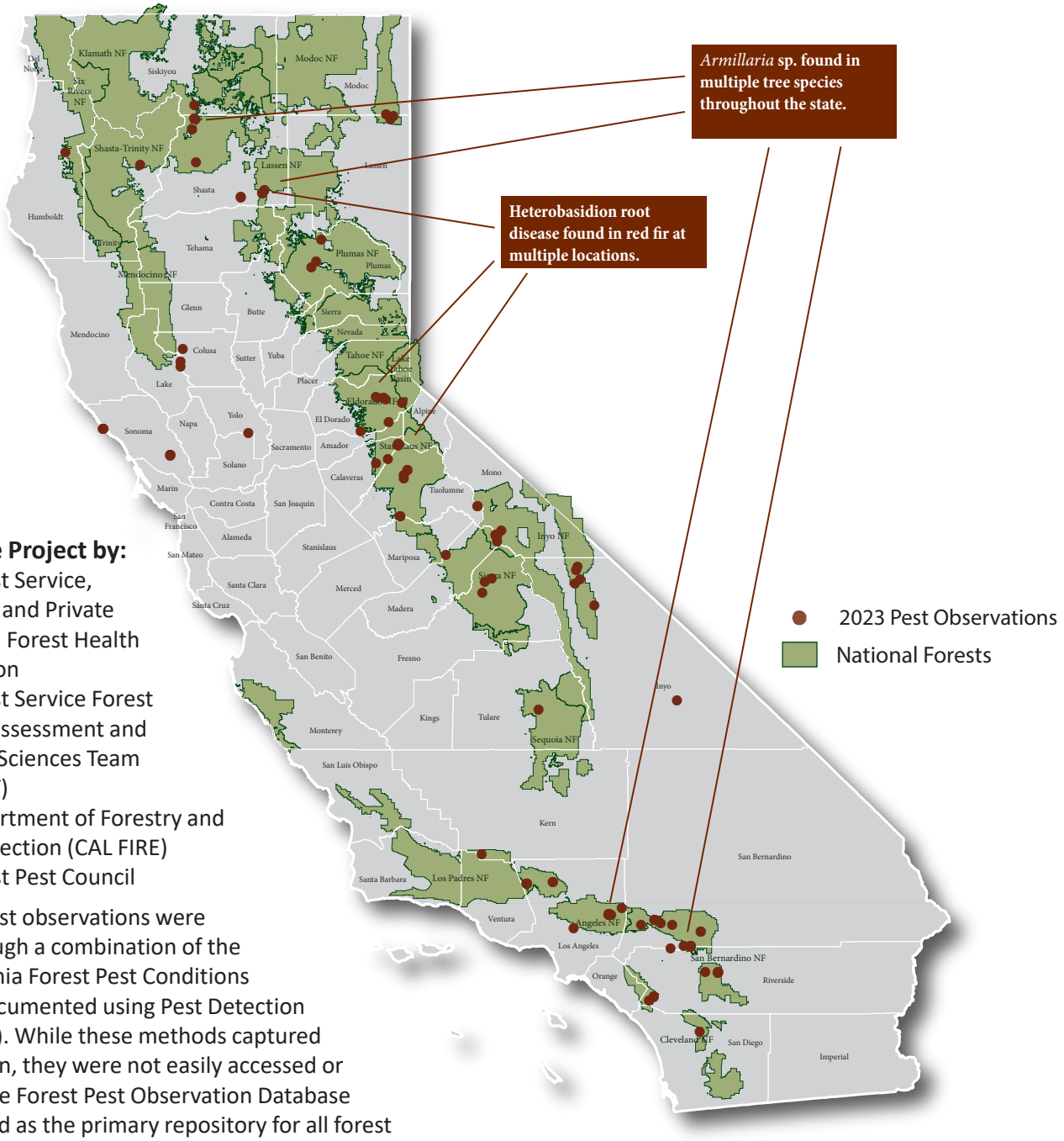
- White fir defoliation caused by Douglas-fir tussock moth (*Orgyia pseudotsugata*) increased from ~800 acres in 2022 to approximately 9,600 acres in 2023 and was observed spreading westward near Bucks Lake and La Porte, Plumas NF (Plumas County).
- Severe defoliation of lodgepole pine (*P. contorta*) by lodgepole needleminer (*Coleotechnites milleri*) increased from ~380 acres in 2022 to ~9,700 acres, and was observed in eastern Yosemite NP and Inyo NF (Tuolumne and Mono Counties).

Diseases

- Tanoak (*Notholithocarpus densiflorus*) mortality attributed to sudden oak death (*Phytophthora ramorum*) continued to decrease to an estimated 2,300 dead tanoak trees across 620 acres compared to 36,000 dead tanoak trees across 7,300 acres in 2022. Several consecutive years of dry spring weather has inhibited the spread of this invasive disease.

Drought

- Oaks throughout the interior of California looked healthier than in the past several years. Actual mortality is difficult to detect from a distance, but scattered older dead trees were common and likely died during the recent drought.
- Mortality in the north interior was a mix of conifers often in the same areas consisting of white fir, Douglas-fir, ponderosa pine, knobcone pine, and incense cedar (*Calocedrus decurrens*).



2023 Pest Observations.
Map by: M. Woods, USFS

Collaborative Project by:

- US Forest Service, R5 State and Private Forestry, Forest Health Protection
- US Forest Service Forest Health Assessment and Applied Sciences Team (FHAAST)
- CA Department of Forestry and Fire Protection (CAL FIRE)
- CA Forest Pest Council

Historically, pest observations were captured through a combination of the annual California Forest Pest Conditions Report and documented using Pest Detection Reports (PDRs). While these methods captured the information, they were not easily accessed or searchable. The Forest Pest Observation Database (FPODA) served as the primary repository for all forest pest observations in California between 2014 and 2018 but was retired in 2019.

A mobile pest detection data entry form was developed and released in 2018 and has been adopted across the USDA Forest Service Forest Health Protection Service Areas. Ground-based observations are located in a database on ArcGIS Online (AGOL).

For 2023, all observations were submitted via the mobile data entry form and supplement the Aerial Detection Survey data. This map shows the locations of pest observations made by forest health professionals in 2022. The most frequently reported damage-causing agent was western pine beetle, followed by mountain pine beetle, Heterobasidion root disease, and Ganoderma. The most frequently reported host species was ponderosa pine, followed by Jeffrey pine, California live oak, and white fir.

Native Insects

Bark and Woodboring Beetles

Western Pine Beetle (*Dendroctonus brevicomis*)

North Interior

Western pine beetle-caused mortality of ponderosa pine (*Pinus ponderosa*) remains above background levels, primarily at dry sites below 4,000 feet. Groups of 5-20 ponderosa pine were killed in low-elevation oak (*Quercus* spp.)-pine stands on most south-facing slopes along Shasta Lake, Shasta-Trinity NF (Shasta County). Scattered ponderosa pine mortality was also noted in the low elevation ponderosa pine and Douglas-fir (*Pseudotsuga menziesii*) stands around Scott Valley above the community of Fort Jones (Siskiyou County).

Southern California

In southern California, western pine beetle was found infesting medium to large diameter (>15-inch DBH) ponderosa and ponderosa x Jeffrey hybrid pines (*P. ponderosa* x *P. jeffreyi*) near Crystal Lake Recreation Area, San Gabriel Mountains National Monument, Angeles NF (Los Angeles County). Mortality was centered around 30 dead and dying trees adjacent to a picnic area, with additional mortality dispersed throughout the Crystal Lake Campground. Removal of infested trees began in summer 2023 and treatment of uninfested hosts will begin in the spring of 2024. Mortality due to western bark beetle continued around Lakes Gregory and Arrowhead in the Mountaintop Ranger District of the San Bernardino NF (San Bernardino County). Scattered mortality of Coulter (*P. coulteri*) and ponderosa pines attributed to western pine beetle was also observed on San Jacinto Mountain, San Bernardino NF, along the North Fork of the San Jacinto River (Riverside County).

Western pine beetle-caused mortality in ponderosa and ponderosa x Jeffrey hybrid pines, Crystal Lake Campground, San Gabriel Mountains NM, Angeles NF (Los Angeles County). Photo by: B. Kyre, USDA Forest Service

Jeffrey Pine Beetle (*Dendroctonus jeffreyi*)

Northern Sierra Nevada

Jeffrey pine beetle was observed attacking three Jeffrey pines at Little Grass Valley Reservoir (Plumas County). Although Jeffrey pine beetle is often attributed by ADS as the pest agent responsible for Jeffrey pine mortality in northeast California, ground checks over the past several years have found only California flatheaded borers (*Melanophila californica*) and pine engravers (*Ips* spp.) in dead trees. This was the first confirmed activity of this beetle species in this area in several years.

Southern Sierra Nevada

Jeffrey pine beetle caused mortality of mature Jeffrey pine trees north of Mammoth Lakes (Mono County). Three green trees were killed by Jeffrey pine beetle next to large groups of 30-50, large diameter trees (>20-inch DBH) that were killed in previous years. Jeffrey pine beetle attacks were also observed on large, canopy dominant Jeffrey pine trees throughout the Inyo NF (trees with crowns above the rest of the forest canopy) but trees were not killed. Multiple groups of Jeffrey pine trees were killed by *Ips emarginatus* and Jeffrey pine beetle (20-100 trees) throughout Dry Creek Road since activity started in 2017, north of Mammoth Lakes (9,000 ft elevation, Mono County). Approximately 700 acres have been affected over multiple years of infestation by the two species.

Southern California

A single dead, large diameter (>17-inch DBH) Jeffrey pine containing Jeffrey pine beetle galleries was identified in San Jacinto State Park. This is the first confirmed report of Jeffrey pine beetle activity in the San Jacinto Mountains. Trapping for Jeffrey pine beetle and additional surveys will be conducted in the spring of 2024.

Western pine beetle galleries in a recently dead Coulter pine, San Jacinto Mountain, San Bernardino NF (Riverside County). Photo by: B. Kyre, USDA Forest Service

Jeffrey pine beetle galleries in Jeffrey pine, Mount San Jacinto State Park (Riverside County). Photo by: B. Kyre, USDA Forest Service

Mountain Pine Beetle
(*Dendroctonus ponderosae*)

North Interior

In northwest California, mountain pine beetle-caused mortality of whitebark pine (*P. albicaulis*) was found on Goosenest Mountain, Klamath NF, inside and surrounding the crater in groups of 1-5 trees covering approximately 150 acres (Siskiyou County). This follows a small outbreak in 2020 with new mass attacks on green trees often associated with white pine blister rust (*Cronartium ribicola*). Mountain pine beetle was found in association with dwarf mistletoe (*Arceuthobium monticola*) causing mortality in western white pine (*P. monticola*) in several groups of 1-3 trees in the 60 acres surrounding Deadfall Lakes, Shasta-Trinity NF (Siskiyou County).

Mountain pine beetle mass attack on a green whitebark pine, Goosenest Mountain, Klamath NF.
Photo by: C. Snyder, USDA Forest Service

Western white pines killed by mountain pine beetle and dwarf mistletoe, Deadfall Lakes, Shasta-Trinity NF.
Photo by: C. Snyder, USDA Forest Service

Northern Sierra Nevada

In the northern Sierra Nevada, mountain pine beetle-caused mortality of lodgepole pine (*P. contorta*) continued to increase at Medicine Lake, Modoc NF (Siskiyou County). Multiple groups of 3-15 trees were observed within and adjacent to recreation areas that encompass approximately 300 acres. Recent verbenone applications were mostly effective in protecting trees within campsites and day-use areas, but three notable groups of attacked trees (10-12 trees, >14-inch DBH) were located within treated areas. The infested trees were removed in fall 2023, well before beetle emergence. Mountain pine beetle activity also continued in the Warner Mountains, Modoc NF, where beetles attacked larger diameter whitebark and western white pine (>12-inch DBH) at the edges of previous years' group kills. At least ten large, green, mountain pine beetle-infested whitebark pine trees were observed at Homestead Flat (Modoc County) and Buck Mountain (Lassen County). The whitebark pine on Buck Mountain were previously infected with white pine blister rust.

Mountain pine beetle also attacked fire-injured western white and lodgepole pines with cambium injury on the lower trunk sustained during the 2021 Dixie Fire near Silver Lake and Caribou Wilderness, Lassen NF (Lassen County). Several hundred trees over approximately 2,000 acres were infested.

