



Forest Service
U.S. DEPARTMENT OF AGRICULTURE

2022 Aerial Detection Survey Results: California

State & Private Forestry, Region 5
Forest Health Monitoring Program • 1731 Research Park Drive, Davis, CA 95618
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COVER PHOTO

Severe ponderosa pine mortality west of Whiskeytown National Recreation Area in Trinity County. Notice the center pocket of older dead grey trees likely also ponderosa killed in previous year and likely mapped in 2021. ADS would not rerecord this older mortality.

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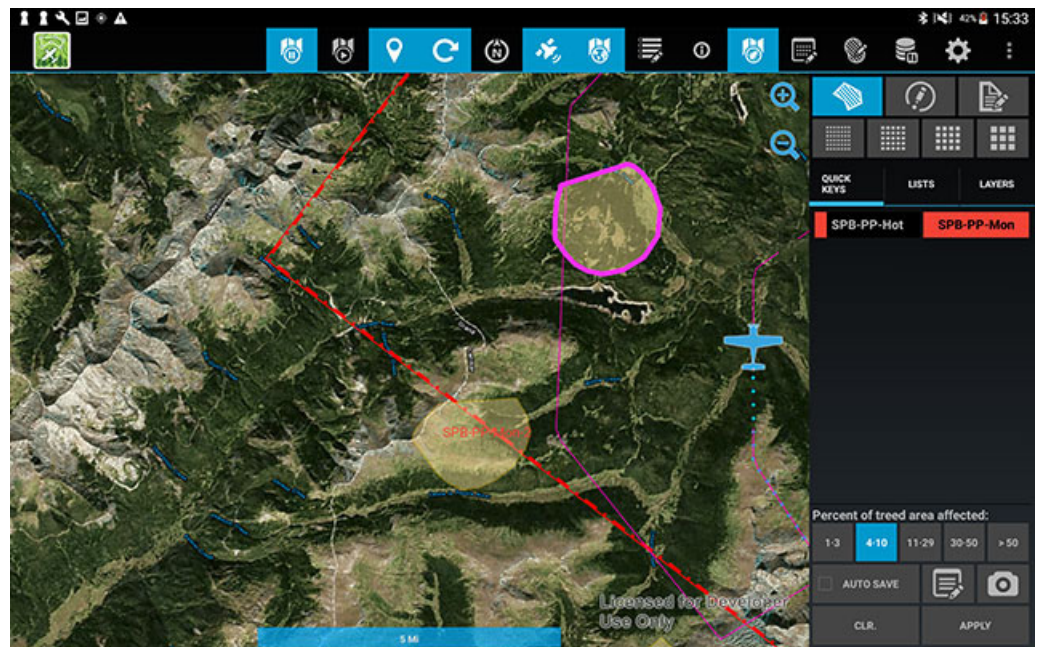


Photo of the Digital Mobile Sketchmapping System (DMSM) used to record tree mortality and damage data

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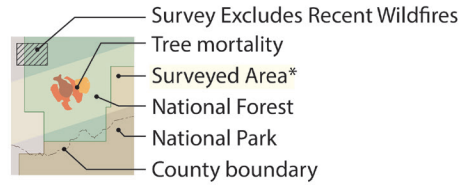
2022 Aerial Survey Results: California

