



United States Department of Agriculture

2019 Aerial Survey Results: California



Forest Health Monitoring Program • 1731 Research Park Drive, Davis, CA 95618
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Forest
Service

Pacific
Southwest
Region

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COVER PHOTO

Ongoing severe mortality of whitebark pine on the northern slope of Mount Shasta. The older mortality has been captured by previous year's surveys, and recent mortality is visible along the expanding perimeter.

Photo by: Loren McAfee, Quercus Consultants Inc.



Prepared by **Jeffrey Moore, Meghan Woods, and David Greenberg**
USDA Forest Service, Region 5

Contributors

Aerial Surveyors:

Jeffrey Moore
Loren McAfee
Daniel Depinte

Contributing Editors:

Kayanna Warren
Sheri Smith

Special Thanks to the Pilots:

Paul Clark
Steven Datema

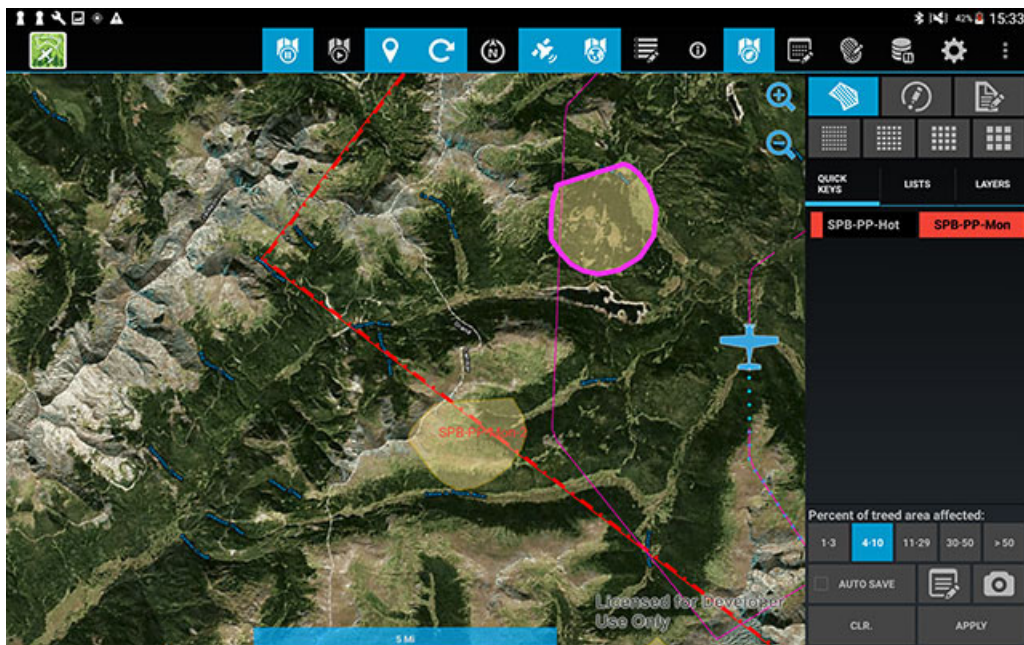


Photo of the Digital Mobile Sketchmapping System (DMSM) used to record tree mortality and damage data

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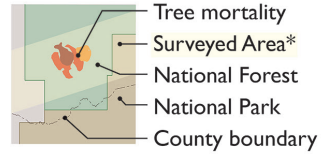
Statewide Damage Mapped



UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST HEALTH PROTECTION AERIAL DETECTION MONITORING

2019 SURVEY

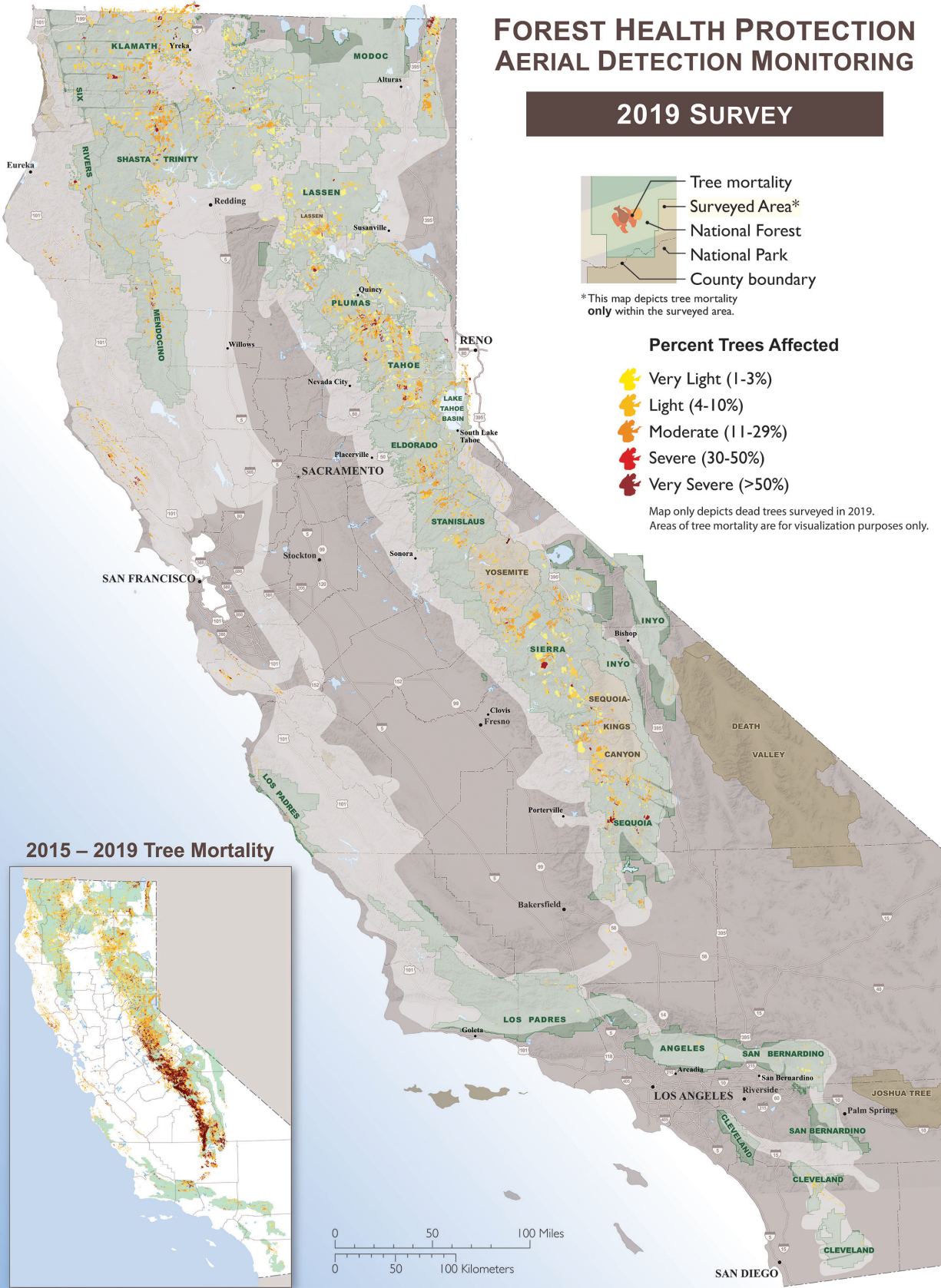


*This map depicts tree mortality only within the surveyed area.

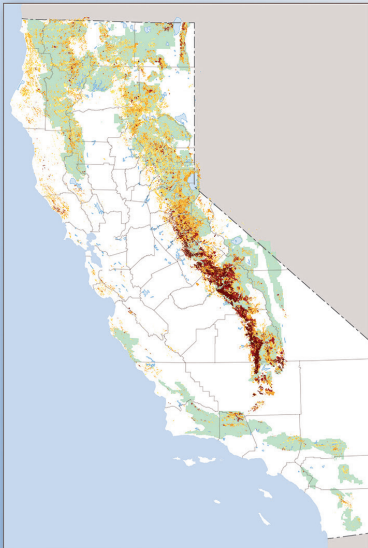
Percent Trees Affected

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

Map only depicts dead trees surveyed in 2019. Areas of tree mortality are for visualization purposes only.