Mountain pine beetle-infested lodgepole pine with verbenone, Medicine Lake, Modoc NF.
Photo by: D. Cluck, USDA Forest Service

Southern Sierra Nevada

Mountain pine beetle was detected in nearly all preferred hosts in the southern Sierra Nevada at various locations and elevations despite the above average winter precipitation. Activity occurred in locations disturbed by recent thinning, fuel reduction treatments, and wildfire. Mountain pine beetle continued to attack lodgepole and whitebark pine trees in equal severity at Minaret Summit (Mono County). Approximately 100 acres of lodgepole and whitebark pines, reported as only whitebark pines in ADS, were attacked in 2022 at moderate levels of severity. This year, targeted lodgepole pine trees were single stemmed and much larger in diameter (>25-inch average DBH) than whitebark pine trees attacked in 2022. Whitebark pine trees were attacked in groups, where beetles attacked and killed all trees greater than 5-inches DBH.

Small amounts of lodgepole pine mortality (1-2 dead trees per acre) occurred on the eastern side of the Minaret Summit and towards Deer Mountain. Mortality mostly occurred around the edges of groups of previously killed lodgepole pine. Lodgepole pine mortality also occurred at the edges of dead, high elevation whitebark pine-dominated stands.

Mountain pine beetle attacked whitebark pine at Minaret Summit (Mono County). Photo by: B. Bulaon, USDA Forest Service

Mountain pine beetle-attacked lodgepole pine, Lakes Basin, Inyo NF (Mono County). Photo by: B. Bulaon, USDA Forest Service

Mortality of mature western white pine trees injured in the 2020 Caldor Fire and attacked by mountain pine beetle in 2022 occurred at Sierra-At-Tahoe Ski Resort (El Dorado County). This year, mortality was mostly of whitebark pines at the top of ski runs.

Mountain pine beetle-caused mortality occurred in limber pine trees (*P. flexilis*) on Telescope Peak, Death Valley NP, around five previously attacked limber pines along Rogers Peak service road (Inyo County). Mountain pine beetles appear to have attacked pines in this area twice: once in early June where re-emerging females attacked green trees, and again in mid-summer when the next generation emerged, and mass attacked the same trees. One Great Basin bristlecone pine (*P. longaeva*) (approximately 20-inch DBH) was found newly mass-attacked along the trail, adjacent to a limber pine which received only strip-attacks.

Personnel implementing a prescribed fire in the North Grove of Calaveras Big Trees State Park found mountain pine beetle attacks on three large sugar pines (*P. lambertiana*) but trees did not die (Calaveras County). In Goat Meadow, Sierra NF, mountain pine beetle killed fire-injured sugar pines (Madera County). Trees were potentially weakened by blister rust infections and pine engraver beetles in the upper crowns. Mountain pine beetles attacked but did not kill two legacy-sized sugar pines that sustained deep root burn during a prescribed fire in early July on Calaveras Ranger District, Stanislaus NF (Calaveras County).

Lodgepole pines in Mammoth Lakes and the Lakes Basin area (Inyo NF) have been heavily infested by mountain pine beetle for the past few years, resulting in a large amount of dead standing trees (Mono County; see previous pest conditions reports). Lodgepole pine mortality was obscured by overwhelming levels of red fir (*Abies magnifica*) mortality and was not reflected in ADS data. Thinning treatments are currently underway in and around Lake Mary (approximately 70 acres) to significantly reduce overall basal area. As a result, the density of lodgepole pine around campgrounds and administrative sites along Lake Mary Road, Mammoth Lakes, Inyo NF has been reduced by 30-40% (Mono County).

Douglas-fir Beetle (*Dendroctonus pseudotsugae*)

North Coast

In 2023, Douglas-fir beetle activity abated but did not stop in a five-acre redwood (*Sequoia sempervirens*)-dominated stand in Jackson Demonstration State Forest, in the South Fork Noyo River drainage (Mendocino County). Beetles continued to attack the remaining Douglas-fir in the stand which had been selectively harvested for redwood over the previous two years. Affected Douglas-firs exhibited pitch streaming from various parts of the bole, but boring dust was not present. Although this may indicate an attempt at active defense by the trees, it is uncertain whether they will live, since nearly all the trees have poor live crown ratios and the root-rotting fungus *Phaeolus schweinitzii* has colonized many trees in the stand.

Pitch streaming on Douglas-fir at Jackson Demonstration State Forest, with trees previously killed by Douglas-fir beetle in background (Mendocino County). Photo by: C. Lee, CAL FIRE

FULL 12(c)(i)

Red Turpentine Beetle (*Dendroctonus valens*)

Southern Sierra Nevada

Heavy red turpentine beetle activity was observed in moderately scorched ponderosa and sugar pines after recent prescribed fires on Stanislaus NF and Calaveras Big Trees State Park (Calaveras County). Mortality of infested trees is limited to date.

Moderately scorched sugar pine with red turpentine beetle frass, Calaveras Big Trees State Park (Calaveras County).
Photo by: B. Bulaon, USDA Forest Service

Red turpentine beetle was found in several whitebark pines that were also infested with mountain pine beetle around 9,000 feet on Minaret Summit (Mono County). Red turpentine beetles have rarely been detected in high-elevation five-needle pines in the Eastern Sierra Nevada.

At the eastern base of Waucoba Mountain, Inyo NF around 7,000 feet, red turpentine beetle was found in a remote stand of single-leaf pinyon pine (*P. monophylla*) that also sustained severe dwarf mistletoe (*A. divaricatum*) infection and pinyon pine engraver (*I. confusus*) attack (Mono County). Mortality is occurring at a rate of one tree per acre.

Red turpentine beetle-attacked pinyon pine, Waucoba Mountain, Inyo NF.
Photo by: B. Bulaon, USDA Forest Service

Pinyon Ips (*Ips confusus*)

Central Coast

Pinyon ips-caused mortality of single-leaf pinyon pine continued throughout the Tejon Pass, Los Padres NF (Los Angeles and Kern Counties). The most notable infestation of 20-30 trees occurred in the immediate two-acre area surrounding the USDA Forest Service Apache Saddle Fire Station west of Pine Mountain Club. Infested trees were removed, and the slash was burned as capacity allowed.

Sap flow on ips-attacked pinyon pine, Los Padres NF.
Photo by: B. Kyre, USDA Forest Service

Fir Engraver (*Scolytus ventralis*)

North Interior

White fir (*A. concolor*) mortality was observed in mid-elevation stands extending upslope into Shasta red fir (*A. magnifica* var. *shastensis*) stands on the north flank of Mt. Shasta, Shasta-Trinity NF (Siskiyou County). Shasta red fir mortality was also heavy on the southern flank, though white fir was less affected. On the north flank, mortality was most associated with fir engraver beetle attacks in overstocked mid-elevation stands and scattered at approximately 3-5 trees per acre over at least 5,000 acres. Mortality found on the south flank of Mt. Shasta was caused by fir engraver beetle attack on trees infected with dwarf mistletoe (*A. abietinum* f.sp. *magnificae*) in contiguous stands of Shasta red fir covering over 1,000 acres.

Northern Sierra Nevada

White and red fir mortality was moderate to severe between Medicine Lake and Burnt Lava Flow Geologic Area, Modoc NF (Modoc and Siskiyou Counties). Mortality was most associated with fir engraver beetle attacks and Heterobasidion root disease (*Heterobasidion occidentale*) infections in overstocked stands. Mortality affected 10-50% of the white fir in lower elevation stands over several thousand acres. Mortality of red fir was generally less severe than white fir but large patches of high severity mortality of over 50% occurred over more than 100 acres. Recent mortality, and corresponding loss of canopy cover, has likely made some of these stands unsuitable for wildlife habitat objectives.

Y-shaped pinyon ips gallery in pinyon pine, Los Padres NF.
Photo by: B. Kyre, USDA Forest Service

Southern Sierra Nevada

While true fir mortality and damage caused by fir engravers (*Scolytus* spp.) were confirmed throughout the southern Sierra Nevada in high numbers (reported by ADS in 2022); this year there were fewer attacks on green trees. Several common factors were noted among the firs attacked: multiple leaders, thin or small crowns in comparison to tree size, moderate to severe dwarf mistletoe infections, and top kill from previous year's infestations. Fading large firs were also found with profuse amounts of ambrosia beetle boring dust at their bases.

From a distance, red firs of all size classes appeared ragged or declining from branch dieback in the crown. Upon closer inspection, all dying branches had older dwarf mistletoe infections hidden in the dense crown. Some trees with no outward symptoms of mistletoe infection or beetle activity are still fading sporadically. This phenomenon is widespread in red fir forests in the Eldorado, Stanislaus, Sequoia, and Inyo NFs, and much of the current red fir mortality may be only partially attributed to fir engraver.

White fir killed by fir engraver and Heterobasidion root disease near Burnt Lava Flow Geologic Area, Modoc NF. Photo by: D. Cluck, USDA Forest Service

Southern California

Fir engraver beetle activity in white fir increased in the residential areas of Lake Arrowhead and Crestline, San Bernardino NF with a majority of the mature white fir along Highways 173 and 189 exhibiting partial to total upper crown loss (San Bernardino County).

Flatheaded Fir Borer (*Phaenops drummondi*)

North Interior

Flatheaded fir borer activity has been elevated across northern California for several years and continues to kill Douglas-fir trees across the lower elevations of the Shasta-Trinity and Klamath NFs (Shasta, Trinity, and Siskiyou Counties).

Northern Sierra Nevada

Douglas-fir mortality caused by drought and flatheaded fir borer continued in the same locations as 2022. Mortality was most intense (several hundred to potentially thousands of trees over a few hundred acres) in the Pit River drainage near Lake Britton (Shasta County) and the Deer Creek drainage at the western boundary of Lassen NF (Butte County). These are drier sites for Douglas-fir with a significant oak component and a common species composition for most areas of Douglas-fir mortality in northern California. Flatheaded fir borer also attacked and killed several hundred Douglas-fir at lower elevation and south facing slopes around Quincy (Plumas County).

Red fir declining from multiple-branch dieback, possibly caused by insects or dwarf mistletoe infection, Stanislaus NF. Photo by: B. Bulaon, USDA Forest Service

Multiple leaders and large terminal die-off on this red fir are indicators of previous *Scolytus* spp. infestations, Devils Postpile NP. Photo by: B. Bulaon, USDA Forest Service

For all locations, 2023 Douglas-fir mortality was mostly the result of drought-associated beetle attacks that occurred in 2022 and possibly earlier. Any benefits of the wet winter of 2022/2023 on Douglas-fir health will likely be observed as reduced mortality in 2024.

Current-year and older Douglas-fir mortality caused by flatheaded fir borer near Lewiston Reservoir (Trinity County). Photo by: C. Lee, CAL FIRE

Ambrosia Beetles

(*Gnathotrichus; Treptoplatypus; Trypodendron*)

Southern Sierra Nevada

Large amounts of ambrosia beetle boring dust were observed at the base of ten large fire-injured red firs that survived the 2020 Creek Fire on the Bass Lake Ranger District, Sierra NF (Madera County). Crowns were slightly fading at the time of survey, but significant dust was found in the crevices and encircling boles.

The ambrosia beetle, *Treptoplatypus wilsoni* was confirmed on two dying mature (>30-inch DBH) red fir trees along Rattlesnake Creek, Stanislaus NF (Calaveras County). Evidence of infestation by other woodboring insects and fir engraver beetles was observed on smaller diameter trees.

Cedar Bark Beetles (*Phloeosinus sp.*)

Southern Sierra Nevada

The historic snow load in the southern Sierra Nevada this winter caused widespread mechanical injury with broken limbs, broken stems, and uprooted trees. Snow damage at the highest peaks and ridges was observed on nearly every whitebark pine at Sierra-At-Tahoe Ski area (El Dorado County) and Minaret Summit (Mono County). *Phloeosinus* spp. responded to the abundance of damaged trees by mostly infesting broken branches. Inventory crews working in whitebark pine plots on June Mountain Ski Area (Mono County) noted similar conditions at the top of the mountain.

Sitka spruce defoliation near Loleta (Humboldt County). Photo by: C. Lee, CAL FIRE

Foliar Insects

Spruce Aphid (*Elatobium abietinum*)

North Coast

In 2023, defoliation associated with the spruce aphid was the worst observed to date in Humboldt County. Many trees, particularly those in the Ferndale and Loleta areas, McKinleyville and Big Lagoon, and the Highway 101 corridor between these communities, were nearly completely defoliated, with only a few branch whorls of green needles at the tops of the trees. Additionally, branch tip dieback exceeded the levels noted in the 2021 California Forest Pest Conditions Report, prompting the hypothesis that a fungal pathogen may have been responsible, although none could be isolated. Spruce aphid adults were easily found on spruces (*Picea* sp.) in certain locations in April. Numerous eggs of giant conifer aphids (*Cinara* spp.) along with an adult or two, low numbers of spruce spider mites (*Oligonychus ununguis*), and a few small larvae of the greenstriped forest looper (*Melanolophia imitata*) were also found on defoliated spruces.