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FOREST HEALTH PROTECTION AERIAL DETECTION MONITORING

2022 SURVEY

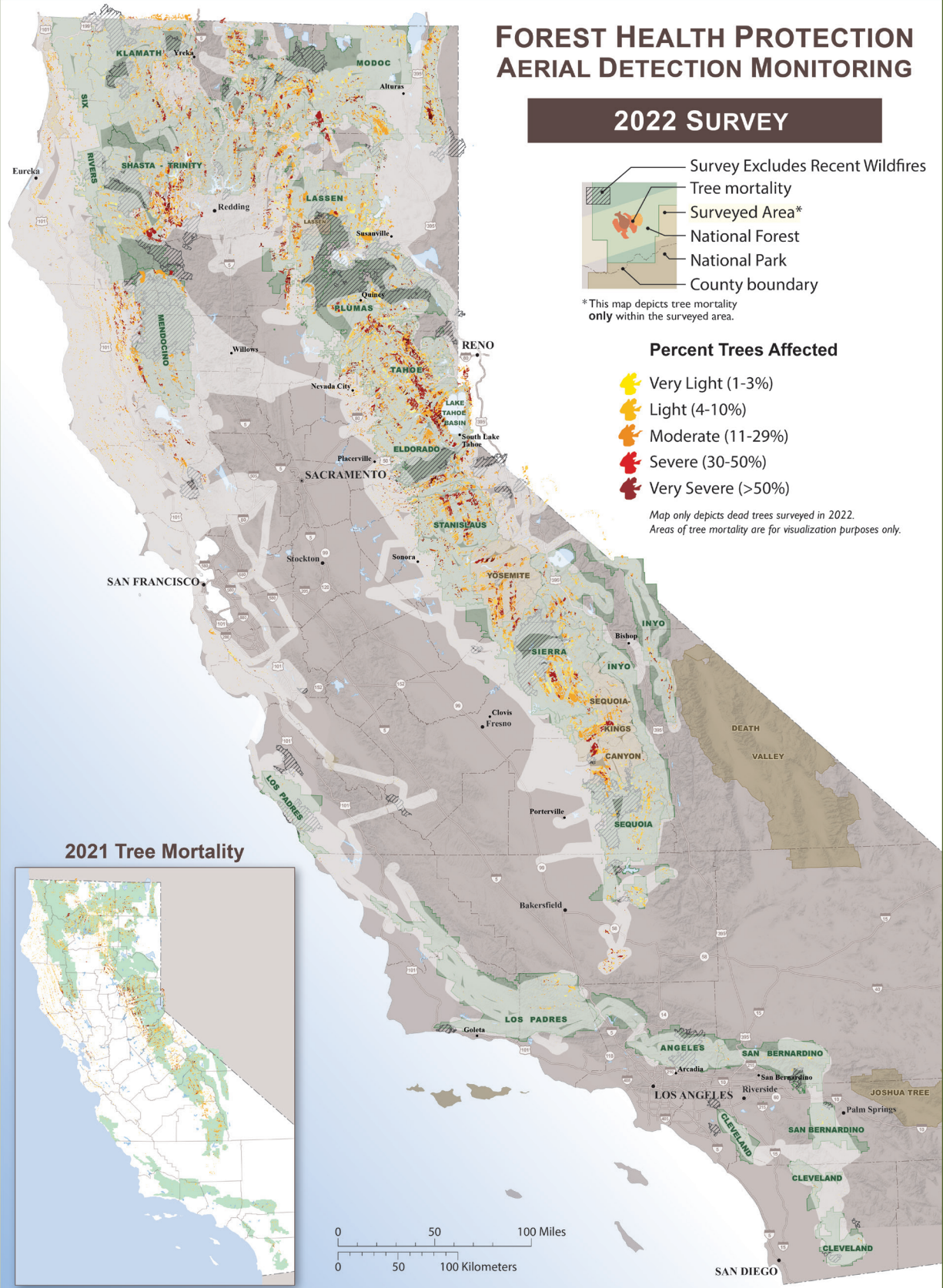


* This map depicts tree mortality only within the surveyed area.

Percent Trees Affected

- Very Light (1-3%)
- Light (4-10%)
- Moderate (11-29%)
- Severe (30-50%)
- Very Severe (>50%)

Map only depicts dead trees surveyed in 2022.
Areas of tree mortality are for visualization purposes only.



2021 Tree Mortality

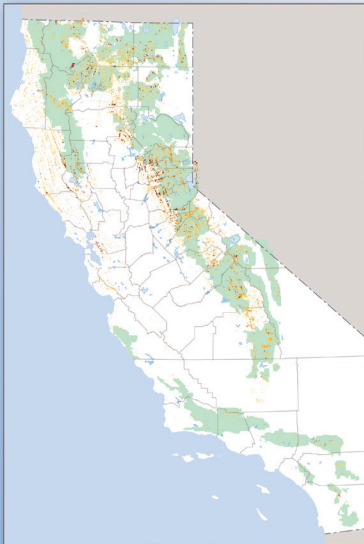


Figure 1. Statewide damage mapped via aerial detection survey in 2022.

Overview

The USDA Forest Service (USFS), Pacific Southwest Region, State and Private Forestry staff conduct annual aerial detection surveys (ADS) throughout forested areas of California to detect tree mortality and tree damage such as defoliation or dead/dying branches. Surveys 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. The objective of this report is to summarize observations from the 2022 aerial detection surveys.

Approximately 39.6 million acres were surveyed during the 2022 flight season (July – October).

Several large areas were excluded from surveys in 2022 due to large wildfires that occurred within the previous three years. Insect and disease activity is difficult to discern in forests that have burned recently (Figure 1).

Elevated levels of tree mortality (i.e. more than 1% of forested area affected) were recorded on more than 2.6 million acres, totaling an estimated 36.3 million dead trees. The majority of trees killed were fir (*Abies* spp.), followed by ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) and mortality was particularly severe and widespread in the central Sierra Nevada range and north interior (Figure 2). The elevated levels of tree mortality can be attributed in part to the ongoing effects of long-term, intermittent, [exceptional drought conditions](#) and subsequent successful bark and engraver beetle attacks that have resulted in more than 200 million trees killed since 2010 (Figure 3).

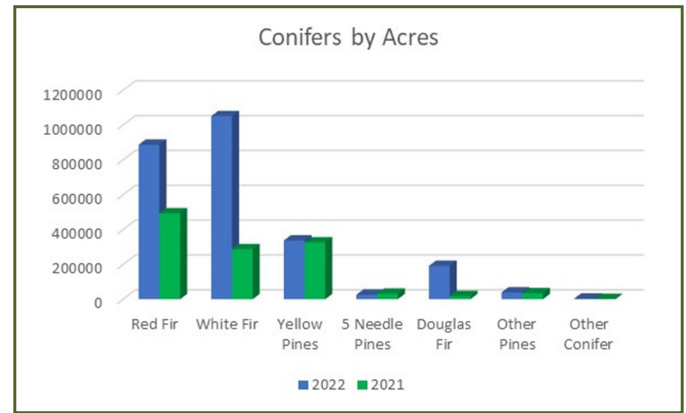


Figure 2. Chart compares the number of acres with conifer mortality in 2021 and 2022.