2015 – 2019 Tree Mortality



FOREST SERVICE

Overview

The US Forest Service (USFS), Pacific Southwest Region, State and Private Forestry staff conduct annual aerial surveys throughout forested areas of California to detect tree mortality and tree damage, such as defoliation or branch flagging. Surveys are flown in small, fixed-wing aircraft on a 4-5 mi grid pattern with 2 observers recording from opposite sides of the plane. Most National Forests and Parks in California are surveyed, along with other federal, state, and private lands. For the 2019 flight season, approximately 41 million acres were surveyed. Elevated levels of tree mortality were recorded on ~2.2 million acres, totaling an estimated 15.1 million dead trees, mostly California red or white fir.

Most of the mortality recorded in 2019 was again strongly correlated to lingering effects of the drought and subsequent successful bark beetle attacks. These have now resulted in a total of ~163 million dead trees since 2010, mostly in southern areas of the Sierra Nevada Range. Until the three most recent years, mortality in this area affected primarily lower elevation pine. Surveys were flown from June - August.

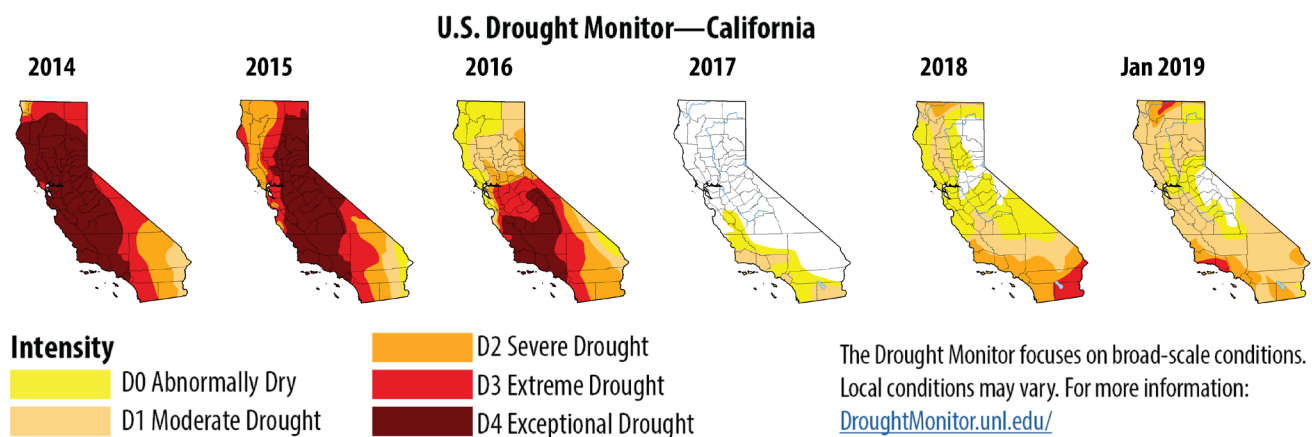


Figure 1. The U.S. Drought Monitor maps of 2014 through early January 2019 illustrate the severity of the drought event in California. Maps are presented from the last water year report date in September. D1 is the least intense drought level and D4 the most intense; D0 areas are not in drought. A full description of each drought severity classification is available from the U.S. Drought Monitor website. Source: U.S. Drought Monitor

Background

Continuing from 2018, the 2019 water year was also above normal for most of the state, especially in southern areas. However, the growing season was exceptionally dry in northern areas as almost no measurable precipitation was recorded from late May through late November.

California red and white fir trees continued to die in greatly elevated numbers into 2019, primarily from successful fir engraver beetle attacks. Tree mortality typically occurred in trees growing in overstocked stands.

Tanoak mortality associated with sudden oak death remained elevated again in 2019 as a result of the wet spring in 2017.