Spruce aphids on a Sitka spruce branch near Trinidad (Humboldt County). Photo by: C. Lee, USDA Forest Service

Black Oak Leafminer (*Eriocraniella aurosparsella*)

Northern Sierra Nevada

Extensive blotch mining of black oak (*Quercus kelloggii*) leaves by black oak leaf miner was observed for the first time since

FULL 12(c)(i)

Early instar satin moth caterpillar on aspen in south Warner Mountains, Modoc NF.
Photo by: D. Cluck, USDA Forest Service

Pinyon needle scale egg masses under the bark of a pinyon pine, White Mountains, Inyo NF.
Photo by: B. Bulaon, USDA Forest Service

Pinyon pine recovering after pinyon needle scale infestation, White Mountains, Inyo NF.
Photo by: B. Bulaon, USDA Forest Service

2017 near Blue Canyon, Tahoe NF (Placer County). Nearly every black oak was partially defoliated over approximately 7,000 acres of mixed conifer and hardwood forest along Highway 20 near Bear Valley and along Interstate 80 from Baxter to Emigrant Gap.

White Satin Moth (*Leucoma salicis*)

Northern Sierra Nevada

Defoliation of quaking aspen (*Populus tremuloides*) caused by white satin moth was detected both by ADS and ground observation in the south Warner Mountains, Modoc NF (Lassen County). The two principal locations consisted of approximately 20 acres and 100 acres of severe aspen defoliation. Many trees had grown new foliage in at least a portion of previously defoliated crown by late summer. These locations will be monitored for further activity in the spring of 2024.

Pinyon Needle Scale (*Matsucoccus acalyptus*)

Southern Sierra Nevada

The distribution of pinyon needle scale appeared to be more widespread at the southern base of the White Mountain Range, along Westgard Pass (Mono County). Top kill of pole-sized single-leaf pinyon pine trees by pinyon needle scale was severe (>50% of trees per acre) over a ten-mile stretch of the Westgard Pass Road, centered around Cedar Flat Campground. No mortality was observed, but the overall decline resulted from several years of repeated infestation by pinyon needle scale. Many trees looked gray and dead from afar, but ground surveys indicated these trees were alive and slowly recovering. Trees had fading crowns but experienced epicormic sprouting this spring despite losing more than 80% of their needles. Infestation of scale was still evident: adult scales were noted on older needles, and cottony egg masses were found under flakes of outer bark. Pinyon needle scale was also observed in the Inyo Mountains on the eastern side of Waucoba Mountain where thinning crowns were visible from the road and could easily be mistaken as dead trees (Inyo County).

Douglas-fir Tussock Moth (*Orgyia pseudotsugata*)

Northern Sierra Nevada

Douglas-fir tussock moth-caused white fir defoliation was observed near Bucks Lake and La Porte, Plumas NF (Plumas County). These areas were detected by ADS and ground verified. Defoliation was mostly light to moderate. Tussock moth caterpillars were also observed in other locations, including caterpillars beginning to pupate at Morgan Summit, Lassen NF, but no defoliation was reported (Tehama County).

Southern California

Feeding by Douglas-fir tussock moth larvae was observed on at least 20 white fir trees near Heaps Peak in San Bernardino NF. Trap catches in Heaps Peak Arboretum and near the Hubert Eaton Scout Reservation were not indicative of a population increase, but a severe tropical storm mid-trapping season may have disrupted adult flight resulting in reduced detection (San Bernardino County).

Douglas-fir tussock moth-caused defoliation on Douglas-fir, San Bernardino NF. Photo by: B. Kyre, USDA Forest Service

Exotic Invasive Insects

Balsam woolly adelgid (*Adelges piceae*)

North Coast

In 2023, balsam woolly adelgid continued to infest grand fir (*A. grandis*) in the North Coast. Areas where infestations were observed included Salt Point State Park in Sonoma County (the southernmost observation in California to date), points along Highway 20 near Fort Bragg in Mendocino County, Sequoia Park in Eureka (Humboldt County), Walker Point Road between Arcata and Eureka (Humboldt County), and Azalea State Preserve in McKinleyville (Humboldt County).

Goldspotted Oak Borer (GSOB) (*Agrilus auroguttatus*)

www.gsob.org

Southern California

Goldspotted oak borer activity remained consistent in areas of known infestation and continued its spread east, primarily through the transport of oak firewood. Common points of ingress include campsites, mountain communities, and permitted cabins as firewood is often the primary heat source for residents and permit holders.

Los Angeles County

Goldspotted oak borer continued to infest oaks in the unincorporated community of Green Valley located in San Francisquito Canyon, Angeles NF. The Inland Empire Resource Conservation District (IERCD) identified 103 infested oak trees of varying species, 60 of which were removed. Goldspotted oak borer has also been detected in nearby Bouquet Canyon in areas adjacent to private inholdings and permitted cabins within the forest boundary. The National Forest Foundation surveyed for GSOB-infested trees in the Angeles NF and surrounding areas in fall and early winter 2023.

In the community of Wrightwood in the San Gabriel Mountains National Monument, Angeles NF, IERCD documented nine isolated infestations on individual residential properties along Flume and Acorn Canyons. Goldspotted oak borer has not yet been detected in the surrounding forest, but surveys are ongoing.

Orange County

Irvine Ranch Conservancy staff identified six coast live oak (*Q. agrifolia*) trees with GSOB emergence holes in upper Fremont Canyon. In April, a total of 1,443 trees in Weir Canyon and Gypsum Canyon were treated using externally-applied preventative insecticide spray, and three infested trees in upper Fremont Canyon were treated via injection of a systemic insecticide. Due to the success of ongoing management efforts, the treatment buffer around infested trees was reduced to approximately 30 meters to reduce non-target impacts of chemical treatment.

The Arden Modjeska House and the adjoining Modjeska preserve in Silverado treated a total of 86 oak trees with preventative insecticides in 2023. Just south of Silverado in Trabuco Canyon, O'Neill Regional Park identified 19 infested trees, two of which were removed. In response, 199 trees immediately adjacent to the infestation were treated with preventative insecticides.

Contractors under a CAL FIRE grant to the Orange County Fire Authority removed three heavily infested amplifier trees and treated an additional 96 coast live oak trees with preventative insecticides in Bell Canyon on Audubon California Starr Ranch Sanctuary.

Riverside County

California State Parks continued and expanded GSOB monitoring and management of approximately 800 tagged trees over 350 acres at Mt. San Jacinto State Park. One hundred thirty-five trees had evidence of past GSOB infestation. Continued monitoring included surveys at Idyllwild and Stone Creek Campgrounds. Both campgrounds received annual basal applications of dinotefuran with a surfactant and infested trees were removed as needed.

Beginning in January of 2022, the Mountain Communities Fire Safe Council extensively surveyed for goldspotted oak borer in the community of Idyllwild-Pine Cove and surrounding areas, San Jacinto Mountain, San Bernardino NF. To date, GSOB emergence holes have been recorded in approximately 709 trees, predominantly California black oak. Of the 709 GSOB-infested trees, 35 were severely infested (>50 emergence holes), 38 were moderately infested (30-49 emergence holes), and the remainder were lightly infested (1-29 emergence holes).

San Bernardino County

CAL FIRE surveyed communities in the Sugarloaf area of Big Bear located in the Mountaintop District of the San Bernardino NF and documented 22 California black oak trees with evidence of past GSOB infestation. GSOB is well established in Sugarloaf. No trees in the surrounding forest land have been found to be infested with GSOB, but surveys by USDA Forest Service staff are ongoing.

GSOB-caused mortality of coast live oak on the Sycuan Reservation (San Diego County). Photo by: B. Kyre, USDA Forest Service

GSOB-caused mortality of coast live oak on the Sycuan Reservation (San Diego County). Photo by: B. Kyre, USDA Forest Service

San Bernardino NF staff and IERCD surveyed around the community of Forest Falls in Mill Creek Canyon and identified emergence holes on 49 California black oak trees. GSOB activity continues to impact the community of Oak Glen, covering approximately 117 acres of oak woodland, hillsides, and the stream corridors of Oak Glen Preserve. In late 2022 and 2023 IERCD staff identified an additional 112 California black oak trees with GSOB infestations. Mitigation efforts are ongoing.

Two GSOB-infested coast live oak trees were identified and removed following 2022 surveys in Wildwood Canyon, California State Parks. Additional surveys in 2023 of 375 trees identified seven more trees with confirmed infestations. Preventative applications of dinotefuran and a penetrating surfactant have been completed in the surrounding oak woodland.

In July 2023, four California black oak with GSOB emergence holes were found in Miller Canyon and one infested black oak was identified on the shore of Silverwood Lake State Recreation Area, California State Parks, near highway 138. San Bernardino NF staff inspected 300 trees on the national forest side of Highway 138, none of which were infested with GSOB. Removal of the infested trees and preventative insecticide treatments of surrounding oaks are planned for spring 2024. Park staff conducted another inspection of the state park in conjunction with national forest staff who surveyed the adjacent national forest land in fall 2023.

<u>San Diego County</u>

Management efforts on the Cleveland NF shifted from suppression to long-term management. Annual carbaryl applications and tree removal continue in high priority sites such as picnic areas, campgrounds, and along heavily used roads. Treatment funding was provided by Forest Health Protection (FHP), a division of State, Private, and Tribal Forestry, USDA Forest Service for treatments on the Palomar Ranger District, and a CAL FIRE Forest Health grant awarded to the National Forest Foundation.

For the seventh consecutive year, the contact insecticide carbaryl was applied to ~256 coast live oaks at four sites on the Palomar Ranger District, Cleveland NF: Oak Grove Campground and Fire Station (both west of Warner Springs), Inaja Memorial Picnic Area, and the Pine Hills Fire Station near Julian.

Carbaryl was applied to ~1,157 coast live oak trees for the fifth consecutive year at eight developed recreation sites located adjacent to Ortega Highway and west of Lake Elsinore: Blue Jay Campground, Falcon Group Campground, adjacent oak woodland along Long Canyon Road, areas between the aforementioned sites, Wildland Firefighters Memorial, El Cariso Picnic Areas (North and South), El Cariso Campground, and the shared USDA Forest Service, Riverside County Fire Station (Trabuco Ranger District, Cleveland NF). Surveys performed in early 2023 identified GSOB infestations in Silverado, Hot Springs, and San Juan Canyons. Tree removal is scheduled for spring 2024.

The La Jolla Band of Luiseño Indians continued implementing their GSOB Pest Management Plan for the La Jolla Indian Reservation which includes continued surveys, removal and processing of infested trees, and the planting of coast live oak seedlings in campgrounds. The tribe continues to work closely with the University of California, Riverside to develop indigenous cultural and prescribed burning recommendations funded by the USDA Forest Service Special Technology Development Program.

The Pala Band of Mission Indians documented a slight spread of GSOB from two to six infested trees in 2023 and will continue suppression efforts to contain the localized infestation using both mechanical and chemical means.

In 2023, the Pechanga Band of Indians received USDA Forest Service Landscape Scale Restoration Funds to augment the implementation of their GSOB Management Plan on the Pechanga Reservation. GSOB management on the reservation is ongoing and includes the preventative treatment of high value trees, the removal of infested trees, and the propagation of coast live oak seedlings for oak restoration.

The Sycuan Band of the Kumeyaay Nation reignited efforts for GSOB suppression and management in 2023. In October 2023, windshield surveys were conducted on the approximately six square miles of Sycuan Reservation and off-reservation trust lands. Crown thinning and dieback was noted in 50% of the coast live oak areas surveyed. Foot surveys of a subset of 19 acres showed high levels of infestation in living trees and scattered mortality indicating a long-term infestation. The Sycuan Band of the Kumeyaay Nation also applied for USDA Forest Service suppression funds supported by Region 5 FHP staff to renew a long-term GSOB management program.

