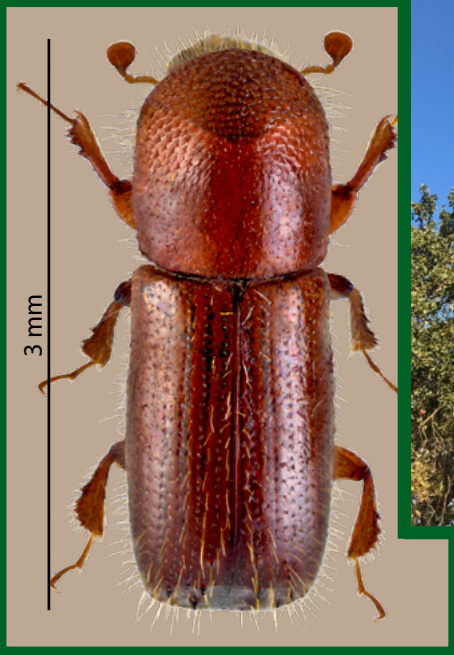
California Forest Pest Conditions



2020

A publication of the
California Forest Pest Council

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Cover photos:

Top left: Female Mediterranean oak borer (MOB). Photo credit: R. Rabaglia, USFS

Top right: Valley oak tree infested by MOB. Photo depicts typical initial pattern of mortality starting in the uppermost limbs primarily on one side of the tree. Photo Credit: S. Smith, USFS

Bottom right: Dropped branch showing trellis like MOB brood galleries at point of weakness, ~7 in diameter, Mt. St. Helena. Photo credit: C. Ewing, CALFIRE.

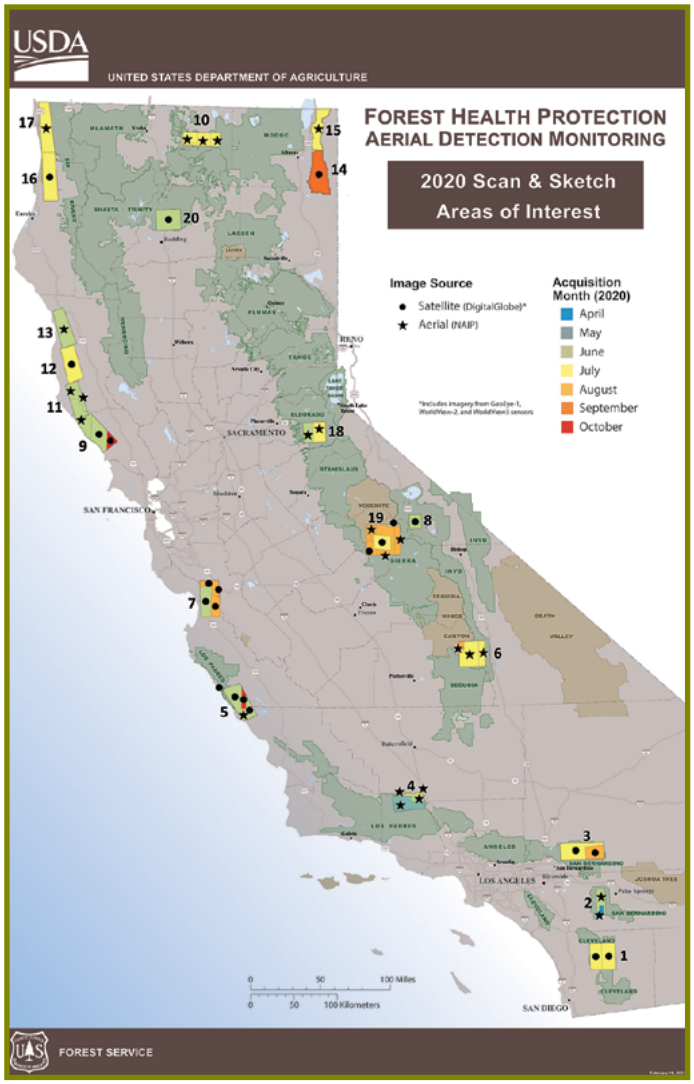
Bottom left: Base of valley oak tree infested by MOB depicting distinctive staining throughout the ray parenchyma attributed to fungal associates of the beetle. Photo Credit: S. Smith, USFS

Remote Sensing Survey	
Acres virtually surveyed 2020:	4 million acres
Acres aerially surveyed 2019:	41 million acres

The USDA Forest Service, Pacific Southwest Region, State and Private Forestry staff normally conduct annual aerial surveys throughout forested areas of California to detect recently killed and currently damaged forest trees. Because of safety concerns related to multi-person flights during the COVID-19 global pandemic in 2020, other remote sensing methods were used to monitor for forest conditions.

In the pre-season, monitoring staff tested several methods of remotely-sensed image analysis, including: manual delineation of tree mortality using visual interpretation of satellite and aerial imagery, machine learning, and several automated change detection products that use satellite imagery. Ultimately, manual delineation of mortality based on satellite and aerial imagery was selected because existing change detection methods seemed, from early-season evaluation, to be insufficiently detailed to detect background tree mortality patterns and machine learning methods still too early in development. In addition, available data sources producing imagery at the <1m scale could be used with existing Aerial Detection Survey (ADS) digital reporting tools.

In 2019, aerial detection surveys flown between July and August covered 41 million acres of forested land. Field staff then conducted spot ground checks on selected points and polygons to verify host and agent. This year, approximately 3.8 million acres were virtually surveyed by 13 surveyors who utilized either tablets or PCs to visually scan satellite or aerial imagery and digitize points and polygons of disturbance. Imagery acquisition dates fell between April 15 and October 22, 2020.