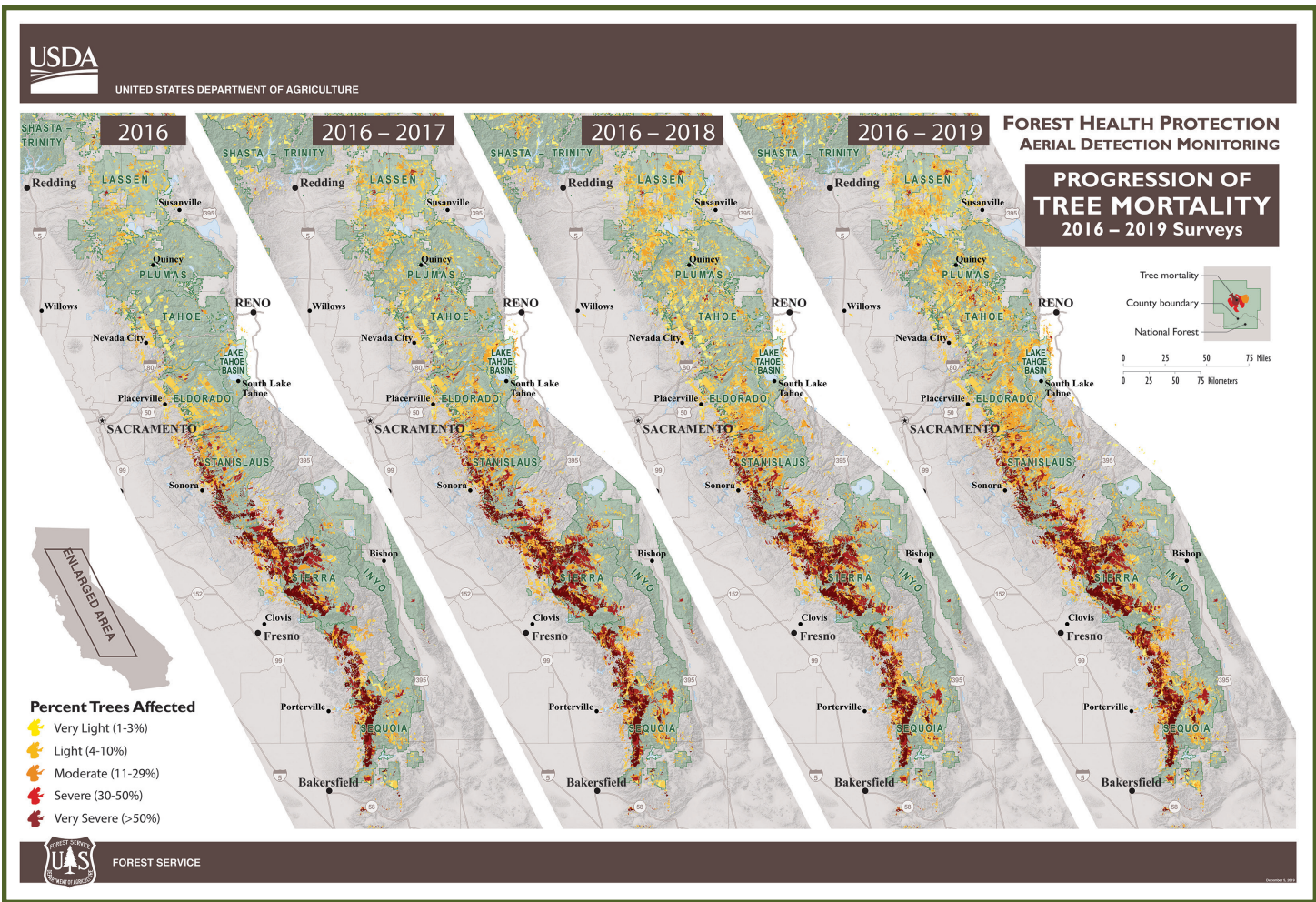


Figure 2. This map shows the cumulative progression of drought induced mortality in the most impacted areas of the Sierra Nevada range of California from 2016-2019. Map on the far right depicts the cumulative mortality over the preceding four years.

Highlights

Acres reported below may be noted in more than one bullet, as multiple damaging agents often occur in the same location. Additionally, although acres reported had some level of damage, not all host trees in any given acre were killed or damaged. The numbers of acres and trees below are rounded to the nearest 1,000, as appropriate.