Spotted Gum Lerp Psyllid (*Eucalyptolyma maideni*)

Southern California

Approximately 12 lemon gum eucalyptus (*Corymbia citriodora*, formerly *Eucalyptus citriodora*) were heavily infested with spotted gum lerp psyllid in Rancho Cucamonga (San Bernardino County). This psyllid is native to Australia and has been found throughout Southern California. This psyllid may weaken trees and cause leaf drop in heavy infestations. Like other psyllids, spotted gum lerp psyllid produces copious amounts of honeydew, which is then covered by sooty mold on leaf surfaces. Feeding may eventually cause death of host trees. Unlike the red gum lerp psyllid, spotted gum lerp psyllid larvae can move freely in and out of a lerp, the structure created by larvae through excreting a gelatinous honeydew. In addition, more than one spotted gum lerp psyllid larva has been observed occupying a lerp. Outbreaks have been assisted by man-made eucalyptus monocultures that occupy city streets and parks. Infestations are characterized by heavy sooty mold of old and fully mature leaves. Spotted gum lerp psyllid has been found in Los Angeles and Orange Counties.

Invasive Shot Hole Borer (ISHB) (*Euwallacea fornicatus* and *E. kuroshio*)

http://www.iscc.ca.gov/ishb.html
http://www.ishb.org

Southern California

Region 5 is impacted by two species of exotic ambrosia beetles known as invasive shot hole borers (ISHB). The two species, polyphagous shot hole borer (*Euwallacea fornicatus*) and Kuroshio shot hole borer (*E. kuroshio*), are nearly indistinguishable morphologically making species level identification difficult.

Los Angeles County

The Los Angeles County Agricultural Commissioner reported that approximately 95 parks were surveyed for ISHB in 2023. Surveys found seven parks in Los Angeles County with moderate infestations, and six with heavy to severe infestations. Lightly to moderately infested tree species include London plane (*Platanus* x *hispanica*), black cottonwood (*Populus trichocarpa*), palo verde (*Parkinsonia aculeata*), boxelder (*Acer negundo*), and sycamore (*Platanus* spp.). The only tree species severely infested was western sycamore (*P. racemosa*). Numerous previously infested trees show signs of recovery. One western sycamore and one black cottonwood in Bixby Marshland tested positive for the pathogenic fungus, *Fusarium kuroshium*. These two trees are the only confirmed infestations of Kuroshio shot hole borer in the county. All other ISHB identified to species in Los Angeles County have been polyphagous shot hole borers.

Orange County

California State Parks is working with Orange County Fire Authority, University of California Cooperative Extension (UCCE), and other partners to monitor and manage ISHB infestations at Chino Hills State Park, located at the convergence of Orange, Riverside, and San Bernadino Counties. In 2023, State Park staff identified 24 infested hosts surrounding the Discovery Center. Affected species included arroyo willow (*Salix lasiolepis*), western sycamore, and one castor bean (*Ricinus communis*).

San Diego County

In late 2022, San Diego Natural History Museum's Entomology Department identified ISHB from traps collected along the southern boundary of Camp Pendleton located in San Diego County. In spring 2023, an additional five beetles were trapped. Canopy dieback, staining, and boring holes were observed on arroyo willow along the Margarita River. University of California Agriculture and Natural Resources (UCANR) staff confirmed ISHB presence from live specimens that were retrieved from an infested tree.

Imported Willow Leaf Beetle (*Plagiodera versicolora*)
Central Coast
Imported willow leaf beetle-caused defoliation was detected along Coon Creek Trail in Montaña de Oro State Park (San Luis Obispo County). There was significant damage on arroyo willows over approximately 11 acres.

Mediterranean Oak Borer (*Xyleborus monographus*)
North Coast
The first report of Mediterranean oak borer (MOB) attack on Oregon white oak (*Q. garryana*) in California was documented in May 2023. Two Oregon white oaks in Bothe-Napa Valley State Park were charred during the Glass Fire of 2020 and had extensive MOB infestations in areas with fire-damaged bark. MOB range expansion was greatest in Sonoma County. In 2022, confirmed infestations were limited to the Highway 101 corridor from Cotati north to Santa Rosa. In 2023, infestations were confirmed in Cloverdale and a major infestation was identified in west Santa Rosa. In Lake County the range expanded north to Clear Lake. In Sacramento County the verified range expanded from the previously identified infestation in Citrus Heights to the south and southwest into Fair Oaks and the City of Sacramento respectively.

Emerging Pest Highlights

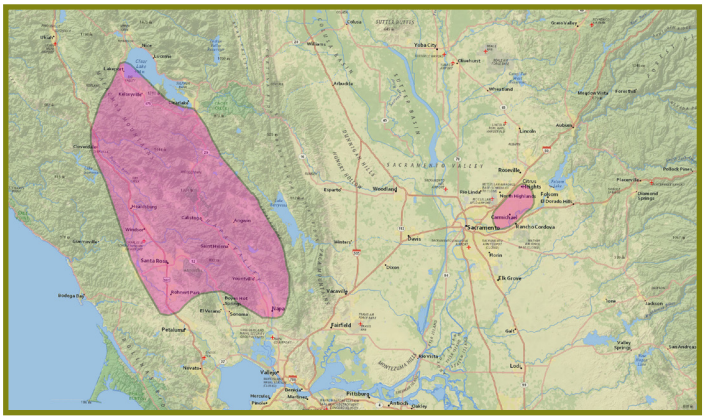
The following exotic invasive pests are not currently causing widespread damage to trees in California but have been caught in monitoring traps or intercepted at airports and agricultural checkpoints and therefore pose a potential risk.

Spongy Moth (formerly known as gypsy moth) (*Lymantria dispar*)
Seven male moths were trapped in the California Department of Food and Agriculture (CDFA) trap grids in 2023. One flightless 'Siberian' spongy moth was trapped in Los Angeles County. Six European spongy moths were trapped in Los Angeles, San Diego, Monterey, Santa Clara, and Ventura Counties. The finds led to delimitation grid trapping in six locations in addition to an ongoing site in Contra Costa County.

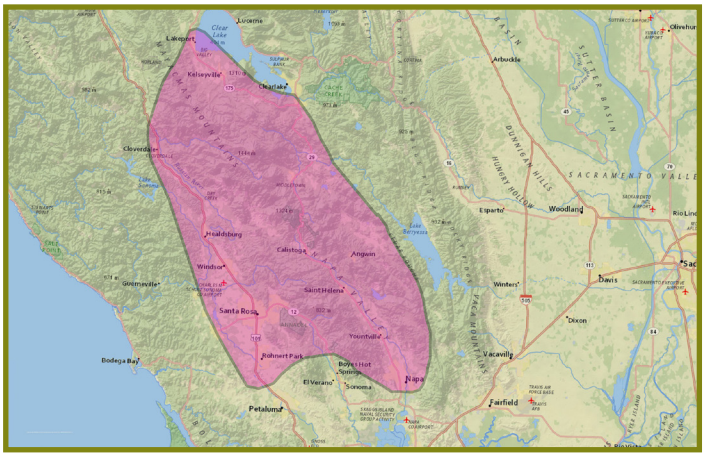
Spotted Lanternfly (*Lycorma delicatula*)
The spotted lanternfly is native to China but has become established in the Northeastern United States. It is a potential pest for many tree species as well as numerous woody agricultural crops, including grapes and fruit trees. In 2023, live adult lanternflies and a viable egg mass were discovered in aircraft as part of the CDFA pest detection program.

Japanese Beetle (*Popillia japonica*)
Although primarily a pest of grasses, ornamental shrubs, and agricultural crops, the Japanese beetle has a host range of over 300 species including oaks, alders (*Alnus* spp.), maples (*Acer* spp.) and sycamores. Larvae feed on roots while adults are defoliators. In 2023, there was an ongoing spot eradication effort of Japanese beetle in Sacramento County and viable life stages were found in aircraft as part of the CDFA pest detection program.

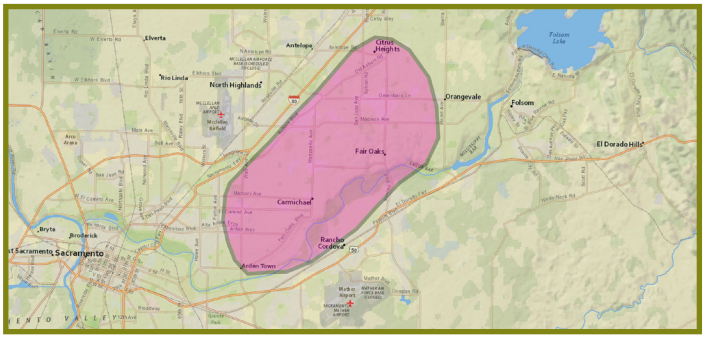
Willow leaf beetle feeding on arroyo willow on Coon Creek Trail, Montaña de Oro State Park (San Luis Obispo County). Photo by: J. Gee, CAL FIRE



Verified distribution of MOB in Sonoma, Napa, Lake, and Sacramento Counties, Fall 2023. Map by: C. Ewing, CAL FIRE



More detailed view of MOB in Sonoma, Napa, and Lake Counties, Fall 2023. Map by: C. Ewing, CAL FIRE



Verified distribution of MOB in Sacramento County, Fall 2023. Map by: C. Ewing, CAL FIRE

Emerald Ash Borer (*Agrilus planipennis*)
The recent discovery of emerald ash borer in Oregon instigated efforts to survey, trap, and monitor for the insect in California. A grid of traps will be deployed at areas along the Oregon Border, the Interstate 5 corridor, and campgrounds and parks with an ash (*Fraxinus* spp.) component that may be suitable for the insects. Movement of infested firewood into California is the primary concern.

Native Diseases

Root Diseases

Black Stain Root Disease (*Leptographium wageneri* varieties)
A group of Douglas-fir (*Pseudotsuga menziesii*) trees infected with *Leptographium wageneri*, the cause of black stain root disease, was observed along South Fork Road in Del Norte County. The trees were on the shoulder of the county road and contained 10-15 Douglas-firs in various stages of health, decline, and mortality. Black stain root disease was also detected in Douglas-firs near where Essex Gulch empties onto Highway 299 between Arcata and Blue Lake (Humboldt County). One or two trees die every year at this site; approximately 6-8 trees have died in past years, and two were newly dead in 2023.

USDA Forest Service Forest Health Protection (FHP) examined twelve five-acre black stain root disease plots established in 1996 on the Devils Garden Ranger District, Modoc NF. Occasional disease-related new mortality of ponderosa pine was observed in and around the plots. The plots that were thinned in 1996 and then under-burned in 2002 by the Muldoon Fire had the least recent black stain root disease activity. Fire may have hastened the death of infected trees and prevented further pathogen spread.

Bristlecone pine (*Pinus longaeva*) and single-leaf pinyon (*P. monophylla*) were surveyed for black stain root disease in the Ancient Bristlecone Pine Forest and adjacent Inyo NF, respectively (Inyo County). Disease severity was roughly the same for both pine species at less than 10%. Samples were taken for comparative DNA analysis and results are pending.

Armillaria Root Disease (*Armillaria* spp.)
Armillaria was detected in many areas of the north coast in 2023, although in each case its role was unclear, as is typical for this versatile fungus. Fruiting was observed on downed alder (*Alnus* sp.) in Del Norte County early in the year, on woody debris near College Cove in Humboldt County in early November, and in association with ongoing grand fir (*Abies grandis*) mortality near Fortuna, also in November. Numerous fruiting bodies, some very large, were observed in December throughout coastal Humboldt and Del Norte Counties on dead red alder (*A. rubra*) as well as at the bases of nearby living red alders; identification is ongoing. Rhizomorphs and mycelial fans of the fungus were found on about five windthrown grand fir at Berta Road in Eureka, but numerous standing grand firs had copious pitching at their bases, indicative of possible *Armillaria* infection. In one tree, a long column of sapwood decay caused by the pathogen was bordered by new patches of dead wood with galleries of fir engraver beetle (*Scolytus ventralis*) (Humboldt County). In each of these cases, identification to species was ongoing, except at the Del Norte site, where the species was suspected to be *A. nabsnona*. Both *A. gallica* and *A. mellea* had been identified in Del Norte County in past years. Previous years' fruiting bodies in association with red alder near the College Cove area in Humboldt County were identified as *A. gallica*.

Armillaria mycelium was also present at the base of a 10-inch DBH Douglas-fir along Blue Lake Boulevard at the eastern edge of Blue Lake

Staining typical of black stain root disease (variety unknown) at the base of a dead bristlecone pine in the Ancient Bristlecone Pine Forest.
Photo by C. Barnes, USFS

Armillaria sp. fruiting on a dead red alder at Headwaters Forest Reserve.
Photo by: C. Lee, CAL FIRE

One side of a long decay column caused by *Armillaria* sp. at Berta Road south of Eureka (Humboldt County). The decayed wood (black, at right) features Armillaria mycelium and rhizomorphs; the healthier wood (brown, at left) displays egg galleries of the fir engraver beetle.
Photo by: C. Lee, CAL FIRE

resulting in a copious distress cone crop apparently before the tree died in 2023 (Humboldt County). The tree was growing at the edge of a drainage ditch, a location likely advantageous to the fungus and too wet for the tree to thrive.