USFS Aerial Detection Survey, Scan & Sketch Areas of Interest, 2020.
Map by: M. Woods, USFS

Images were acquired for Areas of Interest (AOIs) determined by forest health staff and key partners. The "scan and sketch" is a time-consuming approach, and only a small percentage of California's forestland could be surveyed with this method; AOIs were selected in order to sample across the typical aerial survey area using criteria for:

1. Severe and Extreme Drought Designation in the 2020 Drought Monitor: North Interior California (AOI 10, 20);
2. Severe Tree Mortality within the last 5 Years: Warner Mountains, Southern Sierras (AOI 6, 8, 14, 15, 18, 19); and
3. Pest or Pathogen of Interest: North Coast for Sudden Oak Death (9, 11-13, 16, 17), Southern California to Santa Cruz County for Goldspotted Oak Borer, Invasive Shothole Borers, and others (1-5, 7).

Images collected by the WorldView-2, WorldView-3, and GeoEye-1 satellites, pansharpened to 30-50cm resolution, were acquired from Maxar Technologies under the U.S. Government's EnhancedView Program. Imagery from the National Agriculture Imagery Program (NAIP), available at 60cm resolution, was used for areas not covered by the available satellite imagery.

The same input tools and software used for ADS were used for this monitoring effort, facilitating easy integration with the USFS National Insect and Disease Database as well as allowing for a similar style of data entry and point/polygon creation. This effort required approximately 660 hours from 13 forest health specialists from the USFS and Cal Fire, all of whom had limited ability to conduct spot ground checks in the field this year because of both COVID-19 travel restrictions and the exceptional fire year.

Demonstration of creating damage features using the DMSM interface on a tablet by visually scanning satellite imagery in 2020.
Photo by: N. Stevens, USFS

Below are the results of observations made in 2020 using these alternative methods with the caveats that to some degree these differences may reflect a difference in methodology as much as a change in host or agent presence or severity. Other factors that may have played into different results from 2019 include: multiple observers in 2020, different months of imagery gathering versus flights, and variation in clarity of image sharpness and color.

In past years, we presented tables of mortality by species. Tables by species are not presented for 2020 because comparability to past years is hampered by differences in methodology. For 2020 surveyors, it was often difficult to discern, even at 30-60cm resolution, individual tree species (and therefore make appropriate inferences about agent) and mortality stage (recent or old). Additionally, some fir mortality typically detected via ADS was likely not detected this year because of fir's more subtle color signature and more numerous sub-canopy presence.

We observed, relative to 2019:

Fir (white, red) – *Abies manifica, Abies concolor*

- Fir mortality due to fir engraver was down consistently over most AOIs (2, 3, 4, 8, 10, 15, 18, 19, 20) -
  - » except AOI 6, where fir engraver tree mortality increased.

Pine

- Pine mortality was down in AOIs 2, 3, 4, 18.
- Yellow pine (ponderosa - *Pinus ponderosa*, Jeffrey - *P. jeffreyi*) mortality was consistent with 2019 levels in AOIs 10, 19.
- In AOI 20, ponderosa pine mortality increased, particularly around the edges of recent wildfires.
- Lodgepole pine (*Pinus contorta*) mortality increased due to mountain pine beetle (*Dendroctonus ponderosae*) in AOI 8; however, Jeffrey pine mortality decreased.
- Mortality of white pines (western white - *P. monticola*, limber - *P. flexilis*, and whitebark - *P. albicaulis*) attributed to mountain pine beetle was consistent in AOI 15.
- Other AOIs did not record notable levels of pine mortality.

Invasive Agents and Hardwoods

- Tanoak mortality attributed to Sudden Oak Death (SOD - *Phytophthora ramorum*) was down consistently over most relevant AOIs (5, 7, 9, 11, 12, 13) -
  - » Except AOIs 16 and 17, where SOD was first confirmed in 2019 by ground personnel, allowing for attribution to SOD in 2020.
- Oak mortality attributed to goldspotted oak borer (GSOB - *Agrilus auroguttatus*) in AOI 1 was down.

Other

- Unattributed (no determination of agent) oak (*Quercus* spp.) mortality was down in AOI 5 but continued at similar levels in AOI 7.
- Unattributed tanoak (*Notholithocarpus densiflorus*) mortality was up in AOI 13, 17 and may have been caused by SOD.
- Douglas-fir (*Pseudotsuga menziesii*) mortality, including from from flatheaded fir borer (*Phaenops drummondi*), was down in AOIs 16, 17, 20.

The following AOIs were impacted by fire, including by high severity fire, after monitoring was completed: AOI 19 (35% by Creek and Horse Fires); AOI 6 (15% by SQF Complex); AOI 5 (7% by Dolan Fire); AOI 14 (3% by W-5 Cold Springs Fire).