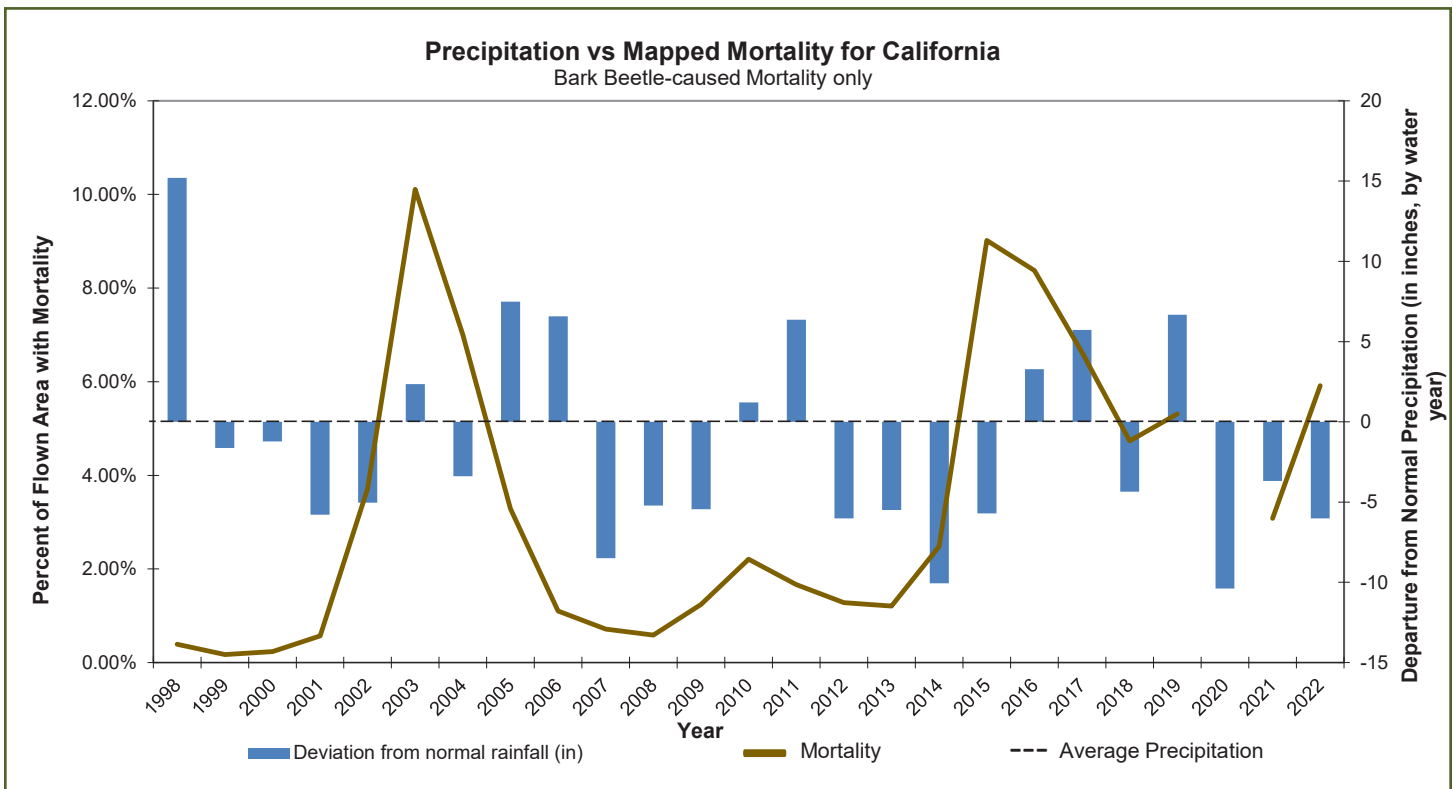


Figure 3. This chart shows the long-term trends in tree mortality and precipitation variability in California since 1993. There is a break in tree mortality data for 2020 because aerial survey was not flown that year due to COVID-19 restrictions.

U.S. Drought Monitor—California

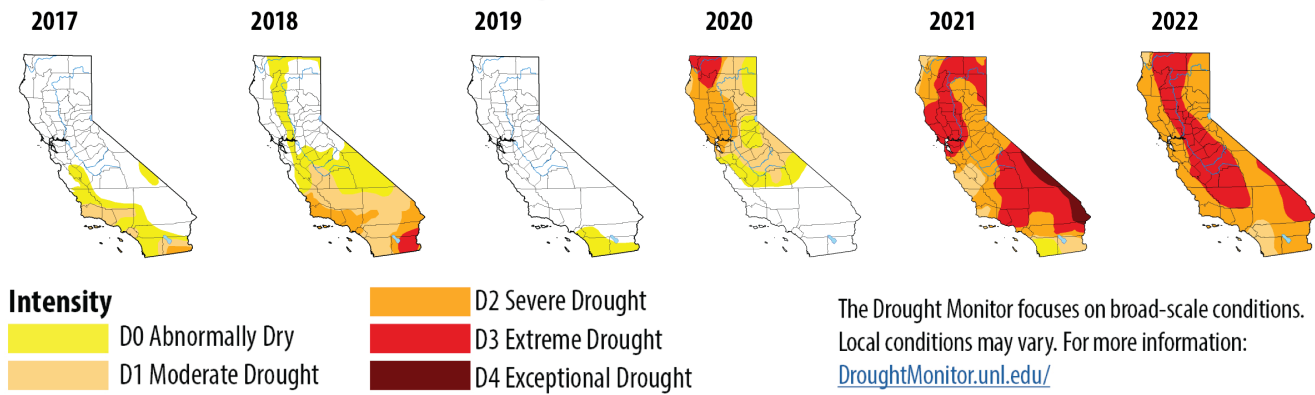


Figure 4. The U.S. Drought Monitor maps of 2017 through 2022 illustrate the severity and range of drought in California over the past six years. Maps are presented from the report date in April of each year. D1 is the least intense drought level and D4 the most intense; D0 areas are not in drought. A full description of each drought severity classification is available from the [U.S. Drought Monitor](https://www.drought.gov/). Source: U.S. Drought Monitor