Armillaria sp. rhizomorphs were found on the outsides of snapped-off root systems of three large windthrown tanoak (*Notholithocarpus densiflorus*) in Montgomery Woods State Natural Reserve (Mendocino County).

Armillaria sp. was fruiting in several locations along Highway 44 in eastern Shasta County, including at the Eskimo Hill Recreation Area. The fruiting bodies were associated with mature grand fir that were also infected with other pests and pathogens, including *Heterobasidion occidentale*. *Armillaria* sp. mycelium and rhizomorphs were associated with a small ponderosa pine mortality center near the Turntable Bay Exit off Interstate 5 near Shasta Lake; this stand of pine was also heavily infested with dwarf mistletoe (*Arceuthobium vaginatum*). Material was collected for identification to species in all these cases.

California State Parks, Inland Empire District staff identified *Armillaria* symptoms on a downed black oak (*Quercus kelloggii*) in July 2023. The identification was confirmed by a USDA Forest Service forest pathologist in August 2023. This disease site had significantly increased in size and was located at the Silverwood Lake State Recreation Area, Black Oak Day Use Area in Miller Canyon, primarily in the southeastern area of the park (San Bernardino County). Only California black oaks were currently infected in a 14-acre area, but there are approximately 350 acres of susceptible vegetation adjacent to the known infection. Follow up actions were focused on monitoring, delimiting the infested area, and managing for hazard trees. Monitoring was still in the initial stage, so the entire infestation footprint was not yet known.

An approximately 15-acre *Armillaria* root disease center was found in an Engelmann spruce (*Picea engelmannii*), white fir (*A. concolor*), ponderosa pine (*P. ponderosa*) mixed stand along South Russian Creek in the Klamath NF (Siskiyou County). *Armillaria* sporocarps were found fruiting from the base and roots of white fir and Engelmann spruce, and mycelial fans were found under the bark at the root collar and root bark of white fir, Engelmann

Armillaria sp. mycelial fans on the same decayed grand fir as in the previous figure. While standing, the tree attempted to compartmentalize the decay with new "callus" wood. After the tree blew down in the 2022-2023 winter, Armillaria mycelium began to colonize this new tissue. Photo by: C. Lee, CAL FIRE

Witches' broom caused by ponderosa pine dwarf mistletoe (*A. campylopodum*) on ponderosa pine, and associated with *Armillaria* sp. and windthrow, along the shore of Shasta Lake.
Photo by: C. Lee, CAL FIRE

Armillaria/*Heterobasidion* root disease center in an Engelmann spruce, white fir, ponderosa pine stand in the Klamath NF. Photo by A. Hawkins, USDA Forest Service

Fruiting bodies of *Armillaria* sp. on the roots of a white fir in the Klamath NF. Photo by A. Hawkins, USDA Forest Service

Engelmann spruce and white fir killed by *Armillaria* sp. in the Klamath NF. Photo by A. Hawkins, USDA Forest Service

Mycelial fans of *Armillaria* sp. on white fir in the Klamath NF. Photo by A. Hawkins, USDA Forest Service

A. mellea fruiting bodies on Siberian elm. Photo by C. Barnes, USDA Forest Service

spruce, and ponderosa pine. *H. occidentale* sporocarps and decay were found on white fir as well. The disease center consisted of a mix of healthy trees, declining trees with thinning and rounded crowns, and recently dead as well as older dead trees. *Armillaria* fruiting bodies were collected for species determination.

A. mellea was found in numerous locations across both the Angeles and San Bernardino NFs in 2023. The list of hosts includes California black oak, blue oak (*Q. douglasii*), coast live oak (*Q. agrifolia*), and Siberian elm (*Ulmus pumila*). The flush of fruiting bodies followed the atmospheric rivers and copious rainfall at the beginning of 2023. DNA sequencing of fruiting bodies provided by USDA Forest Service, Pacific Northwest Research Station was used to identify the *Armillaria* species infecting a Siberian elm and a black oak that were approximately 250 m (273 yds) apart. Both are *A. mellea*. Significant differences in the ITS sequences suggest the isolates belong to different genets (vegetative clones).

A fallen Jeffrey pine with symptomatic stringy white rot of *H. irregulare*. Photo by C. Barnes, USDA Forest Service

Heterobasidion root disease

(*Heterobasidion occidentale* and *H. irregulare*)

H. occidentale was commonly observed in stands containing true firs in Humboldt County in 2023. In the Arcata Community Forest, the presence of *H. occidentale* fruiting bodies on recently fallen trees and on standing snags is associated with what appears to be the gradual elimination of grand fir and, in some places Sitka spruce (*P. sitchensis*), from these redwood (*Sequoia sempervirens*)-dominated stands. *H. occidentale* fruiting bodies were noted along the Skunk Cabbage Trail in Redwood NP, on Sitka spruce logs and stumps at the Ma-le'l Dunes in Manila, and on redwood stumps in the Arcata Community Forest.

H. irregulare was infecting a ponderosa pine along the Twin Bridges Road in eastern Shasta County. This same pathogen was identified in a nearby ponderosa pine in this area in 2017. Fruiting bodies were not found in either instance; instead, discolored wood incubated in moist conditions yielded the diagnostic asexual state of the pathogen. The pathogen appeared widespread in the area as evidenced by many dead sapling-sized ponderosa pine and sporadic bark beetle (*Dendroctonus* spp.) activity in the pines along the road.

H. occidentale conk in white fir stump, Burnt Lava Flow Geologic Area, Modoc NF. Photo by D. Cluck, USDA Forest Service

Heterobasidion root disease caused by *H. occidentale*, was found associated with recently and older dead white fir in areas south of Medicine Lake around Burnt Lava Flow Geologic Area, Modoc NF (Modoc and Siskiyou Counties). Drought and fir engraver beetle activity caused high levels of mortality in this area but root disease was suspected to be playing a significant role in ongoing tree stress due to classic root disease symptoms.

Fallen trees with symptoms of Heterobasidion root disease (*H. irregulare* on Jeffrey pine and *H. occidentale* on white fir) were found in multiple areas in the Mount San Jacinto State Park (Riverside County). Classic symptoms of pitting on one side of the laminae and stringy white rot on both the pine and fir suggest that both *Heterobasidion* species are prevalent in the area.

Onnia Root Rot (*Onnia subtriquetra*)
Onnia was associated with continued deterioration of shore pines (*P. contorta*) at Hiller Park in McKinleyville (Humboldt County) and bishop pines (*P. muricata*) near Russian Gulch (Mendocino County). Approximately 10-20 acres were affected at both locations, and numerous other native pine pests were also observed, including *Phaeolus schweinitzii*, western gall rust (*Cronartium harknessii*), sequoia pitch moth (*Synanthedon sequoiae*), native bark beetles such as *Pseudips*/*Ips* spp., and *Armillaria* spp.

Phytophthora Root Rot (*Phytophthora* spp.)
Phytophthora cinnamomi was detected at Sunny Brae Park in Arcata (Humboldt County). The park is near a utility line corridor and walking trail, where 10-15 madrones (*Arbutus menziesii*) in various stages of decline and death were present. A large, declining redwood that is also likely infected with the pathogen was observed at the bottom of the slope.

P. cinnamomi and *P.* x *cambivora* were also detected by both soil baiting and direct isolations from the roots of dying tanoak and shore pine in Mendocino County near Iversen Road, and at Jughandle State Preserve on the west side of Highway 1 south of Fort Bragg. Additionally, *P.* x *cambivora* was baited from soil beneath a stand of non-native plum trees (*Prunus domestica*) one mile south of the Jughandle site. Only the plum trees' small lateral roots were symptomatic.

Other Oomycete Pathogens (various species)
Several oomycetes of uncertain pathogenicity were isolated from a large stand of dead and dying Monterey cypress (*Hesperocyparis macrocarpa* formerly *Cupressus macrocarpa*) trees in Manchester (Mendocino County). The cypresses are very large, mature trees that have been dying for at least a decade. Most of the stand occupies a very wet, low-lying area. In this stand, *Elongisporangium anandrum* and an unknown *Globisporangium* sp. (formerly *Pythium*) were baited from soil and *Pythium coloratum*, the same unknown *Globisporangium* sp., and *G. macrosporum* (also formerly *Pythium*) were isolated from root lesions. It is unknown whether the isolated organisms are pathogenic to cypress or if they are secondary pathogens or saprophytes that invaded after initial infection by some other pathogen. The same unknown *Globisporangium* sp. was baited from soil underneath a declining mature coast redwood on the campus of Cal Poly Humboldt in Arcata (Humboldt County).

Bishop pine stem decay associated with *O. subtriquetra* infection at Russian Gulch State Park. Photo by C. Lee, CAL FIRE

Declining trees in Arcata associated with *P. cinnamomi* soil infestation. Dead and dying madrones are in the middle background. An unhealthy coast redwood in foreground contrasts with healthy ones higher on the slope. Photo by C. Lee, CAL FIRE

Shore pine root cankers from which *P. cinnamomi* was isolated at Jughandle State Park. Photo by C. Lee, CAL FIRE

Another species formerly classified in the genus *Pythium* - now called *Elongisporangium undulatum* - was baited from soil underneath several species of damaged or dying trees and shrubs in Mendocino County. These trees included tanoaks, shore pines, and wax myrtles (*Morella californica*), and locations ranged from the southernmost part of the county near Iversen Road to McKerricher State Park in the north.

Velvet Top Fungus (*Phaeolus schweinitzii*)
This pathogen was observed extensively throughout the north coast in 2023. It was associated with root decay and tree failure from Marin County up through Humboldt County, primarily in Douglas-fir and Sitka spruce. It was also associated with Douglas-fir beetle attack on standing mature trees in Jackson Demonstration State Forest (Mendocino County; see "Douglas-fir beetle," in the Insects section), and with dead and dying bishop pines within a Monterey cypress mortality center at Manchester (Mendocino County; see "Other Oomycete Pathogens," above).

Ilyonectria (*Ilyonectria* sp.)
The fungus was detected in roots of Monterey cypress near Manchester (Mendocino County). This genus, also called by the asexual form-name *Cylindrocarpon*, was detected in a large (approximately five-acre) group of cypresses that have been dying for at least a decade. The cypress from which it was isolated was alive but had extensive decay in large, structural roots. In the past, this fungus has been associated in the north coast with damage to a wide variety of conifers situated in low-lying or recently flooded areas. Affected species include coast redwood, exotic planted Podocarps (*Podocarpus* spp.), and shore pine.

Foliar Diseases

Marssonina Blight of Poplars (*Marssonina populi*)
Marssonina blight of aspen was observed in the south Warner Mountains, Modoc NF on poplars (*Populus* spp.) (Lassen County). Light infections were observed in most stands throughout the area but had not resulted in leaf browning and drop. However, three stands were nearly or completely defoliated due to blight. These stands ranged from 0.5-20 acres consisting of sapling to pole sized stems.

Diplodia Blight (*Sphaeropsis sapinea*)
Diplodia blight continued to affect ponderosa pines along the Sacramento River near Interstate 5 in Shasta and Siskiyou Counties and along the Trinity River and East Weaver Creek off Highway 299 in Trinity County.

Needle Browning of Ponderosa Pine (*Sydowia polyspora*)
Ponderosa pine along Highway 299 in eastern Trinity County and along Interstate 5 throughout Shasta and Siskiyou Counties exhibited browning of one-year-old and/or earlier needles, premature needle-drop and, in some cases, necrotic lesions on green needles. Molecular and culture-based diagnosis performed by the California Department of Food and Agriculture (CDFA) revealed the presence of *Sydowia polyspora* in needles with necrotic lesions. *S. polyspora* is thought to be an endophyte and a weak pathogen of conifers. The ubiquity of browning and premature needle drop suggests an underlying abiotic cause to the disease issue.

Madrone Leaf Blight (cause uncertain)
Pacific madrones along Highway 299 in Trinity County were severely affected by branch dieback and leaf blight. This was especially apparent along the Trinity River where more than 75% of trees were affected. Although samples were not collected for diagnosis, symptoms were consistent with known shoot canker and leaf blight on madrone caused by various fungi.