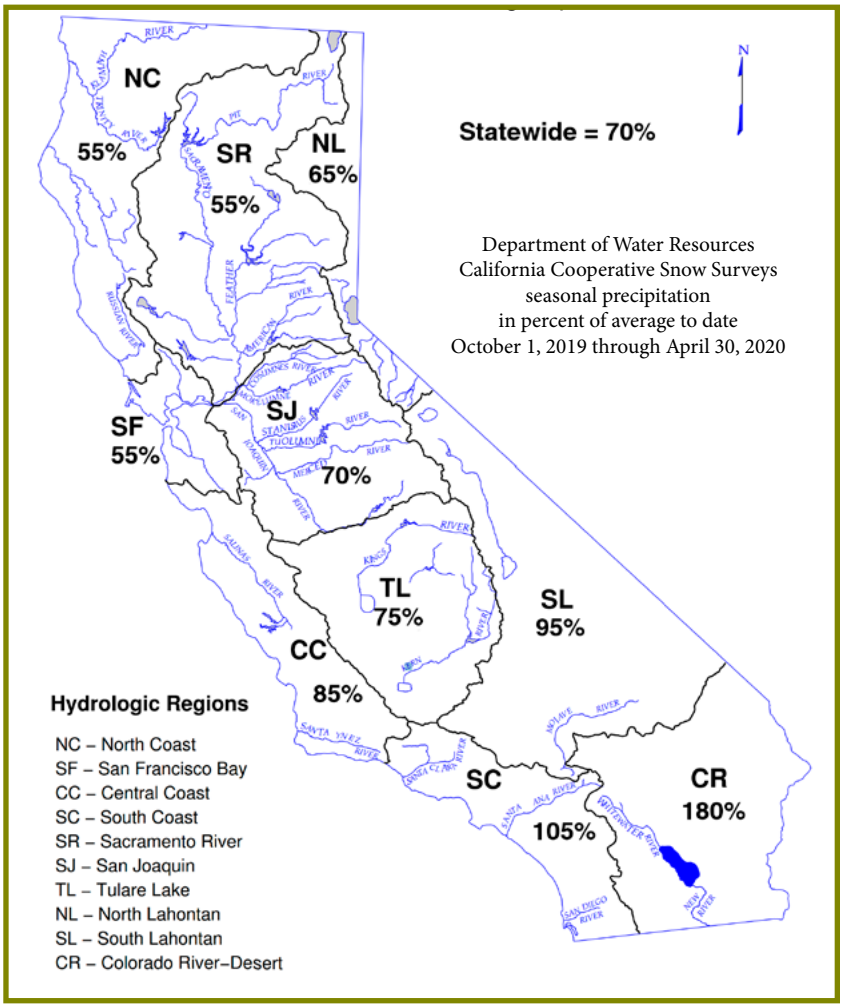
2020 methodologies were less conducive to detection, and therefore reported none or much reduced numbers, of:

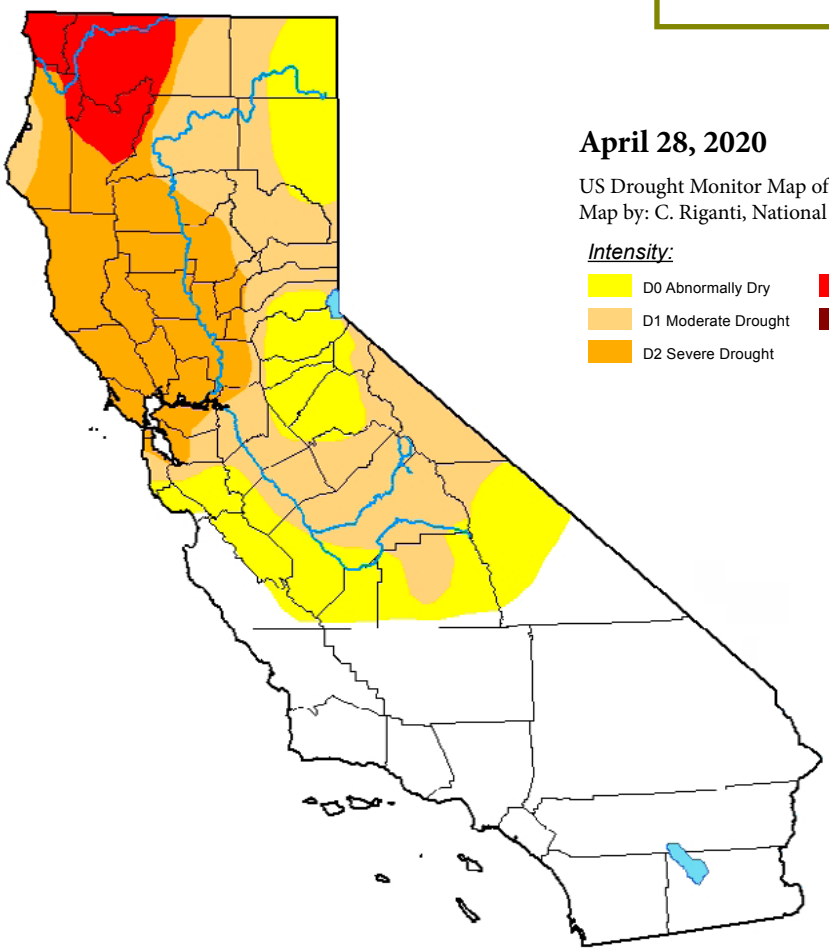
- Incense cedar (*Calocedrus decurrens*), sugar pine (*Pinus lambertiana*), Coulter pine (*Pinus coulteri*), and bigcone Douglas-fir (*Pseudotsuga macrocarpa*) (difficult to identify amongst mixed conifer stands dominated by fir and yellow pine);
- Coastal pines like Monterey (*Pinus radiata*) and Bishop pine (*Pinus muricata*);
- Damage to trees that had very limited presence in the AOI areas, including Santa Lucia fir (*Abies bracteata*), Port-Orford cedar (*Chamaecyparis lawsoniana*), and quaking aspen (*Populus tremuloides*). AOIs did not cover bristlecone pine (*Pinus longaeva*) ranges;
- Damage affecting mostly small or understory trees, including tree damage caused by bears, although some was identified.