Drought Conditions

Water Year 2022 (October 1, 2021 to September 30, 2022) was the third straight year of drought conditions in California according to the [California Department of Water Resources \(CDWR\)](https://www.cdwr.ca.gov/). Overall, the state experienced 76% of its average precipitation in 2022. However, the beginning of the year was the driest January through April based on records dating back to 1895. California received only 25% of average statewide precipitation during that time. A massive persistent heat dome then settled over California in early September that was long-lasting and intense, setting numerous daily and nightly high temperature records. Much of California received no precipitation for a record-shattering 212 days, putting central and northern California into the exceptional drought category (Figure 4). This resulted in the hottest, driest three-year period in California since at least 1895 ([National Center for Environmental Information](https://www.noaa.gov/)).

Methodology

Recent tree mortality and damage was mapped on a mobile device by an aerial observer flying in a small, fixed wing aircraft at ≈1000' above ground level (AGL). Aerial observers searched for visibly dried and discolored foliage, typically yellow to reddish brown.

The following information was collected for each area with tree mortality or damage: a) damage type (mortality, [top kill, defoliation, branch flagging, die back 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.).

Not all trees in reported acres are dead or damaged. Tree mortality and damage was recorded on a severity scale based on the percent of trees affected within a given area (Figure 5). 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 (rounded as appropriate).

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

State Highlights

In 2022, there was an increase in the number of trees killed, the acreage with mortality, and the average severity

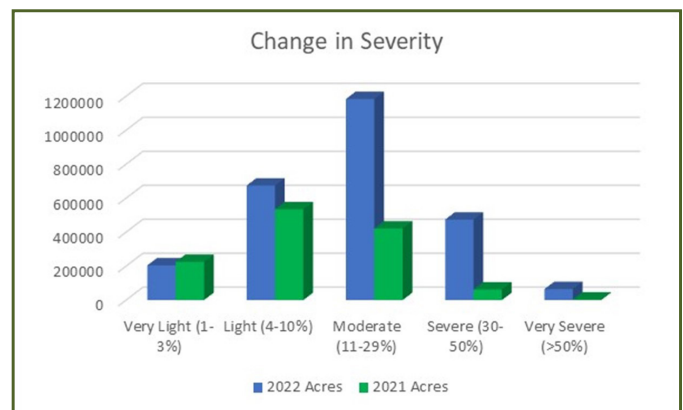


Figure 5. Chart compares the number of acres observed in each severity category in 2021 and 2022.

of that mortality as compared to 2021 (Figure 5). However, there was not the same large-scale, high-severity mortality experienced in 2016 and 2017 at the height of the last exceptional drought ([2016](#) and [2017](#) ADS Reports).

Tree mortality was common throughout the Sierra Nevada Range and along the North Coast but was particularly concentrated in the central Sierra Nevada Range and northern interior where the recent drought has been most intense. Live trees with dead tops (top killed trees) were also common in 2022. California red fir (*Abies magnifica*) and white fir (*Abies concolor*) mortality continued to occur in overly dense mixed conifer forests. Fir mortality has shifted to higher elevations and more northern areas of the state (Figure 1).

Bark Beetles and Wood Borers

Fir mortality attributed to fir engraver beetle:

California/Shasta red fir, white fir, and grand fir (*Abies grandis*) mortality attributed to fir engraver beetle (*Scolytus ventralis*) increased in 2022. Approximately 28.1 million dead fir trees were recorded across 1.9 million acres, compared to ~6.1 million dead fir across 780,000 acres recorded in 2021. Mortality was most severe and widespread throughout the central Sierra Nevada Range.

- California and Shasta red fir mortality occurred at generally higher severities than other conifers. An estimated 15 million trees across 890,000 acres were recorded, an increase from ~4.5 million trees across 500,000 acres in 2021.
- White fir mortality was widespread but generally light to moderate in severity and associated with dense mixed conifer stands. White fir mortality increased from ~1.6 million trees across 290,000 acres in 2021 to ~13 million trees across 1.1 million acres in 2022.
- Grand fir mortality was light to moderate in severity and was found throughout its range in northwestern California. Grand fir mortality increased from ~590 trees across 47 acres in 2021 to ~8,400 trees across 2,000 acres in 2022.

Note: Red and white fir often occur together in mixed conifer mid-elevation stands and can be difficult to differentiate from the air.

Conifer mortality attributed to flatheaded fir borer (*Phaenops drummondi* prev. *Melanophila*):

Tree mortality attributed to flatheaded fir borer increased in all host species. This year was the highest level of mortality caused by this agent ever recorded by ADS in California.

- Virtually all Douglas-fir mortality (not attributed to damage by bears in pole sized plantations) was caused by flatheaded fir borer in 2022 with an estimated 3 million dead trees across 190,000 acres, compared to ~170,000 dead trees across 18,000 acres in 2021. Mortality was particularly severe and widespread in the Redding area, but mortality was also common along the coast, particularly in Lake County.
- Santa Lucia fir (*Abies bracteata*) mortality was mostly moderate in severity and occurred within the Monterey District of the Los Padres NF. An estimated 3,500 trees across 380 acres died, compared to 350 trees across 120 acres in 2021.
- Bigcone Douglas-fir (*Pseudotsuga macrocarpa*) mortality increased from ~18 trees in 2021 to approximately 105 trees in 2022, and occurred as widely scattered, single trees or small groups with the exception of one larger area of mortality within Mount San Jacinto State Park (Riverside County).