Elytroderma Needle Blight (*Elytroderma deformans*)
Elytroderma disease symptoms were widespread on ponderosa pine along Highway 89 and Esperanza and Pilgrim Creek Roads in

Madrone showing severe leaf blight and branch dieback symptoms along Highway 299 in Humboldt County. Photo by A. Hawkins, USDA Forest Service

the McCloud Flats area (Shasta and Lassen Counties). Samples collected and sent to CDFA for diagnosis revealed the presence of an *Elytroderma* sp. in affected tissue. *S. polyspora* was also detected in some samples.

Tubakia (*Tubakia californica*)

Extreme defoliation most likely caused by *Tubakia californica* was observed on scattered individual tanoak and true oak trees along South Fork Road in Del Norte County, near Orleans in northeastern Humboldt County, just west of Willow Creek along Highway 299 in Humboldt County, and east of Salyer in Trinity County. The pathogen was either previously confirmed or was confirmed in 2023 at all the sites through molecular analysis.

Trunk and Stem Cankers

Sooty Canker of Honey Mesquite (*Neoscytalidium dimidiatum*)

The presence of sooty canker led to red oozing cracked bark, cankering, yellow leaves, and dying branches of honey mesquite (*Prosopis glandulosa*) in Death Valley NP (Inyo County). A very wet winter followed by typical high temperatures in the Park of 85-105°F encouraged the fungus to become widespread, particularly in the Cow Creek area. Cankering was often associated with flatheaded borer damage, pruning wounds, waterlogged soils, and overall stress. Careful removal of infected branches was recommended since the disease typically attacked individual branches. Main trunks of the trees were not impacted unless the disease had spread from individual branch infections.

Botrytis Tip Dieback (*Botrytis* sp., *Diplodia* sp., *Sydowia* sp.)

Botrytis was isolated from extensive tip dieback in outdoor-grown, clonal redwood seedlings at a timber company nursery in Humboldt County. The symptoms on these redwoods were unlike the typical symptoms caused by *Botrytis* on nursery seedlings, which are usually seen at the bases of trees where humid conditions persist. Investigation by CDFA diagnosticians revealed that this *Botrytis* sp. does not match any previously identified species, except for one report of extensive damage to peony (*Paeonia* sp.) in Alaska. It was possible that the same *Botrytis* species was responsible for widespread tip dieback on other conifers including redwood, Douglas-fir, Sitka spruce, and grand fir in Humboldt County in 2023. In all these cases - collected and identified before awareness of the unnamed *Botrytis* species mentioned above - only *Botrytis* could be isolated from the tip dieback symptoms but was generally dismissed as a secondary or contaminating fungus. Further investigation is needed to clarify the identity and distribution of the fungus and its role, if any, as a primary pathogen.

Another tip dieback-causing fungus, *Sydowia* sp., was isolated from branch tip cankers on ponderosa pine north of Laytonville (Mendocino County), coast redwood sprouts near the southern Mendocino County coast, and Douglas-fir near Bridgeville (Humboldt County). *Sydowia* is a common tip-killing fungus that has been isolated from a wide spectrum of conifers and hardwoods in California. It may be a latent endophytic pathogen that only kills tissue during times of stress. (Also see the Foliar Diseases section above.)

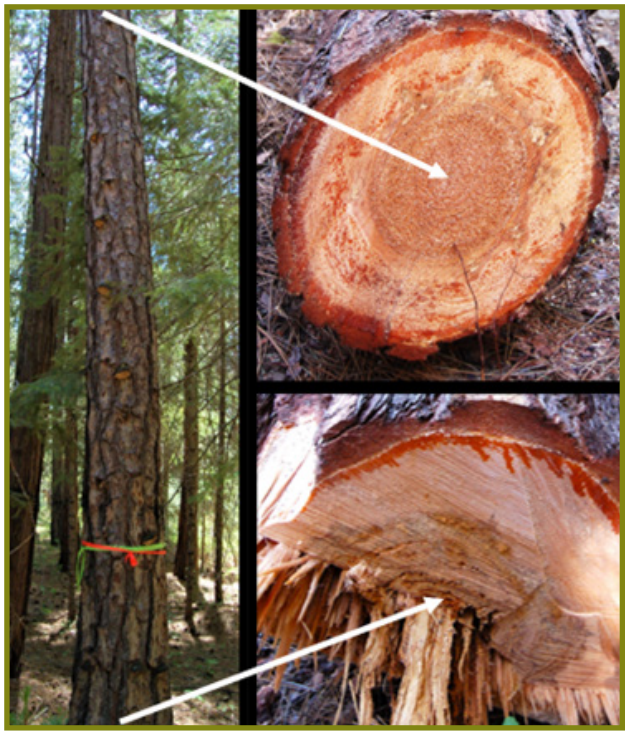
Diplodia was isolated from tip dieback of ponderosa pine along Highway 101 north of Laytonville in Mendocino County causing a bot canker. However, symptoms of this shoot-blighting pathogen were generally much diminished in northwestern California in 2023 relative to the previous two years, perhaps because its pathogenicity was exacerbated by drought stress in the past. (Also see the Foliar Diseases section above.)

Decay

Several decay fungi were noted in 2023 that neither caused disease to the host nor posed a significant hazard:

Ponderosa Pine Decay (*Porodaedalea pini*)

Fruiting bodies of *Porodaedalea pini* were found on 48 large ponderosa pine trees in Greenville Campground, Plumas NF (Plumas County). The average infected tree was 24-inch DBH and 120-feet tall. Most of the trees had 5-10 conks on the bottom 16 feet of the trunk. About five of the trees had up to ten more conks higher on the bole. In May, the Mt. Hough Ranger District fire crew cut down 37 of the infected trees, all of which had at least five conks. Freshly cut stumps were treated with



P. pini decay in ponderosa pine. FULL 12(c)(i)
Photo by W. Woodruff, USDA Forest Service

Paint fungus (*E. tinctorium*) on white fir in the Mount San Jacinto State Park. Photo by C. Barnes, USDA Forest Service

a fungicide (disodium octaborate tetrahydrate) to prevent Heterobasidion root disease from becoming established. After examination of the log ends, the observed decay was much less than anticipated and did not appear serious enough to cause imminent tree failure. However, since decay increases over time, mitigation of the hazard was deemed warranted.

Paint Fungus (*Echinodontium tinctorium*)
In July 2023, more than 2,100 white firs over approximately 180 acres in the Mt. San Jacinto State Park were evaluated for paint fungus, with an overall infection rate of 5.2% (Riverside County). Trees were categorized as small <10-inch DBH, medium 10-20-inch DBH, and large >20-inch DBH. In the survey, 1% of the small trees, 3% of the medium trees, and 15% of the large trees were infected with paint fungus. Disease levels were within expected ranges for this forest type and age class, and not considered a management concern.

Red-belt Fungus (*Fomitopsis schrenkii*)
In July 2023, red-belt fungus was found on white fir throughout the Mt. San Jacinto State Park (Riverside County). The fungus has likely been in the area for years, as very old, bleached conks and newly forming conks were present in relatively equal numbers. The infection rate was 1-5%.

Red-belt fungus (*F. schrenkii*) on white fir was observed in the San Jacinto State Park in July 2023. Photo by C. Barnes, USDA Forest Service

Pholiota species on white fir on the Angeles NF. Photo by C. Barnes, USDA Forest Service

Fruiting body of *I. munzii* found on box elder in a city park in Redlands California in December 2022. Photo by C. Barnes, USDA Forest Service

Pholiota Decay Fungus (*Pholiota* sp.)
Pholiota sp. was observed on multiple white fir over ~50 acres near the Grassy Hollow Visitor Center and Jackson Campground on the Angeles NF (Los Angeles County). All trees observed with *Pholiota* were standing dead with no other pathogens observed.

In December 2023, a *Pholiota* sp., tentatively identified as *P. alnicola*, was observed growing at the base of a group of red alder at Headwaters Forest Reserve (Humboldt County). Some of the red alders were alive; the fruiting bodies were growing on living trees, standing dead trees, and woody debris on the ground. Some of the woody debris was occupied by rhizomorphs of *Armillaria* spp., which was fruiting synchronously on red alder in many other parts of the Reserve (see "Armillaria Root Disease," above).

Inonotus (*Inonotus munzii*)
Inonotus munzii has been found in the United States and Mexico and is considered an aggressive pathogen attacking angiosperm trees, notably on *Quercus*, *Salix*, and *Schinus* in Mexico. In late 2022, *I. munzii* was found on a box elder (*Acer negundo*) in a Redlands city

Close up of pores of *I. munzii* on box elder. Photo by C. Barnes, USDA Forest Service

P. dryadeus fruiting at the base of an old-growth white fir at Horse Mountain (Humboldt County). Photo by C. Lee, CAL FIRE

Western Jack-o-lantern (*O. olivascens*) on a dead coast live oak in the Cleveland NF, southwest of Lake Elsinore. Photo by C. Barnes, USDA Forest Service

G. brownii on white alder. Photo by C. Barnes, USDA Forest Service

park (San Bernardino County). The species was confirmed through DNA analysis by the Department of Plant Pathology, University of Minnesota, St. Paul MN. Based on host information provided with the sequences available in GenBank, *I. munzii* has now been found in Arizona on cottonwood (*Populus* sp.), in New Mexico on pecan (*Carya illinoinensis*), and on box elder in California (a first detection in California).

Fir and Hemlock Decay (*Pseudoinonotus dryadeus*)
Pseudoinonotus dryadeus fruiting bodies were observed in two sites along the main stem of the Smith River (Del Norte County). At one site near State Route 197, fruiting occurred at the base of a living grand fir, while at the other site located near Walker Road, the fungus was associated with many living and dead western hemlock (*Tsuga heterophylla*) trees, many of which were also infected by hemlock dwarf mistletoe (*A. tsugense*). This decay fungus was also observed fruiting on old-growth white fir at Horse Mountain in Humboldt County.

Heartwood decay associated with *Ganoderma* sp., most likely *G. brownii*, in a recently cut bay laurel stump in Hiouchi. Fruiting body of the fungus is at bottom. Photo by C. Lee, CAL FIRE

Western Jack O'Lantern (*Omphalotus olivascens*)
Western Jack O'Lantern was found on a dead coast live oak on the Cleveland NF, east of Lake Elsinore (Riverside County). While this is only a single sample, the same fungus was found in previous years infecting the same host species 75 miles to the south near the Mexican border.

Ganoderma (*Ganoderma brownii*)
Ganoderma sp. (most likely *G. brownii*) was observed fruiting on numerous tree species throughout the north coast in 2023, including bay laurel (*Umbellularia californica*) and grand fir. One infected bay laurel cut in Hiouchi revealed the extent of decay in the tree's heartwood (Del Norte County). *G. brownii* (identity confirmed through PCR) was also fruiting at the base of a large eucalyptus (*Eucalyptus globulus*) in a group of eucalyptus trees that had been dying back for several years at the intersection of Highway 101 and Highway 299 in Humboldt County.

In early June 2023, *G. brownii* was also found on California bay laurel and white alder (*A. rhombifolia*) at the Fairfield Osborn Preserve (Sonoma County).

Laughing Jim on Giant Sequoia (*Gymnopilus junonius*)
Large mushroom fruiting bodies were found around the base of a dying old-growth giant sequoia (*Sequoiadendron giganteum*) in the Mountain Home Demonstration State Forest (Tulare County). Giant sequoia trees were examined due to recent wildfires and concern for high rates of mortality of the old-growth trees. Initially, the fruiting bodies were thought to be an *Armillaria* sp. but further examination found they were this secondary decay fungus known to follow tree mortality.

The same mushrooms were observed fruiting prolifically at the same time (November/December) in Fortuna and Arcata (Humboldt County). In both cases they were associated with dead or nearly dead grand fir trees.

Brown Rot Decay (*Laetiporus conifericola*)
Laetiporus conifericola, a brown-rotting decay fungus, was noted on the base of a large windthrown western hemlock and on a coast redwood stump, both along the Skunk Cabbage Trail in Redwood NP (Humboldt County).

Laughing Jim (*G. junonius*) on Giant Sequoia in Mountain Home Demonstration State Forest. Photo by T. Smith, CAL FIRE

Rust Diseases

Stalactiform Rust
(*Cronartium coleosporioides,* formerly *C. stalctiforme*)
Stalactiform rust on lodgepole pine (*P. contorta*) was observed in the Mt. San Jacinto State Park (Riverside County). The stand was dominated by white fir, however, rust infection was present on 5-10% of the lodgepole pines.

Western Gall Rust (*Cronartium harknessii*)
In early June 2023, western gall rust was found on Monterey pine (*P. radiata*) at the Fairfield Osborn Preserve in Sonoma County. Galls were observed on several small seedlings in an approximately 15 square-meter area. Also in June 2023, western gall rust was found on multiple bishop pines at the Gerstle Cove Campground near the Salt Point State Marine Conservation Area (Sonoma County). The two areas were roughly 64 kilometers (40 miles) apart.