Scan & Sketch Acknowledgements: Cal Fire forest health staff Kim Corella and Chris Lee, USFS R5 forest health staff Beverly Bulaon, Charlie Barnes, David Greenberg, Ashley Hawkins, Andrea Hefty, Stacy Hishinuma, Jeff Kaiden, Martin MacKenzie, Loren McAfee, Stephen McKelvey, Jeff Moore, Micha Salomon, Cynthia Snyder, Nicholas Stevens, and Bill Woodruff.

Statewide precipitation in percent of average to date from October 2019 - April 2020 was 70% , compared to 125% for the same time period in 2018- 2019. Northern California forested area rainfall totals were 55 - 65% of average, and southern coastal areas were 105% of average (see map on right). The 2019 – 2020 water year (water year is from October 1 – September 30) was the 13th driest on record (since January 1895). Precipitation was slightly above average in December, April, and May, while February was the driest ever recorded (3.64" below average), and September was the 2nd driest ever recorded. 2020 water conditions as well as cumulative water conditions from previous years contributed to water deficits across Central and Northern Calfiornia (see map below).

Statewide temperatures varied widely from historical averages (1895 – 2019). While March was ~1.0°F cooler than average, August was the warmest August on record (5.2°F above the August average), and September was also the warmest on record (5.5°F above the September average). The 2020 water year was the 6th warmest on record; the average annual temperature across California was 2.6°F above the historical average (https://www.ncdc.noaa.gov/cag/statewide/rankings).





April 28, 2020

US Drought Monitor Map of California
Map by: C. Riganti, National Drought Mitigation Center

Intensity:

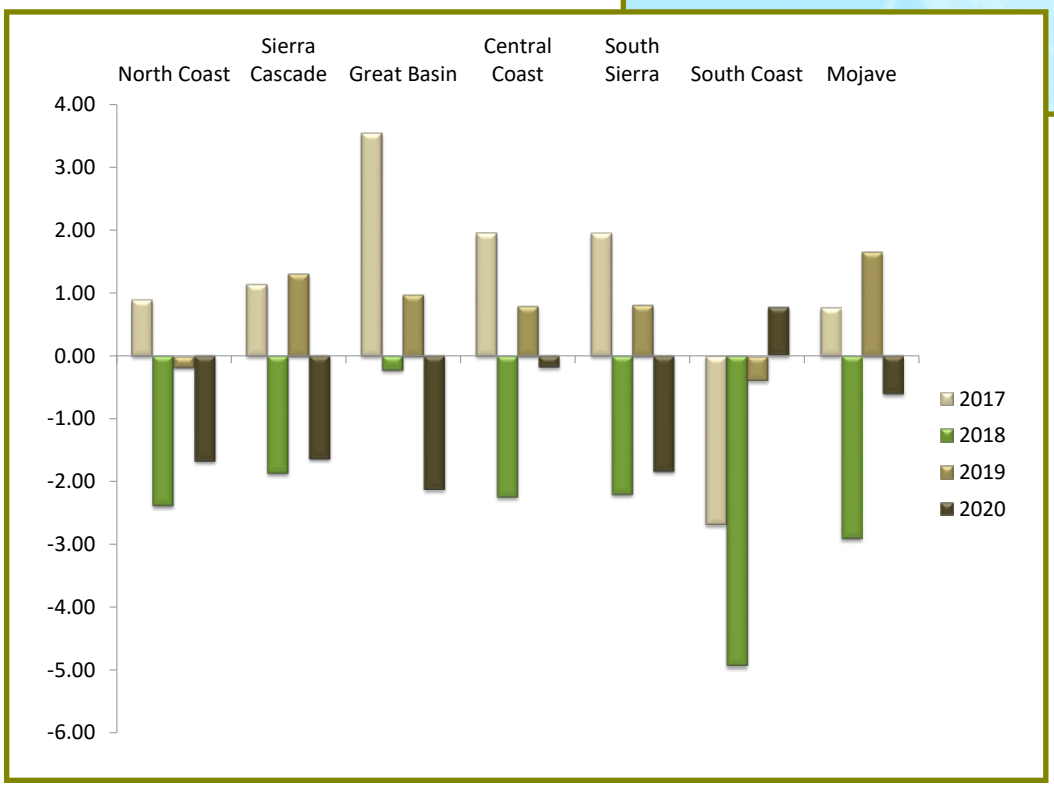
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

Palmer Drought Index

The Palmer Drought Severity Index (PDSI) is an indicator of drought and moisture excess, with negative values denoting degree of drought. In 2020, the yearly average PDSI values ranged from 0.77 in the South Coast (least dry zone) to -2.12 in the Great Basin (driest zone) (see map). The South Coast was the only zone that observed some reprieve from drought in the 2020 water year, compared to the rest of the state (denoted by negative numbers).