Bark Beetles and Wood Borers

Fir mortality attributed to fir engraver beetle (*Scolytus ventralis*) comprised over 82% of the total tree mortality observed in 2019. Approximately 12.4 million dead firs were recorded across 1.9 million acres, compared to ~14 million dead fir trees across 1.4 million acres in 2018. Fir mortality was greatly elevated from background levels for the third straight year.

- White fir (*Abies concolor*) mortality was widespread throughout its range but typically at light intensities. An estimated 4.6 million trees across 840,000 acres died.
- California red fir (*Abies magnifica*) mortality was widespread throughout its range and typically of light to moderate intensity, but severe levels of mortality were also detected in many areas. Mortality was routinely detected in very high remote wilderness areas. An estimated 7.8 million trees across one million acres died.

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

Pine mortality attributed to mountain pine beetle (*Dendroctonus ponderosae*) remained elevated with an estimated 500,000 dead trees across 50,000 acres in 2018 and ~552,000 dead trees across 57,000 acres in 2019.

- Whitebark pine (*Pinus albicaulis*) mortality increased from ~40,000 trees across 6,000 acres in 2018 to ~143,000 trees across 15,000 acres in 2019. Particularly active areas of mortality were north of Lake Tahoe around Mount Rose and the north side of Mount Shasta.
- Lodgepole pine (*Pinus contorta*) mortality remained fairly unchanged from an estimated 270,000 trees across 34,000 acres in 2018 to ~278,000 trees across 28,000 acres in 2019.
- Sugar pine (*Pinus lambertiana*) mortality decreased from ~18,000 trees across 3,000 acres in 2018 to ~2,000 trees across 490 acres in 2019.
- Limber pine (*Pinus flexilis*) mortality decreased from ~200,000 trees across 12,000 acres in 2018 to ~88,000 trees across 12,000 acres in 2019.
- Western white pine (*Pinus monticola*) mortality increased from ~800 trees across 200 acres in 2018 to ~41,000 trees across 1,400 acres in 2019. The most active mortality was north of Stampede Reservoir, Tahoe National Forest.

Western pine beetle (*Dendroctonus brevicomis*)-related pine mortality decreased to ~793,000 dead trees across 124,000 acres, down from the ~950,00 dead trees across 166,000 acres recorded in 2018. Ponderosa pine (*Pinus ponderosa*) accounted for 99% of this mortality.

- Coulter pine (*Pinus coulteri*) mortality decreased from ~9,000 dead trees across 2,000 acres in 2018 to ~2,000 trees across 170 acres in 2019.

Jeffrey pine (*Pinus jeffreyi*) mortality attributed to Jeffrey pine beetle (*Dendroctonus jeffreyi*) decreased from ~753,000 dead trees across 99,000 acres in 2018 to ~179,000 dead trees across 67,000 acres in 2019.

Goldspotted oak borer (*Agrilus auroguttatus*)-related oak (*Quercus* spp.) mortality in San Diego County increased in 2019 to ~17,000 dead trees across 11,000 acres, up from ~11,000 dead trees across 3,700 acres in 2018.

Knobcone pine (*Pinus attenuata*) mortality attributed to California flatheaded borer (*Melanophila californica*), although multiple agents are likely involved, increased from ~11,000 trees across 2,000 acres in 2018 to ~14,000 trees across 2,400 acres in 2019.

Mortality of ~11,000 Jeffrey pine trees (*Pinus jeffreyi*) attributed to ips (*Ips* spp.) across 3,000 acres was recorded in and around the northeast portions of the Mt. Pinos Ranger District, Los Padres National Forest.

Douglas-fir (*Pseudotsuga menziesii*) mortality (not attributed to bear damage) remained elevated in 2019 with an estimated 127,000 dead trees across 27,000 acres, compared to ~107,000 dead trees across 32,000 acres in 2018. Scattered mortality was common throughout most of the northern coastal range.