Pine mortality attributed to western pine beetle (*Dendroctonus brevicomis*):

- Ponderosa pine mortality caused by western pine beetle increased from ~2.1 million dead trees across 300,000 acres in 2021 to an estimated 3.5 million dead trees across 280,000 acres in 2022 and occurred primarily in northern areas of the State.
- Coulter pine (*Pinus coulteri*) mortality increased from ~260 trees across 20 acres in 2021 to ~330 trees across 110 acres in 2022. Mortality occurred in small groups primarily along the Central Coast.

Pine mortality attributed to mountain pine beetle (*Dendroctonus ponderosae*):

Mountain pine beetle-caused tree mortality remained constant with an estimated 390,000 dead trees across 40,000 acres in 2022 compared to ~380,000 dead trees across 44,000 acres in 2021 and was most prevalent in and around Mammoth on the Inyo NF.

- Limber pine (*Pinus flexilis*) mortality increased from ~3,000 trees across 660 acres in 2021 to an estimated 86,000 trees across 2,900 acres in 2022. Mortality was concentrated east of the Chagoopa Plateau (or Kern Canyon) and in the White Mountains.

- Lodgepole pine (*Pinus contorta*) mortality decreased from an estimated 98,000 trees across 12,000 acres in 2021 to ~65,000 trees across 13,000 acres in 2022. Mortality occurred along the Sierra Nevada and Klamath mountain ranges.
- Sugar pine (*Pinus lambertiana*) mortality increased from ~4,000 trees across 480 acres in 2021 to an estimated 20,000 trees across 800 acres in 2022. Mortality was scattered throughout the state, excluding the Central Coast and Southern California.
- Western white pine (*Pinus monticola*) mortality increased from an estimated 190 trees across 210 acres in 2021 to ~5,200 trees across 1,200 acres in 2022. Mortality occurred primarily north of and around Lake Tahoe.
- Whitebark pine (*Pinus albicaulis*) mortality remained elevated from approximately 270,000 trees across 31,000 acres in 2021 to ~220,000 trees across 22,000 acres in 2022. Mortality occurred throughout the range of whitebark pine in the eastern Sierra Nevada Range.

Jeffrey pine mortality:

Jeffrey pine (*Pinus jeffreyi*) mortality attributed to Jeffrey pine beetle (*Dendroctonus jeffreyi*) increased from ~120,000 dead trees across 26,000 acres in 2021 to an estimated 270,000 dead trees across 40,000 acres in 2022. Mortality occurred primarily in higher elevations of the Sierra Nevada range.

Jeffrey pine mortality attributed to ips engraver beetles (*Ips* spp.) increased from ~11,000 dead trees across 4,700 acres in 2021 to ~80,000 dead trees across 12,000 acres in 2022. Mortality was concentrated within the Mt. Pinos Ranger District on the Los Padres NF and, to a lesser degree, west of Grasshopper Valley bordering both Modoc and Lassen NFs.

Pinyon pine mortality:

Pinyon pine (*Pinus monophylla*) mortality attributed to *Ips* spp. decreased from an estimated 60,000 dead trees across 8,400 acres in 2021 to ~220,000 dead trees across 16,000 acres in 2022. Mortality was concentrated primarily in the White Mountains and in the Mt. Pinos Ranger District of the Los Padres NF.

Knobcone pine mortality:

Knobcone pine (*Pinus attenuata*) mortality attributed to California flatheaded borer (*Melanophila californica*) decreased from an estimated 95,000 dead trees across 8,000 acres in 2021 to ~8,200 dead trees across 960 acres in 2022 and occurred primarily within the Klamath NF.

Knobcone pine mortality attributed to *Ips* spp. was not reported in 2021, however an estimated 250,000 dead trees across 9,000 acres were recorded in 2022 based on field observations along the northern coast. Mortality was dispersed along the northwestern portions of the state but was concentrated and often severe west of Clear Lake and east of Laytonville within the Yuki Nation.

Gray pine mortality:

Gray pine (*Pinus sabiniana*) mortality decreased from an estimated 53,000 dead trees across 4,200 acres in 2021 to ~2,300 dead trees across 250 acres in 2022. The causal agent for gray pine mortality is not well understood and therefore assigned to an unknown agent or drought in 2022. Additional information is included in the drought section below.

Oak mortality:

Goldspotted oak borer (*Agrilus auroguttatus*)-caused oak mortality decreased from ~19,000 dead trees recorded across 4,400 acres in 2021 to ~8,000 dead trees across 1,600 acres in 2022. Most mortality detected in aerial surveys occurred in the Cleveland NF on the Palomar Ranger District and around Lake Henshaw (San Diego Co.).

Note: In 2022, processing of GSOB mortality observations was changed to be consistent with other causal agents. This change caused an increase in the number of trees in data collected by polygons, however most GSOB mortality is now collected as point data and not affected by this change.