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

Palmer Drought Severity Index (PDSI) for California, 2017 - 2020



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

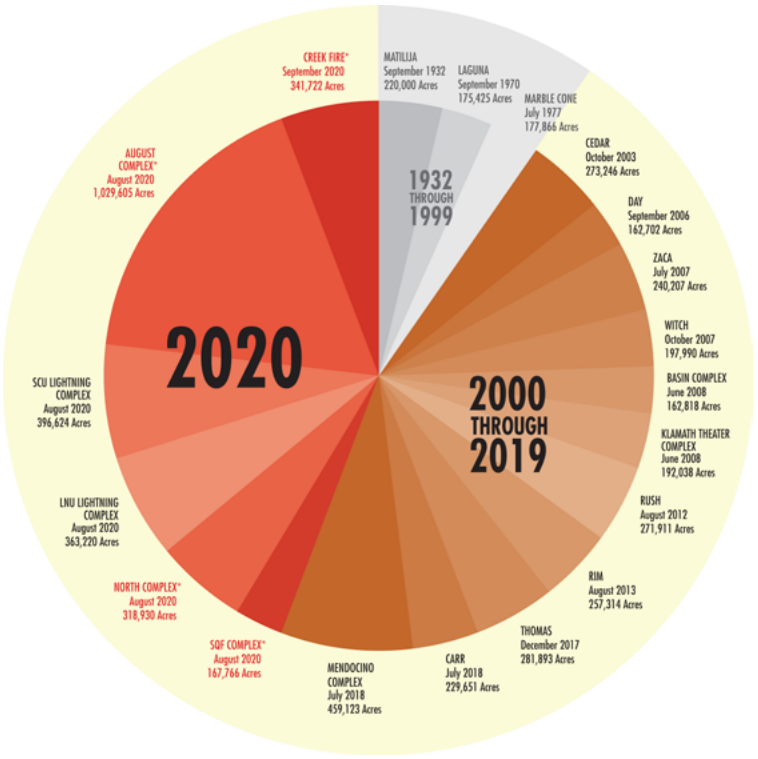
Source: National Climatic Data Center, U.S. Department of Commerce, https://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp

Wildfires caused the greatest negative impacts on forest health in California in 2020 with over 4.3 million acres burned, comprising 4% of the state's total land area. This marks 2020 as the worst wildfire year on record for the state in terms of acres burned (approximately 3 times the previous record number of acres burned in a single year). Many of the wildfires were described as megafires (fires burning >100,000 acres) and occurred in all parts of the state: coastal redwood, Southern California mountains, Sierra Nevada mixed conifer, North Bay mixed conifer and oak woodland, Klamath Mountains, etc. Many were ignited by a rare and extremely severe widespread electrical storm in August.

Five of the six largest wildfires in state history burned simultaneously in 2020, including the August Complex, which at more than one million acres, was more than double the previous largest wildfire (Mendocino Complex, 2018). These megafires resulted in large continuous patches of high-severity fire, displayed extreme fire behavior, and individual runs covering 200,000+ acres in one burn period were recorded. The seemingly increasing severity of these fire seasons is notable as three of the five worst fire seasons have occurred in the last five years.

Fire impacts on specific damage agents and hosts are still being evaluated. Levels of tree mortality resulting from these fires are still being determined, including from fires like the Creek Fire and SQF Complex that burned in areas with high levels of bark beetle and fir engraver-caused tree mortality resulting from the 2012-2016 drought. In addition, several large fires burned extensive areas impacted by sudden oak death, pitch canker, Mediterranean oak borer, and/or native bark and engraver beetles, and the effects on these hosts and agents is still unknown.

The 2020 Castle Fire, part of the SQF Complex, burned an estimated 13,600 acres in ten giant sequoia (*Sequoiadendron giganteum*) groves located within the Giant Sequoia National Monument, Sequoia National Forest (Tulare County), which has a total of 33 groves. The groves impacted were Alder Creek, Mountain Home, Belknap Complex (McIntyre, Wheel Meadow, Belknap), Dillonwood, Middle Tule, Burro Creek, Freeman Creek, Silver Creek, Upper Tule, and Wishon groves. Approximately 9,800 acres (35%) burned out of the 27,830 USFS-managed acres of giant sequoia groves in the Monument, with approximately 6,000 acres (61%) burning at high severity. Where fire burned at lower severity, or where high-severity patches were small, the fire is expected to have restorative effects on the groves by activating sequoia seedling growth, reducing fuel loads that may influence future fires, and clearing out small trees leaving more water and light available for remaining plants and sequoia seedlings. Patches of high-severity fire in the 2020 Castle Fire were likely much larger than they would have been historically, and this could mean an uncertain future for portions of the groves.



Top 20 Largest California Wildfires (*indicates that acreages were not final at the time this infographic was created, 10/13/2020). Infographic by: California Forest Management Task Force, https://fmtf.fire.ca.gov/media/cjwfpckz/californiawildfireandforestresilienceactionplan.pdf

