USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE

AERIAL DETECTION SURVEY: 2022 SUMMARY REPORT

Information below is based on data recorded and shared by the USDA Forest Service, R5 State & Private Forestry, Aerial Detection Survey (ADS) program.

Surveys are conducted to provide annual estimates of tree mortality and damage and depict broad mortality trends. Most of California's forested areas were surveyed in 2022.

Summary for 2022 Season Aerial Detection Survey

Report Date	December 2022
Flight Dates	July 18th to Oct 7th
Area Flown	California, state-wide
Acres Surveyed	39.6 million
Acres with Mortality	2.6 million
Acres with tree damage other than mortality	25,000
Primary agents of non-mortality tree damage (does not include bears, fire, herbicide damage)	drought, Douglas-fir tussock moth, Cytospora canker, needleminers
Estimated number of dead trees	36.3 million

Highlights from this year's survey

- Total tree mortality increased significantly both in acres affected and particularly in estimated trees killed from 2021. Average severity of mortality was also significantly higher.
- Mortality consisted primarily of true fir which comprised over 77% of the total and was the largest tally ever recorded by R5 ADS. Mortality was particularly severe and widespread in the central Sierra Nevada Range.
- Mortality was particularly severe and widespread in the north interior in several conifer species where drought conditions were most exceptional.
- Mortality attributed to mountain pine beetle (*Dendroctonus ponderosae*) remained steady with an estimated 380,000 dead trees across 44,000 acres in 2021 to approximately 390,000 dead trees across 40,000 acres in 2022. Within this group, whitebark pine accounted for most of the mortality occurring throughout its range.
- Douglas-fir mortality (not attributed to damage by bears) increased most dramatically. However, mortality in 2021 was relatively small. 2022 Mortality was common throughout the host range but was particularly concentrated north and west of the Redding area.
- Pinyon pine mortality attributed to *Ips* sp. increased from an estimated 60,000 dead trees across 8,400 acres in 2021 to ~220,000 dead trees across 16,000 acres in 2022 mostly in the White Mountains of far eastern CA.
- Incense cedar mortality was quite common and is underrepresented by aerial survey based on field reports as these trees were typically smaller size class and thus hard to see from a distance.
- Tanoak mortality attributed to sudden oak death (*Phytophthora ramorum*) decreased substantially since dry spring weather inhibits the spread of this invasive disease.
- Oak mortality attributed to goldspotted oak borer (*Agrilus auroguttatus*) decreased significantly and was again concentrated primarily in and around the Palomar Ranger District, Cleveland National Forest in San Diego County.
- Oak discoloration, early leaf-drop, possible dieback and mortality was common throughout interior areas of the state. Actual mortality is difficult to detect from a distance, but significant oak mortality is possible over large areas.

Tree Species (Groups)	2022		2021		Percent Change	
	Acres	Estimated Trees Killed	Acres	Estimated Trees Killed	Acres	Estimated Trees Killed
Red Fir	890,000	15,200,000	490,000	4,500,000	80%	242%
White Fir	1,500,000	12,800,000	290,000	1,600,000	266%	691%
Yellow Pines	340,000	3,800,000	330,000	2,200,000	4%	73%
5 Needle Pines	26,000	310,000	32,000	280,000	-18%	11%
Douglas-Fir	190,000	3,000,000	18,000	170,000	973%	1650%
Other Pines	39,000	570,000	34,000	320,000	15%	79%
Other Conifer	3,300	18,000	1,000	11,000	231%	74%
Oaks	16,000	110,000	26,000	160,000	-39%	-31%

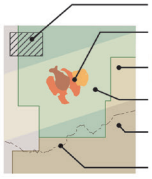
Online resources:
Pacific Southwest Aerial Detection Program
https://www.fs.usda.gov/detail/r5/forest-grasslandhealth/?cid=fsbdev3_046696
Scan QR code to visit the program web page for reports, maps, and more information about the Aerial Detection Survey program.

Questions regarding this report should be directed to Jeff Moore at jeffrey.moore@usda.gov or 530-759-1753.

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FOREST HEALTH PROTECTION
AERIAL DETECTION MONITORING

2022 SURVEY



Survey Excludes Recent Wildfires
Tree mortality
Surveyed Area*
National Forest
National Park
County boundary

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

Percent Trees Affected

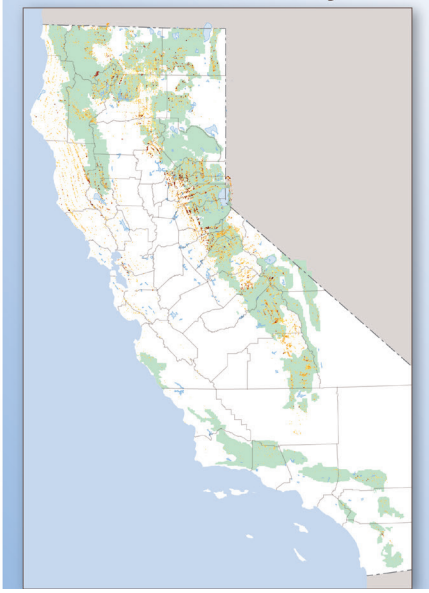
- Very Light (1-3%)
- Light (4-10%)
- Moderate (11-29%)
- Severe (30-50%)
- Very Severe (>50%)

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

KLAMATH
Yreka
MODOC
Alturas
SIX RIVERS
SHASTA - TRINITY
Eureka
Redding
LASSEN
Susanville
PLUMAS
Quincy
MENDOCINO
Willows
RENO
TAHOE
Nevada City
LAKE TAHOE BASIN
South Lake Tahoe
ELDORADO
Placerville
SACRAMENTO
STANISLAUS
Stockton
Sonora
SAN FRANCISCO
YOSEMITE
INYO
Bishop
SIERRA
INYO
SEQUOIA-
KINGS
CANYON
Clovis
Fresno
DEATH
VALLEY
LOS PADRES
Porterville
SEQUOIA
Bakersfield
LOS PADRES
Goleta
ANGELES
SAN BERNARDINO
Arcadia
San Bernardino
LOS ANGELES
Riverside
JOSHUA TREE
Palm Springs
CLEVELAND
SAN BERNARDINO
CLEVELAND
CLEVELAND
SAN DIEGO

0 50 100 Miles
0 50 100 Kilometers

2021 Tree Mortality



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RESULTS BY COUNTY – 2022

County	Estimated Number of Acres with Mortality	Estimated Number of 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 Luis Obispo	1	2
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

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RESULTS BY COUNTY – 2022

County	Estimated Number of Acres with Mortality	Estimated Number of Dead Trees
Shasta	180,000	2,800,000
Sierra	110,000	2,000,000
Siskiyou	310,000	4,100,000
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
Total	**2,545,096 acres**	**36,388,524 dead trees**

RESULTS BY NATIONAL FOREST – 2022

Forest	Estimated Number of Acres with Mortality	Estimated Number of 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
Total	**1,904,500 acres**	**26,730,000 dead trees**

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