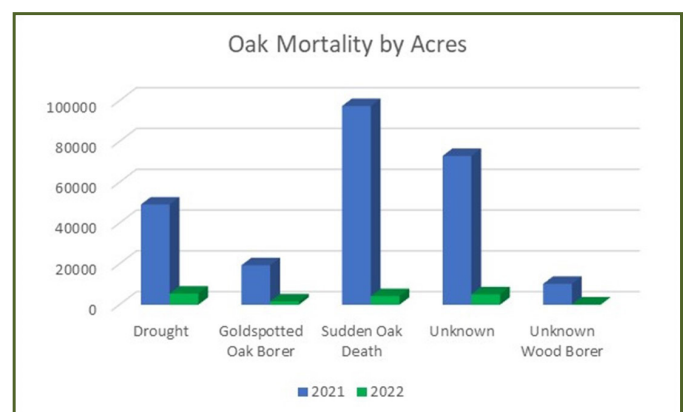


Figure 6. Chart compares the acres with oak mortality caused by various damage causing agents in 2021 and 2022.

Mortality Due to Diseases

Tanoak (*Notholithocarpus densiflorus*) mortality attributed to sudden oak death (SOD) (*Phytophthora ramorum*) decreased from ~97,000 dead trees across 16,000 acres in 2021 to an estimated 36,000 dead trees across 7,300 acres in 2022. Spread and impact of SOD is curtailed in times of drought. Substantial tanoak mortality not attributed to SOD was also recorded outside of known SOD-infected areas. This mortality is suspected to be caused by drought (Figure 6).

Monterey pine (*Pinus radiata*) mortality decreased from an estimated 5,500 dead trees across 680 acres in 2021 to approximately 1,700 dead trees across 95 acres in 2022. This mortality was attributed to pitch canker but was likely caused by other diseases interacting with drought. Mortality was widely scattered and spanned from Mendocino County to Monterey County along the coast.

An estimated ten Port-Orford-cedar (*Chamaecyparis lawsoniana*) died along the coast between Crescent City and Redwood NP. Mortality was attributed to Port-Orford-cedar root disease (*Phytophthora lateralis*).

Mortality Attributed to Drought

Drought contributed to the death of 210,000 conifer and oak trees across 13,000 acres in 2022. Incense-cedar (*Calocedrus decurrens*) mortality was likely underrepresented by aerial detection surveys this year since the affected trees were understory, smaller in size, and/or newly killed needles were light brown and difficult to differentiate from surrounding dry grasses.

Defoliation/Dieback

Top killed true fir (dead foliage at top and healthy, green foliage below) caused by fir engraver beetle was again widespread and generally collocated with mortality.

Approximately 2,000 acres of ponderosa pine defoliation were detected along the North Coast. The defoliation was attributed to Dothistroma needle blight (*Dothistroma septosporum*).

White fir defoliation caused by Douglas-fir tussock moth (*Orgyia pseudotsugata*) was recorded over approximately 800 acres southwest of Quincy on the Plumas NF and north of Ukiah on the Mendocino NF.

Defoliation of quaking aspen (*Populus tremuloides*) attributed to Marssonina leaf blight (*Marssonina* spp.) was observed across more than 410 acres. Defoliation was concentrated south of Little Antelope Valley, Mono County. No insect defoliation of aspen was detected in 2022.

Branch flagging (recently killed branches in otherwise healthy trees) of red fir caused by cytospora canker (*Cytospora* spp.), severe enough to be seen from the air, was recorded across ~800 acres in 2022. This area is largely reduced from predrought conditions.

Forest Highlights

Angeles

Tree mortality increased from ~400 dead trees across 38 acres in 2021 to an estimated 10,000 dead trees across 1,100 acres in 2022 primarily around Mount Baden-Powell.

- White fir mortality increased from approximately 70 dead trees across 15 acres in 2021 to ~8,800 trees across 930 acres in 2022.
- Jeffrey pine mortality increased from an estimated 90 scattered dead trees recorded as single trees or small groups to ~810 trees across 170 acres in 2022.

Cleveland

Tree mortality decreased from ~16,000 dead trees across 3,200 acres in 2021 to an estimated 8,000 dead trees across 1,500 acres in 2022. Mortality was particularly severe in areas around Pine Mountain and Palomar Mountain.

- Detected oak mortality attributed to goldspotted oak borer decreased from ~16,000 dead trees across 3,100 acres in 2021 to ~6,400 trees across 1,400 acres in 2022.
- Ponderosa pine mortality attributed to ips engraver beetles was recorded over 140 acres with an estimated 1,400 dead trees. Mortality was concentrated near Mt. Laguna.

Eldorado

Mortality increased from an estimated 290,000 dead trees across 26,000 acres in 2021 to ~1.3 million dead trees across 91,000 acres in 2022. Mortality was widespread throughout much of the Forest and was particularly severe at higher elevations.

- California red fir mortality increased from approximately 230,000 dead trees across 20,000 acres in 2021 to ~1.0 million dead trees across 66,000 acres in 2022.
- White fir mortality increased from an estimated 600 dead trees across 290 acres in 2021 to ~180,000 dead trees across 20,000 acres in 2022.
- Ponderosa pine mortality increased from approximately 41,000 dead trees across 5,300 acres in 2021 to ~42,000 dead trees across 3,000 acres in 2022.

Inyo

Mortality increased from an estimated 540,000 dead trees over 64,000 acres in 2021 to ~820,000 dead trees across 76,000 acres in 2022.

- California red fir mortality attributed to fir engraver remained constant with approximately 300,000 dead trees across 34,000 acres in 2021 compared to ~300,000 trees across 35,000 acres in 2022.
- Pinyon pine mortality increased from approximately 50,000 dead trees across 6,700 acres in 2021 to ~200,000 dead trees across 13,000 acres in 2022.