California Wildfires, 2020. Map by: M. Woods, USFS

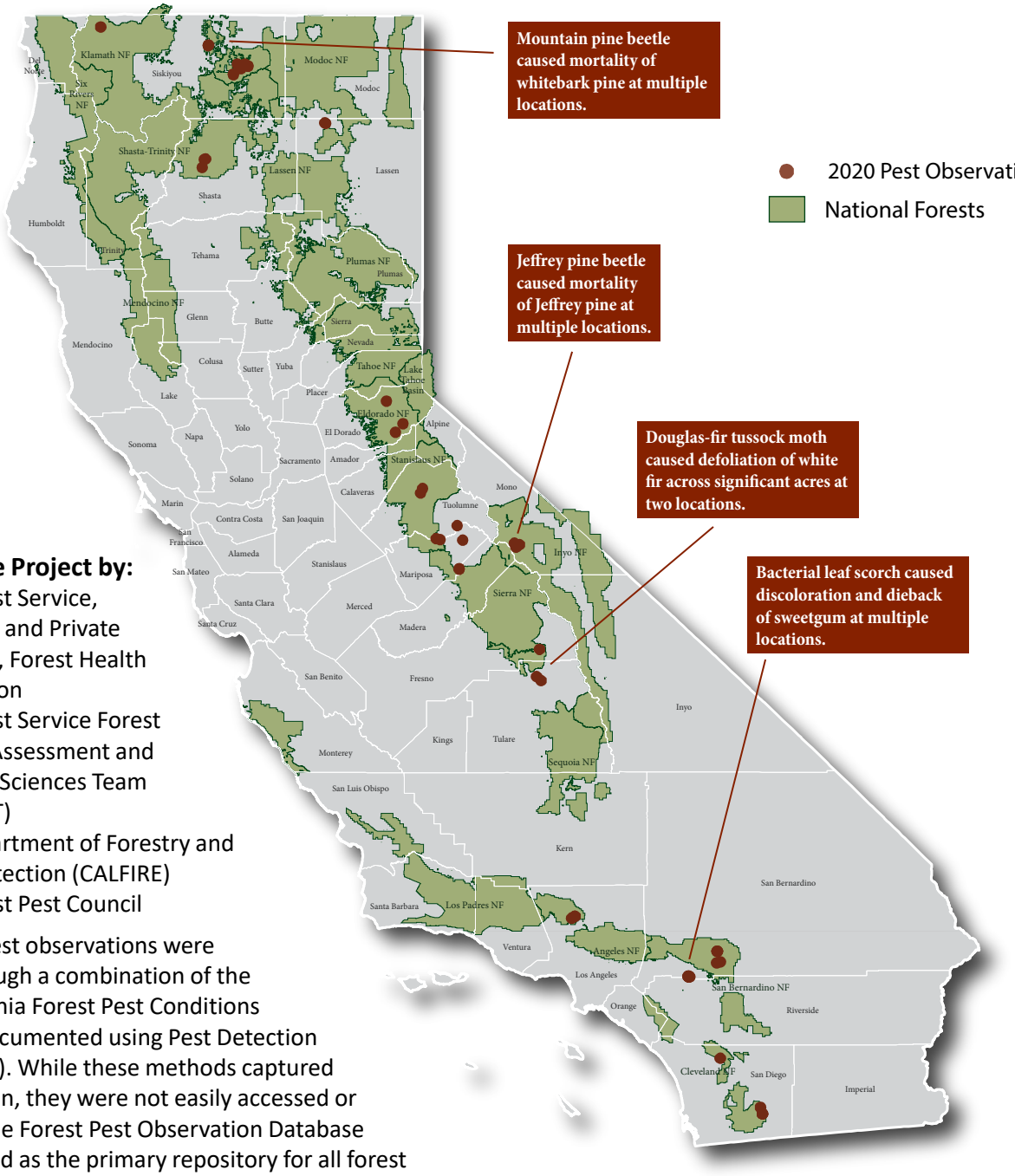
Cypress (*Hesperocyparis* spp.) stands in north coastal California illustrated the roles of disease and wildfire disturbance in the life cycle of this conifer genus in 2020. In Santa Cruz County, the Bracken Brae population of Santa Cruz cypress (*Hesperocyparis abramsiana*) near Boulder Creek, which was reported in the past as experiencing large-scale decline because of *Seiridium* sp. and an unknown butt rot, was burned over by the CZU August Lightning Complex. It is hoped that this stand will regenerate, since coastal cypress species are generally well-adapted to fire. Farther north, in a burned section of Sonoma County at the headwaters of Austin Creek, a large mature stand of Sargent cypress (*Hesperocyparis sargentii*) experienced large-scale die-off (1-2 acres of complete cypress mortality. No evidence of insect damage to the trees was seen. A visit was made to the difficult-to-access site to sample roots and soil, but the only pathogen isolated was from branch dieback symptoms on manzanita (*Arctostaphylos* sp.) caused by *Neofusicoccum australe*. Further plans are being made to visit the site again during the wet season for more soil and root sampling to determine whether this was fire damage, a pathogen, or both.

Unexplained Sargent cypress mortality, likely related to wildfire damage, near the headwaters of Austin Creek in Sonoma County. Photo by: C. Lee, CALFIRE

It is still unknown how many Santa Lucia firs may have been affected, but the Dolan Fire spanned a significant portion of this species' limited range.

It is also worth noting the extreme fire season was experienced across much of the west, including several megafires on the moist western slopes of the Cascade Range in Oregon and Washington in 2020.

Wildfires and the intense smoke from them impacted adequate acquisition of high resolution images, which were used as a substitute to monitor forest health, during late summer and fall in 2020.



2020 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 (CALFIRE)
- 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 Forest Health Protection Service Areas. Ground-based observations are located in a database on ArcGIS Online (AGOL). All records from FPODA will be migrated to the new database in 2021. A new AGOL web app is planned for users to access and query the database.

For 2020*, all FPODA observations were submitted via the mobile data entry form. This map shows the locations of pest observations made by forest health professionals using the FPODA mobile data entry form in 2020. The most frequently reported damage-causing agent was Heterobasidion root disease, followed by bacterial leaf scorch and mountain pine beetle. The most frequently reported ailing host species were ponderosa pine and white fir, followed by Jeffrey and lodgepole pines. These reports supplement the Aerial Detection survey (see page 2).

* Observations in 2020 were limited due to statewide COVID-19 related travel restrictions.

Native Insects

NOTE: Field observations were limited during 2020 due to the COVID-19 pandemic that resulted in stay-at-home orders limiting travel and field work.