Mortality Due to Diseases

Tanoak mortality attributed to sudden oak death (*Phytophthora ramorum*) remained elevated with an estimated 885,000 dead oak trees across 92,000 acres in 2019, compared to ~1.6 million dead trees across 106,000 acres in 2018. This is the second very active year in a row after a wet spring event in 2017 which generally increased mortality in infested coastal areas.

Defoliation/Dieback

Severe defoliation of quaking aspen (*Populus tremuloides*), primarily attributed to Marssonina leaf blight (*Marssonina* spp.), was observed across 4,200 acres in eastern portions of the Sierra Nevada range.

Severe defoliation of lodgepole pine attributed to lodgepole pine needleminer (*Coleotechnites milleri*) was detected on approximately 12,000 acres in and around Yosemite National Park.

Severe defoliation of white fir attributed to sawfly (*Neodiprion abietis*) was detected in Sierra County, primarily on the Tahoe National Forest.

Severe defoliation of Sitka spruce due to spruce aphid (*Elatobium abietinum*) was detected on approximately 1,250 acres along the north coast of California, particularly north of Crescent City near the Oregon border.

Multiple agents were involved in defoliation of pinyon pine that was observed on approximately 37,000 acres in and around the Inyo National Forest. Approximately 9,000 of those acres were attributed to pinyon needle scale (*Matsucoccus acalyptus*) by ground survey.

Acres with Mortality and Estimated Number of Dead Trees by Forest

National Forest	Acres	Dead Trees
Angeles National Forest	3,000	14,000
Cleveland National Forest	7,000	14,000
Eldorado National Forest	91,000	668,000
Humboldt-Toiyabe National Forest	28,000	233,000
Inyo National Forest	66,000	409,000
Klamath National Forest	253,000	1,860,000
Lake Tahoe Basin Management Unit	25,000	194,000
Lassen National Forest	160,000	553,000
Los Padres National Forest	8,000	45,000
Mendocino National Forest	61,000	510,000
Modoc National Forest	93,000	865,000
Plumas National Forest	149,000	995,000
San Bernardino National Forest	13,000	34,000
Sequoia National Forest	88,000	1,014,000
Shasta-Trinity National Forest	214,000	1,348,000
Sierra National Forest	185,000	1,131,000
Six Rivers National Forest	53,000	474,000
Stanislaus National Forest	81,000	499,000
Tahoe National Forest	196,000	1,458,000

Acres and tree counts throughout this report have been rounded to the nearest thousand.

Acres with Mortality and Estimated Number of Dead Trees by County

County	Acres	Dead Trees
Alameda	1	37
Alpine	25,000	132,000
Amador	14,000	137,000
Butte	12,000	59,000
Calaveras	22,000	141,000
Contra Costa	129	1,000
Del Norte	21,000	150,000
El Dorado	76,000	534,000
Fresno	153,000	805,000
Glenn	15,000	138,000
Humboldt	35,000	321,000
Inyo	7,000	60,000
Kern	17,000	89,000

County	Acres	Dead Trees
Lake	1,000	3,000
Lassen	54,000	163,000
Los Angeles	3,000	22,000
Madera	70,000	540,000
Marin	2,000	21,000
Mariposa	38,000	262,000
Mendocino	42,000	297,000
Merced	1	3
Modoc	84,000	894,000
Mono	40,000	234,000
Monterey	5,000	41,000
Napa	39	400
Nevada	39,000	174,000
Orange	39	400
Placer	90,000	712,000
Plumas	187,000	1,110,000
Riverside	1,000	6,000
San Benito	1	14
San Bernardino	12,000	29,000
San Diego	12,000	19,000
San Luis Obispo	134	2,000
San Mateo	2,000	13,000
Santa Barbara	1,000	5,000
Santa Clara	5,000	56,000
Santa Cruz	10,000	89,000
Shasta	115,000	305,000
Sierra	112,000	955,000
Siskiyou	406,000	2,823,000
Sonoma	39,000	424,000
Tehama	67,000	318,000
Trinity	150,000	1,069,000
Tulare	167,000	1,409,000
Tuolumne	72,000	517,000
Ventura	3,000	10,000
Yolo	1	1
Yuba	2,000	5,000

Acres and tree counts throughout this report have been rounded to the nearest thousand.