Klamath

Mortality increased from an estimated 740,000 dead trees across 77,000 acres in 2021 to ~1.8 million trees across 150,000 acres in 2022. Light to moderate severity mortality was widespread, especially in the northeast. Mortality was particularly severe around Etna Mountain.

- Shasta red fir mortality increased from approximately 300,000 dead trees across 26,000 acres in 2021 to ~340,000 dead trees across 21,000 acres in 2022.
- White fir mortality increased from approximately 220,000 dead trees across 26,000 acres in 2021 to ~1.3 million dead trees across 96,000 acres in 2022.

Lake Tahoe Basin

Mortality increased from an estimated 70,000 dead trees across 4,200 acres to ~1.4 million dead trees across 58,000 acres in 2022. Mortality was most widespread and intense west of the Lake.

- California red fir mortality increased from approximately 69,000 dead trees across 4,100 acres in 2021 to ~1.3 million dead trees across 54,000 acres in 2021.
- In 2022, white fir mortality was detected across 1,500 acres with approximately 14,000 dead trees. There was virtually no white fir mortality detected in 2021.

Lassen

Mortality increased from an estimated 270,000 dead trees across 68,000 acres in 2021 to ~2 million dead trees across 170,000 acres in 2022 despite much of the Forest not being surveyed due to the recent Dixie fire. Mortality was generally more severe on the east side of the Forest but widespread in the west.

- White fir mortality increased from approximately 34,000 dead trees across 12,000 acres in 2021 to ~1.3 million dead trees across 120,000 acres in 2022.
- California red fir mortality increased from approximately 98,000 dead trees across 23,000 acres in 2021 to ~310,000 dead trees across 28,000 acres in 2022.

Los Padres

Mortality increased from an estimated 16,000 dead trees across 5,500 acres in 2021 to ~60,000 dead trees across 12,000 acres in 2022. Most of the mortality occurred around Mount Pinos, however widespread light severity mortality also occurred around Mount Frazier.

- Jeffrey pine mortality increased from approximately 11,000 dead trees across 4,700 acres in 2021 to ~44,000 dead trees across 8,600 acres in 2022.
- Pinyon pine mortality increased from approximately 1,600 dead trees across 150 acres in 2021 to ~4,900 dead trees across 1,400 acres in 2022.

Mendocino

Mortality increased from an estimated 450,000 dead trees across 30,000 acres in 2021 to ~490,000 dead trees across 40,000 acres in 2022. Mortality was generally light severity and most widespread on the southwest side of the Forest.

- White fir mortality increased from approximately 24,000 dead trees across 4,900 acres in 2021 to ~220,000 dead trees across 21,000 acres in 2022.

- Ponderosa pine mortality decreased from approximately 410,000 dead trees across 24,000 acres in 2021 to ~160,000 dead trees across 12,000 acres in 2022.

Modoc

Mortality increased from an estimated 435,000 dead trees across 52,000 acres in 2021 to ~2.2 million dead trees across 180,000 acres in 2022 and was widespread at light to moderate intensities. However, there was severe mortality over a large area of the southern Warner Mountains.

- White fir mortality increased from approximately 270,000 dead trees across 29,000 acres in 2021 to ~1.8 million acres across 130,000 acres in 2022.
- Ponderosa pine mortality increased from approximately 160,000 dead trees across 21,000 acres in 2021 to ~260,000 dead trees across 40,000 acres in 2022.

Plumas

Mortality increased from an estimated 141,000 dead trees across 12,000 acres in 2021 to ~1.5 million dead trees across 110,000 acres in 2022 even though much of the Forest was not surveyed due to the 2021 Dixie fire. Mortality was most widespread and intense in southern areas of the Forest.

- White fir mortality increased from approximately 15,000 dead trees across 3,100 acres in 2021 to ~870,000 dead trees across 81,000 acres in 2022.
- California red fir mortality increased from approximately 81,000 dead trees across 6,000 acres in 2021 to ~620,000 dead trees across 24,000 acres in 2022.

San Bernardino

Mortality decreased from an estimated 15,000 dead trees across 5,000 acres in 2021 to ~13,000 dead trees across 3,900 acres in 2022. Mortality was typically light severity and in small groups of large pines around Big Bear.

- White fir mortality decreased from approximately 8,700 dead trees across 2,800 acres in 2021 to ~6,900 dead trees across 1,300 acres in 2022.
- Jeffrey pine mortality increased from approximately 3,900 dead trees across 1,300 acres in 2021 to ~5,300 dead trees across 1,900 acres in 2022.

Sequoia

Mortality increased from an estimated 380,000 dead trees across 64,000 acres in 2021 to ~410,000 dead trees across 75,000 acres in 2022. Most of the mortality was light in severity except for moderate levels of mortality along southern Hume Lake District.

- California red fir mortality decreased from approximately 230,000 dead trees across 34,000 acres in 2021 to ~200,000 dead trees across 35,000 acres in 2022.
- White fir mortality increased from approximately 100,000 dead trees across 17,000 acres in 2021 to ~110,000 dead trees across 19,000 acres in 2022.

Shasta-Trinity

Mortality increased from an estimated 1.2 million dead trees across 200,000 acres in 2021 to ~4.3 million dead trees across 290,000 acres in 2022. Mortality was severe southeast of Hayfork, north of Weaverville, and on the southern flanks of Mount Shasta.