Galleries, pupal case, and adults of Douglas-fir bark beetle near the South Fork Smith River, Del Norte County. Photo by: C. Lee, CALFIRE

Douglas-fir Beetle (*Dendroctonus pseudotsugae*)
Douglas-fir beetle adults and pupae were collected from the trunks of freshly windthrown Douglas-fir (*Pseudotsuga menziesii*) in Del Norte County near the intersection of the G-O Road and South Fork Road over a 2-acre area. Douglas-fir beetle galleries were observed in this same area in previous years (see Forest Pest Conditions, 2017). No obvious cause, such as root disease, could be found for the chronic windthrow problem in this area.

Fir Engraver (*Scolytus ventralis*)
Near Rockport in northwestern Mendocino County, fir engraver beetle activity was observed on five (1/10th hectare) monitoring plots spread out over a 100-acre area. Within these plots, 70-80% of the grand fir (*Abies grandis*) trees had low levels of fir engraver beetle activity. Around 5-10 piles of boring dust and entrance holes were observed within the bottom 10 feet of the trunk of infested trees. Additionally, most decomposing woody debris had evidence of past fir engraver infestation. In these locations, fir engraver may be a chronic problem resulting in a background level of continual stress.

Scattered mortality of red fir (*Abies magnifica*) and white fir (*Abies concolor*) mortality (~1 dead tree/acre) associated with fir engraver beetle continued on the west side of the Klamath National Forest between Ball Mountain and Shovel Creek (Siskiyou County). This pattern of mortality has been occurring for the past two years due to persistent dry conditions. White fir mortality was localized near Green Creek Campground on Shasta Lake, Shasta-Trinity National Forest (Shasta County) with several patches of 3-6 dead trees associated with Armillaria root disease infection.

Mountain Pine Beetle (*Dendroctonus ponderosae*)
Mountain pine beetle continued to cause tree mortality in lodgepole pine (*Pinus contorta*) stands within and around Inyo Craters (Inyo National Forest, Mono County). An estimated 2,000 acres have been affected since 2017, with up to 90% mortality in heavily infested stands. This year, activity was most notable along US Forest Service roads 3S89 and 3S22 (Deer Mountain Road), where tree mortality occurred in groups of

Lodgepole pine killed by mountain pine beetle along Road 3S22, Inyo National Forest. Photo by: B. Bulaon, USFS

High levels of current and older lodgepole pine mortality due to mountain pine beetle along Road 3S89, Inyo National Forest. Photo by: B. Bulaon, USFS

30-50 trees. All lodgepole pine trees greater than 6” DBH were mass attacked in these areas. New mortality was also observed in groups of 10-20 trees along the outer edges of previously attacked stands near US Forest Service road 2N29. Most of the dying lodgepole pines were also heavily infested with an unidentified ambrosia beetle. Ambrosia beetle attacks and boring dust were found on nearly every dead lodgepole pine tree.

Lodgepole pine killed by mountain pine beetle, from Road 2N29 facing west toward Owens River Wilderness, Inyo National Forest. Photo by: B. Bulaon, USFS

Mountain pine beetle-caused mortality of lodgepole pine increased significantly in the Medicine Lake caldera, Modoc National Forest (Siskiyou County). Multiple groups (>10 trees/group) of green-infested trees were identified across 100 acres within and adjacent to the Medicine Lake Recreation Area. Infested tree removal and verbenone applications are planned for 2021 to reduce the level of tree mortality in campgrounds.

Mountain pine beetle-caused mortality of whitebark pine (*Pinus albicaulis*) was elevated on Goosenest Mountain, Klamath National Forest (Siskiyou County) inside and surrounding the crater in several groups of 2-20 trees over a 150-acre area.

Copious ambrosia beetle boring dust at base of mountain pine beetle-killed lodgepole pine. Photo by: B. Bulaon, USFS

Jeffrey Pine Beetle (*Dendroctonus jeffreyi*)
Jeffrey pine beetle activity continued in and around Inyo Craters (Inyo National Forest, Mono County) but with lower levels of mortality than in previous years. Approximately 200 Jeffrey pine (*Pinus jeffreyi*) trees greater than 8” DBH were attacked along the southern section of US Forest Service road 3N22 over 5 acres east of Inyo Crater Lake. Of note, four large Jeffrey pine trees (>50" DBH) died in 2020 that had survived previous years of Jeffrey pine beetle attacks.

Five clusters of Jeffrey pine beetle-killed trees were found along Mammoth Scenic Road (Forest Service road 3S23). These areas of mortality were first observed in 2017, but additional mortality occurred this year in smaller diameter trees (<15” DBH). Cumulative mortality in these centers was approximately 50 trees which included at least one legacy-sized tree (> 50” DBH).

Approximately 20 Jeffrey pine (~16” DBH) were killed by Jeffrey pine beetle on Adin Pass along Highway 299. This mortality was part of an expanding group kill that started in 2019. Jeffrey pine stands in this area are overly dense and have experienced elevated levels of tree mortality during past droughts. This area is in the planning stages for fuels and vegetation treatments designed to improve tree health and forest resiliency.

Severe Jeffrey pine mortality caused by Jeffrey pine beetle, Inyo Craters Trailhead, Inyo National Forest. Photo by: B. Bulaon, USFS

Western Pine Beetle (*Dendroctonus brevicomis*)
Activity of the western pine beetle remained very low following the years of epidemic outbreaks throughout the Sierra Nevada Range. Small pockets of western pine beetle-caused mortality were found in individual or groups of 2-6 ponderosa pine (*Pinus ponderosa*) trees.