Non-Native/Invasive Diseases

Possibly Invasive/Recently Recognized Diseases

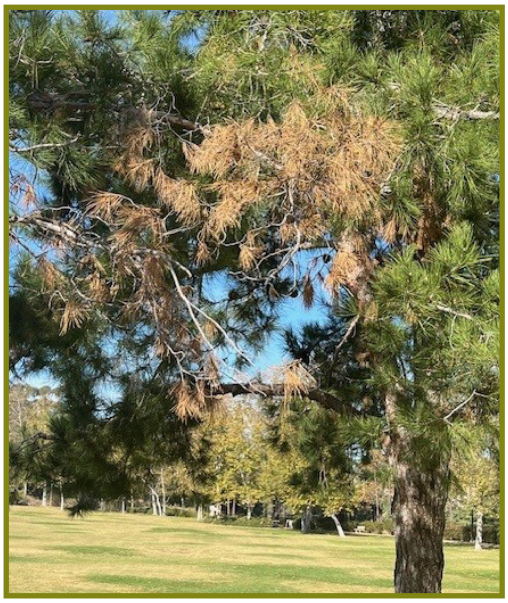
Ghost Canker of Pines (*Neofusicoccum mediterraneum, N. parvum*)
Beginning in 2018, Monterey, Aleppo (*P. halepensis*) and Canary Island (*P. canariensis*) pines were observed dying or exhibiting severe branch dieback in urban areas in eastern Orange County. These host species are not native to that area of California but are commonly planted. Approximately 30-50 weak trees were scattered over ~100 acres. Faint cankers were found in the cross sections of infected and dying stems. DNA analyses are ongoing, but to date samples have yielded two native fungi: *N. mediter-*

Stalactiform rust on lodgepole pine observed in the San Jacinto State Park in July 2023. Photo by: C. Barnes, USDA Forest Service

Western gall rust on bishop pine at the Gerstle campground in Sonoma County.
Photo by: C. Barnes, USDA Forest Service

Ghost canker of pine caused by *Neofusicoccum* sp. in Orange County. Slightly darker rings on the edge of the canker. Photo by: T. Smith, CAL FIRE

raneum and *N. parvum*, that typically cause diseases in grape, avocado, citrus, and nut crops. Although these fungi have previously been identified on other conifer species, this disease constituted a major host jump for the pathogens moving from woody, broadleaf crops to pines. Microscopic fruiting bodies were found on the infected bark of the trees. Infection does not appear to require a wound for entrance. Due to the faint nature of the cankered material, the disease was given the name of "ghost canker" of pines. The potential for spread to other parts of California or to other pine species is not yet known. (For more information see, Bustamante, M.I.; Lynch, S.C.; Elfar, K.; [and others]. 2023. First report of *Neofusicoccum mediterraneum* and *Neofusicoccum parvum* causing pine ghost canker on *Pinus* spp. in Southern California. Plant Disease. 107(7): 2236.)



Dead branches caused by ghost canker of pines caused by *Neofusicoccum* sp. Photo by: T. Smith, CAL FIRE

Sooty Bark Disease of Maple (*Cryptostroma corticale*)

No new sites of sooty bark disease of maples (*Acer* spp.) were found in 2023. Research by the Garbelotto Lab at the Univeristy of California (UC), Berkeley confirmed that both silver maple (*A. saccharinum*) and Norway maple (*A. platanoides*) are hosts to the fungus. To date, known infections in California are limited to five trees at two locations: one site in Elk Grove (Sacramento County) and one in El Dorado Hills (El Dorado County). It is not known whether the disease is more widespread and whether it is native or exotic to the state. Typical symptoms include wilting or yellowing of foliage, dark black bole cankers, and mortality. All known infested trees in California are either dead or dying. *Cryptostroma corticale* may be an endophyte in the wood that only forms bark cankers when the maples are dying from other causes. Big leaf maple (*A. macrophyllum*) is a known host in the state of Washington; however, no big leaf maples have been identified as infected in California as of 2023.

Oozing canker from acute oak decline at the base of a blue oak in Hollister, CA. Photo by: K. Corella, CAL FIRE

Acute Oak Decline

A stand of blue oaks in Hollister were observed to be dying or showing signs of severe decline and dieback (San Benito County). The area had been heavily damaged by rooting wild pigs (*Sus scrofa*). The trees had oozing basal trunk cankers with some cankers reaching up a couple of feet. The cankers were sampled for *Phytophthora* species but came back negative. The trees tested positive for several bacteria including *Rahnella victoriana*, *Brenneria goodwinii*, *Gibbsiella quercinecans*, and *Erwinia* sp. This group of bacteria has been associated with acute oak decline disease in Great Britain and elsewhere. In Britain, the disease is often associated with attack by oak bark beetles (*Agrilus biguttatus*) or other stressors. On the Hollister property, half of the trees have died and the other half appear to be recovering (a total of around 20 large trees).

Approximately 15 mature blue oaks were dying throughout a campground near Castaic (Los Angles County). The isolated bacteria were the same as the ones found in Hollister. At this site, no other contributing factors were found associated with the oozing cankers at the base of the trees. Five coast live oaks infested with goldspotted oak borer (*A. auroguttatus*) also exhibited oozing cankers near the base of the trunks at a second site in Green Valley (Los Angeles County). The same suite of bacteria causing acute oak decline were isolated from the trees.

Blue oak exhibiting dieback and mortality due to acute oak decline in Hollister, CA. Photo by: K. Corella, CAL FIRE

Two coast live oak showed symptoms of staining on the base of the trees in Descanso Gardens (Los Angeles County). Upon initial sampling, one tree was found to be infested with *Stutzerimonas kirkiae* and *Pluribacterium* sp. aff. *corticola*. Additional sampling found other bacteria which included *Pseudomonas daroniae*, *Pseudomonas dryadis*, and *Brenneria goodwinii*. The second coast live oak was sampled and found to be infected with *Pantoea agglomerans*, *Erwinia billingiae*, *Brenneria goodwinii*, *Pantoea* sp., *Gibbsiella quercinecans*, and *Brenneria rosae* subsp. *americana*. All these bacteria have been associated with acute oak decline in Britain. Other coast live oaks showing symptoms were also observed.

Although all the bacteria have been identified to potential species, the DNA sequences are not exact matches to known species. The bacteria involved in acute oak decline in these sites may be new species, previously unknown to science.

Invasive Pathogens

Port-Orford-Cedar Root Disease (*Phytophthora lateralis*)

Phytophthora lateralis was observed killing scattered Port-Orford-cedar (*Chamaecyparis lawsoniana*) along South Fork Road, which follows the South Fork Smith River (Del Norte County) and killing a large Port-Orford-cedar at a residence in downtown Arcata (Humboldt County). Port-Orford-cedar mortality consistent with this pathogen was also widespread along the length of Myrtle Creek (Del Norte County).

Soil sampling in low-elevation mixed-conifer (mostly redwood) forest along the northeast bank of the Smith River along State Route 197 revealed the presence of several oomycete pathogens on the site, including *P. cinnamomi* and *E. senticosum* (Del Norte County). Abundant dead and dying Port-Orford-cedars at this site also indicate that Port-Orford-cedar root disease is likely present.

In late 2023, the non-native pathogen *P. lateralis* was found killing Port-Orford-cedar along the South Fork of the Sacramento River. The pathogen had not been found in the South Fork Sacramento watershed since the early 2000s when the only known infestation was eradicated; however, there are at least eleven known infestations along the main stem of the Sacramento River. It likely spread from an infestation along the main stem to the South Fork via recreation activity.

A Port Orford-cedar likely killed by *P. lateralis* at the headwaters of Myrtle Creek (Del Norte County), next to a currently healthy cedar.
Photo by: C. Lee, CAL FIRE

Sudden Oak Death/Ramorum Blight (*Phytophthora ramorum*)

The UC Berkeley Forest Pathology and Mycology Laboratory coordinated 28 Sudden Oak Death (SOD) Blitzes in 2023. SOD Blitzes are citizen science events in which interested participants sample symptomatic California bay laurel and tanoak leaf and twig tissue in their local areas and submit them for laboratory analysis at UC Berkeley. This year the blitzes stretched from San Luis Obispo County to the Oregon border (Del Norte County). Similar to 2022, 2023 SOD blitzes found that *P. ramorum* levels were close to the lowest recorded since monitoring of this disease began - despite the very wet winter in 2023. Most precipitation fell in very cold fall/winter conditions or in the late spring after many of the blitzes had already occurred.

In general, the later SOD Blitzes (May and June) recorded more positives than the earlier events in 2023. The Carmel/Monterey/Big Sur and South San Francisco Bay regions in the south and Sonoma County in the north had more positive samples than other areas. Warmer and drier areas, such as Napa County, Geyserville, and Cloverdale (Sonoma County), were negative. SOD Blitz Survey did not detect infected trees in San Luis Obispo County, despite frequent past detections of *P. ramorum* in some streams there.

Similar to past years, the Big Sur region tended to support higher levels of *P. ramorum* symptoms and tree mortality than most other coastal areas. In northern Big Sur, recent wildfires appear to have reduced the disease, but tanoak sprouts from trees burned in 2008 were beginning to show symptoms. High levels of tanoak mortality continued in areas of southern Big Sur that have not burned since before 1999. However, there were few new symptoms on sprouts and understory vegetation, a surprising occurrence after the very wet 2022-2023 winter and spring.

2023 SOD Blitzes also confirmed ongoing monitoring results in Del Norte County, the only area of California where the EU1 lineage of *P. ramorum* has established in a forest. This EU1 outbreak spread from the area of first detection in 2020 to infect tanoaks in neighboring watersheds to the north (Hutsinpillar Creek) and south (Little Mill Creek). The EU1 strain was confirmed in Myrtle Creek and subsequent ground surveys were initiated along the watercourse, although the middle reaches of the stream remain hard to access. The NA1 lineage (first detected in Del Norte County in 2019) was detected again for the first time since that year. At that time the NA1 infestation covered an area of 5-10 acres along Mill Creek, a major tributary to the main stem of the Smith River, in Jedediah Smith State Park. The Myrtle Creek stream detections show the EU1 and NA1 strains are close to each other, potentially within 1-3 miles depending on the location of infected vegetation in the Myrtle Creek corridor.

Stream monitoring for *P. ramorum* in 2023, coordinated by the Rizzo Laboratory, UC Davis, sampled 63 streams in San Luis Obispo, Monterey, Humboldt, and Del Norte Counties (at the southern and northern ends of the pathogen's known distribution in California forests). Of these, 11 streams were positive: one in San Luis Obispo County, two in Monterey County, one in Humboldt County, and seven in Del Norte County. Although San Carpoforo Creek in San Luis Obispo County tested positive, no infected vegetation was found, similar to past results. In Del Norte County, three streams that were not previously confirmed positive (Rowdy Creek, Morrison Creek, and Myrtle Creek) represent likely extensions of the EU1 infestation to the north and east, although infected tanoak trees have not yet been confirmed on the landscape.

Ribes sp. Infected with white pine blister rust at 5,000-foot elevation in Los Angeles County. Photo by C. Barnes, USDA Forest Service

Close-up of white pine blister rust infected *Ribes* leaves in the Descanso Gardens, Los Angeles County. Photo by: T. Smith, CAL FIRE

White Pine Blister Rust (*Cronartium ribicola*)

White pine blister rust was observed on more than 20 mature whitebark pine (*P. albicaulis*) scattered on the upper east slope of Buck Mountain in the south Warner Mountains (Lassen County). Infections were restricted to single upper branches and tops that had recently died. Infection sites were associated with squirrel chewing and sap flow and appeared to have been present for many years. Aecia were observed on a few trees.

Rust on Ribes

Rust has been observed on five *Ribes* species in multiple locations running roughly along the southern edge of the Angeles and San Bernardino NFs (Los Angeles and San Bernardino Counties). On *R. aureum* the rust had been confirmed as *C. ribicola*, cause of white pine blister rust. That confirmation was made by DNA sequencing, with the other rust species identifications still pending. The elevation of the infected *Ribes* plants ranged from just under 700 feet to nearly 5,000 feet. Uredinia and telial horns were observed. To date, rust has not been observed on any five-needle white pines in the area.

Snow Damage

In February 2023, wet snow fell at low elevations in San Luis Obispo County and affected about 40 acres of coast live oak (*Quercus agrifolia*) forest along Hi Mountain Road in San Luis Obispo County (on both private property and the Los Padres NF), leading to breakage of large branches in random sections of the tree crowns.