- White fir mortality increased from approximately 400,000 dead trees across 80,000 acres in 2021 to ~2.4 million dead trees across 170,000 acres in 2022.
- Ponderosa pine mortality increased from approximately 370,000 dead trees across 87,000 acres in 2021 to ~570,000 dead trees across 49,000 acres in 2022.

Sierra

Mortality increased from an estimated 860,000 dead trees across 91,000 acres in 2021 to ~1.7 million dead trees across 180,000 acres in 2022.

- California red fir mortality increased from approximately 790,000 dead trees across 75,000 acres in 2021 to ~1.5 million dead trees across 150,000 acres in 2022.
- White fir mortality increased from approximately 13,000 dead trees across 5,500 acres in 2021 to ~130,000 dead trees across 26,000 acres in 2022.

Six Rivers

Mortality increased from an estimated 50,000 dead trees across 8,000 acres in 2021 to ~150,000 dead trees across 24,000 acres in 2022. Mortality was common at light to moderate severities, especially north of Green Mountain.

- White fir mortality increased from approximately 29,000 dead trees across 3,600 acres in 2021 to ~100,000 dead trees across 16,000 acres in 2022.
- Mortality of plantation conifers caused by bear feeding damage increased from approximately 5,000 dead trees across 1,400 acres in 2021 to ~16,000 dead trees across 2,900 acres in 2022.

Stanislaus

Mortality increased from an estimated 590,000 dead trees across 95,000 acres in 2021 to ~2.6 million dead trees across 140,000 acres in 2022. Moderate to severe mortality was observed in the north central region of the Forest.

- California red fir mortality increased from approximately 450,000 dead trees across 63,000 acres in 2021 to ~2.1 million dead trees across 93,000 acres in 2022.
- White fir mortality increased from approximately 59,000 dead trees across 17,000 acres in 2021 to ~390,000 dead trees across 43,000 acres in 2022.

Tahoe

Mortality increased from an estimated 1 million dead trees across 79,000 acres in 2021 to ~5 million dead trees across 260,000 acres in 2022. Mortality occurred at moderate to severe levels over large areas, particularly along the central high-elevation areas of the Forest.

- California red fir mortality increased from approximately 790,000 dead trees across 67,000 acres in 2021 to ~3.8 million dead trees across 170,000 acres in 2022.
- White fir mortality increased from approximately 13,000 dead trees across 3,400 acres in 2021 to ~890,000 dead trees across 74,000 acres in 2022.

Acres with Mortality and Estimated Number of Dead Trees by Forest (2022)

National Forest	Acres	Dead Trees
Angeles National Forest	1,100	10,000
Cleveland National Forest	1,500	8,000
Eldorado National Forest	91,000	1,300,000
Humboldt-Toiyabe National Forest*	50,000	750,000
Inyo National Forest*	78,000	880,000
Klamath National Forest*	140,000	1,800,000
Lake Tahoe Basin Management Unit	58,000	1,400,000
Lassen National Forest	170,000	1,900,000
Los Padres National Forest	12,000	59,000
Mendocino National Forest	40,000	550,000
Modoc National Forest	180,000	2,200,000
Plumas National Forest	110,000	1,600,000
San Bernardino National Forest	3,900	13,000
Sequoia National Forest	75,000	410,000
Shasta-Trinity National Forest	290,000	4,400,000
Sierra National Forest	180,000	1,700,000
Six Rivers National Forest	24,000	150,000
Stanislaus National Forest	140,000	2,600,000
Tahoe National Forest	260,000	5,000,000

The numbers of acres and trees throughout this report have been rounded as appropriate.

* Includes acreages outside of California, but within the National Forest boundary.

Acres with Mortality and Estimated Number of Dead Trees by County (2022)

County	Acres	Dead Trees
Alameda	2	86
Alpine	62,000	1,200,000
Amador	20,000	310,000
Butte	15,000	160,000
Calaveras	28,000	390,000
Colusa	5,400	68,000
Contra Costa	20	120
Del Norte	19,000	130,000
El Dorado	78,000	1,400,000
Fresno	200,000	1,900,000
Glenn	2,000	28,000
Humboldt	46,000	250,000
Inyo	17,000	300,000
Kern	32,000	270,000
Lake	31,000	590,000
Lassen	120,000	840,000
Los Angeles	1,000	9,200
Madera	44,000	580,000
Marin	160	1,400
Mariposa	60,000	970,000
Mendocino	98,000	1,300,000
Modoc	170,000	2,400,000
Mono	31,000	300,000
Monterey	650	6,300
Napa	2,600	47,000
Nevada	79,000	1,400,000
Orange	3	100
Placer	140,000	3,000,000
Plumas	97,000	1,300,000
Riverside	1,000	1,900
San Benito	61	61
San Bernardino	3,000	12,000
San Diego	1,800	9,400
San Francisco	1	2
San Luis Obispo	110	2,300
San Mateo	2,700	19,000
Santa Barbara	300	2,100
Santa Clara	2,900	8,200
Santa Cruz	270	1,300
Shasta	180,000	2,800,000
Sierra	110,000	2,000,000
Siskiyou	310,000	4,100,000

County	Acres	Dead Trees
Solano	1	5
Sonoma	7,900	59,000
Sutter	1	2
Tehama	63,000	1,300,000
Trinity	210,000	3,300,000
Tulare	120,000	1,300,000
Tuolumne	120,000	2,200,000
Ventura	5,700	23,000
Yolo	17	48
Yuba	7,500	100,000

The numbers of acres and trees throughout this report have been rounded as appropriate.

Citation

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