Storm-related damage was locally significant in many parts of Mendocino, Humboldt, and Del Norte Counties in 2023. A rapid assessment of 315 trees in damaged stands from Marin north through Del Norte Counties showed that tree failures occurred on all aspects and at various elevations. Larger trees primarily uprooted or had top breakage, while smaller trees were more likely to snap. A relatively small proportion (~17%) of windthrown or wind-snapped trees was associated with a variety of biotic damage agents. Some of these, such as *Phaeolus schweinitzii*, clearly helped lead to tree failure, but others such as Douglas-fir beetle (*Dendroctonus pseudotsugae*) were taking advantage of the fallen trees as breeding material.

Coast live oak branch breakage from low elevation snow fall.
Photo by: K. Corella, CAL FIRE

Fire Damage to Giant Sequoia

Old-growth giant sequoia (*Sequoiadendron giganteum*) had high levels of mortality in the years following the 2020 and 2021 mega-fires in the central and southern Sierra Nevada Range. An estimated 10% of all the old-growth giant sequoias have been lost either due to direct fire-related mortality or delayed mortality in the following years.

In 2023, dead and dying giant sequoias were examined at Mountain Home Demonstration State Forest (Tulare County). The Forest conducted a prescribed burn throughout the property prior to the devastating 2020 SQF Fire Complex (also called the Sequoia Lightning Complex Fires). Trees appeared healthy after the prescribed burn, but old-growth sequoia trees began dying following the wildfire. The SQF Complex Fire was patchy in intensity with areas of complete devastation and mortality next to areas of only minor burn intensity. Sequoias were dying both in areas of high intensity and in areas where thinner-barked neighboring pines and true firs (*Pinus* spp. and *Abies* spp.) survived with minimal damage.

Fire damage to cambium of giant sequoia.
Photo by: T. Smith, CAL FIRE.

All the dying sequoias showed severe burn damage to the cambium at the bases of the trees. In most cases the surrounding duff layer had been raked back to protect the trees from long burn periods prior to the prescribed burn. The bark often appeared to be visibly thinner in areas that had previously been covered in duff. It is uncertain whether the removal of duff contributed to higher-intensity fire and increased cambium loss during the SQF Complex Fire, or if the intensity of the wildfire alone damaged the cambium enough to cause tree mortality. For most of the dead and dying sequoias, the cambium appeared to be dead or severely damaged around the entire circumference of the trees.

Coast Live Oak Decline

About 30 acres of coast live oak were heavily stressed and in decline in Steckel Park (Ventura County). No specific pathogen or insect was found associated with the declining trees. The cause was thought to be environmental but remains unknown.

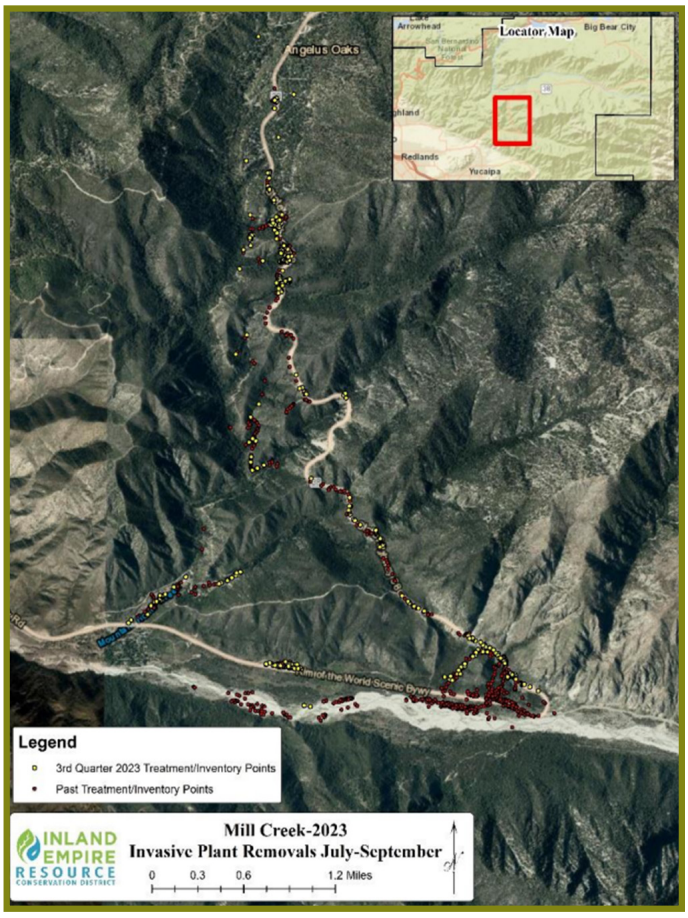
Black Bear (*Ursus americanus*)
Reports of extensive damage, primarily to coast redwood (*Sequoia sempervirens*), from black bear continued in 2023. These reports ranged throughout Mendocino, Humboldt, and Del Norte Counties. Examination of affected stands in the Hutsinpillar Creek watershed in Del Norte County (~10 acres affected) and near Loleta in Humboldt County (1 acre affected) showed many examples of previously bear-girdled or partially girdled trees that had suffered subsequent fungal decay before snapping off in the 2023 winter windstorms.

Coast redwood girdled by black bear and then extensively decayed by fungi prior to being broken in a storm during the 2022-2023 winter at Hutsinpillar Creek (Del Norte County).
Photo by: C. Lee, CAL FIRE

Giant Asian Dodder (Japanese Dodder) (*Cuscuta japonica*)
Giant Asian dodder (also known as Japanese dodder) continued to infest some properties in the City of Sacramento (Sacramento County). The plant is parasitic on trees, shrubs, and perennial plants. It tends to prefer citrus species but can attack most native and ornamental trees. The seeds and plants are sometimes used in traditional herbal remedies and when disposed of improperly can parasitize other plants. Eradication efforts (complete removal and disposal of both the dodder and the host plants) were ongoing at the infected site.

Spanish Broom (*Spartium junceum*) **and Others**
USDA Forest Service Bipartisan Infrastructure Law (BIL) grant-funded projects, in collaboration with the Inland Empire Resource Conservation District (IERCD), made progress in mapping and treating high priority invasive species in the Upper Santa Ana Watershed. The target invasive species for these projects included Spanish broom (*Spartium junceum*), *Arundo donax*, fennel (*Foeniculum vulgare*), and tree of heaven (*Ailanthus altissima*) across the Mill Creek and Cajon Creek sub-watershed areas (San Bernardino County). These highly invasive species distribute seeds and propagules in a downstream direction, allowing for efficient removal and destruction of these target species by IERCD staff working downstream from the highest elevation populations.

In 2023, a total of 6,388 and 1,063 Spanish broom plants were treated across Mill Creek and Cajon Creek areas, respectively. The treatments in Mill Creek occurred over the course of multiple field days along Highway 38 and Angelus Oaks, with a total of 337 GPS points collected to visualize the extent of the treatments. The treatments in Cajun Creek occurred over the course of three field days along County Road and Interstate 15, with 51 GPS points collected of the treated areas.



Map of GPS location coordinates for Spanish broom individuals treated across Mill Creek. Red dots represent individuals treated from July-September. Yellow dots represent individuals treated from May-June. Map by: IERCD

Forest Health Protection – Invasive Plants Grants
In 2023, two USDA Forest Health Protection Special Technology Development Program (STDP) grants were funded with the California Invasive Plants Council (Cal-IPC) to improve the CalWeedMapper tool and develop a climate-matching tool (CMT). CalWeedMapper prioritizes invasive plant species for rapid response at the landscape level and currently relies on a static map of each plant's distribution. This project will add the functionality to track changes over time, allowing planners to prioritize work based on documented spread, to show progress of control work, and to demonstrate the cost of inaction. The proposed CMT will use the growing number of global climate datasets and global species distribution data available through the Global Biodiversity Information Facility to assess a plant's potential for spreading to a new region. That potential will be based on whether that plant is known to grow in other parts of the world that have similar climatic conditions. CAL-IPC is currently working with partners in Arizona, Nevada, Oregon, and Washington on screening emerging weeds to guide the development of the CMT and intends to integrate the tool into Weed Risk Assessment methodologies.

The USDA Forest Service also partnered with Cal-IPC on an Early Detection, Rapid Response (EDRR) grant focused on preventive measures implementing control of priority invasive species. The goal of this project is to address key instances across the state where immediate control may make a significant impact in halting the imminent spread of plants identified as EDRR priority species by National Forest botanists and to protect surrounding forest habitat from future damage. Partners for each project will report on work completed, which CAL-IPC will use to estimate the acreage protected and generate a workplan for future years.

A USDA Forest Service Landscape Scale Restoration (LSR) grant has been awarded to the Elkhorn Slough Foundation to replace highly invasive eucalyptus forests in Las Lomas, Elkhorn, Moss Landing, and Castroville (Monterey County). This project will replace eight eucalyptus forests with native habitats to benefit people and rare animals. Eucalyptus removal reduces fuel loads and fire danger in canyons surrounded by neighborhoods and habitat restoration will bring back wetlands, grasslands, chaparral, and woodlands critical for supporting federally listed amphibians.

USDA Forest Service, Pacific Southwest Region - Invasive Plants Webpage

In 2023, as part of a larger effort to redesign the State, Private & Tribal Forestry webpages, Forest Health Protection staff updated and improved the Invasive Plants of California webpage to include more salient and current information about invasive plants throughout the state. The redesign includes a focus on priority invasive species and highlights recent partnerships.

In 2023, scientific publications concerning California forest pests and wildland conditions included:

Albu, V.; Albu, S. 2023. Lepidoptera assemblages along a western slope elevation gradient of the South-Central Sierra Nevada Mountains in California. The Journal of the Lepidopterists' Society. 77(1): 43-58.

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Bustamante, M.I.; Lynch, S.C.; Elfar, K.; Kabashima, J.N.; Wood, R.; Neault, H.F.; Rauhe, M.B.; Crain, J.; Lopez, J.A.; Penicks, A.; Mojica, H. 2023. First report of *Neofusicoccum mediterraneum* and *Neofusicoccum parvum* causing pine ghost canker on *Pinus* spp. in Southern California. Plant Disease. 107(7): 2236.

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Bourret, T.B.; Mehl, H.K.; Aram, K.; Rizzo, D.M. 2023. Rhododendron leaf baiting of coastal California watersheds for *Phytophthora* and *Nothophytophthora*. Mycological Progress. 22(8): 62.

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Lanning, K.K.; Kline, N.; Elliott, M.; Stamm, E.; Warnick, T.; LeBoldus, J.M.; Garbelotto, M.; Chastagner, G.; Hulbert, J.M. 2023. Citizen science can add value to *Phytophthora* monitoring: five case studies from western North America. Frontiers in Environmental Science. 11: 1130210. DOI: 10.3389/fenvs.2023.1130210

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Young, D.J.N.; Slaton, M.R.; Koltunov, A. 2023. Temperature is positively associated with tree mortality in California subalpine forests containing whitebark pine. Ecosphere. 14(2): e4400.

The California Forest Pest Council (CFPC), a 501(c)(3) non-profit organization, was founded in 1951 as the California Forest Pest Control Action Council. Membership is open to public and private forest managers, foresters, silviculturists, entomologists, plant pathologists, biologists, and others interested in the protection of California's urban and wildland forests from injury caused by biotic and abiotic agents. The Council's objectives are to establish, maintain, and improve communication among individuals who are concerned with these issues. These objectives are accomplished by:

1. Coordinating the detection, reporting, and compilation of pest injury, primarily from forest insects, diseases, and animal damage.
2. Evaluating pest conditions, primarily those of forest insects, diseases, and animal damage.
3. Making recommendations on pest control to forest managers, protection agencies, and forest landowners.
4. Reviewing policy, legal, and research aspects of forest pest management and submitting recommendations to appropriate authorities.
5. Fostering educational work on forest pests and forest health.

The California Board of Forestry and Fire Protection recognizes the Council as an advisory body in forest health protection, maintenance, and enhancement issues. The Council is a participating member in the Western Forest Pest Committee of the Western Forestry and Conservation Association.

This report was prepared by Forest Health Protection, US Forest Service, Pacific Southwest Region and the California Department of Forestry and Fire Protection with other member organizations of the Council.

2023 Field Tours: Weed Tour, Humboldt County, June 21-22; Insect & Disease Tour, El Dorado County, July 18

2023 Annual Meeting: November 14-15, UC Davis, virtual option

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