Western pine beetle-caused mortality of ponderosa pine was elevated at lower elevation (<4,000 ft), dry sites in Shasta County along the Interstate 5 corridor near Shasta Lake. Several groups of 5-20 ponderosa pine trees were killed in and around campgrounds and other recreation areas along the shoreline of Shasta Lake (Shasta-Trinity NF) between Pit River Arm and Shasta Dam.

Other Highlights

Ambrosia Beetles (unidentified)
An unusually large amount of ambrosia beetle boring dust was found at the base of at least 50 older dead and recently-killed lodgepole (*Pinus contorta*) and Jeffrey pine (Pinus jeffreyi) trees in and around Inyo Craters (Inyo National Forest, Mono County). These trees were killed by *Dendroctonus* spp.

Black Oak Leaf Miner (*Eriocraniella aurosparsella*)
California black oak (*Quercus kelloggii*) continued to be defoliated by the black oak leaf miner in the Blue Canyon area of Nevada County. This ongoing infestation has been recorded each year since 2004. Nearly all the California black oaks in the area were impacted. This year, infested tress were found in areas further south than had been recorded previously.

Carpenterworm (*Prionoxystus robiniae*)
In Willits, 4-5 large (>30" DBH) declining Oregon white oaks (*Quercus garryana*) were observed in a residential area (Mendocino County). Carpenterworm was identified as one of the factors contributing to the internal decay of the oak trees. A large fruiting body of the canker-rot fungus (*Phellinus everhartii*) was observed on a nearby oak, indicating another source of decay and instability in these large, old trees.

Douglas-fir Tussock Moth (*Orgyia pseudotsugae*)

Note: Only a few DFTM traps were placed out in the field this year due to COVID-19 travel restrictions.

High numbers of adult male Douglas-fir tussock moths (DFTM) (> 25 moths per trap) were caught in annual monitoring traps, and noticeable defoliation of white fir (*Abies concolor*) was detected at several locations in the southern Sierra Nevada range. Monitoring traps were deployed on ridges, dry sites, or south-facing aspects, typical of locations where DFTM has been active in CA in the past. Trapping occurred at three sites in Yosemite National Park (Mariposa County) and five sites in Sequoia-Kings Canyon National Park (Fresno and Tulare Counties). Three of the five trapping sites in Sequoia-Kings Canyon National Park caught high numbers of Douglas-fir tussock moths: Crystal Springs Campground, Giant Forest and Dorst Campground. All three trapping sites in Yosemite National Park also caught high numbers of Douglas-fir tussock moths: top of Mariposa Grove Road, Henness Ridge and Yosemite Mountain Ranch (private land).

Egg mass sampling and defoliation assessments occurred on over 200 white fir trees in Yosemite and Sequoia-Kings Canyon National Park as well as on the Stanislaus National Forest in areas where outbreaks have occurred historically.

Multiple moths caught in a Douglas-fir tussock moth monitoring trap, Henness Ridge, Yosemite National Park.
Photo by: B. Mattos, CALFIRE

Defoliation in understory white fir trees caused by Douglas-fir tussock moth, Henness Ridge, Yosemite National Park.
Photo by: B. Bulaon, USFS

The four sites surveyed in Yosemite National Park experienced little to no defoliation: Crane Flat Campground, Tuolumne Meadows, Henness Ridge, and Chinquapin Junction. Older DFTM egg masses were found on the underside of tree branches at all sites but with very few current-year pupal cases. A single current year egg mass was found. Defoliation in the upper crowns of overstory white fir trees was estimated at 5% while understory white fir experienced approximately 10% defoliation. Approximately half of the current year growth on tree crowns was defoliated, and webbing was light at the branch tips. Similar defoliation levels were observed on the Stanislaus National Forest.

White fir crowns defoliated by Douglas-fir tussock moth along Highway 198, Sequoia-Kings Canyon National Park. Photo by: B. Bulaon, USFS

Defoliation by Douglas-fir tussock moth on a white fir tree in the understory, Pinewood Picnic Area, Sequoia-Kings Canyon National Park. Photo by: B. Bulaon, USFS

Defoliation in Sequoia-Kings Canyon National Park was more severe with up to 30% defoliation in the upper crowns of white fir over a 2-mile area along the road from Pinewood Picnic Area to General Sherman Grove. The Trail of Sequoias in General Sherman Grove appeared to be a hotspot of defoliation of white fir, but no fresh egg masses were found and only a few pupal cases were observed. Understory trees were the most severely damaged with branch tips covered in thick webbing. The second most affected area in the national park was observed over a 20-mile area along the road between Wuchaski Work Area and Dorst Campground. Groups of mature white fir trees along Highway 198 displayed visible color change due to larval feeding, with some branches showing signs of upturning. Monitoring traps placed in Crystal Springs at Grant Grove captured more than 30 moths/trap. No observable defoliation was found on surrounding trees, and only minor webbing was found on branch tips.

Engraver Beetles and other mortality agents (*Pseudips mexicanus, Dendroctonus valens, Grosmannia* sp.)
Planted pines in Arcata and McKinleyville (Humboldt County) experienced scattered individual tree mortality. On many of the dying Monterey pine trees (*Pinus radiata*), red turpentine beetle (*Dendroctonus valens*) activity was present. Occasionally, dying Monterey and lodgepole pines (*Pinus contorta*) were attacked by *Pseudips mexicanus*. Near the Highway 101 Loleta/Fernbridge exit in central coastal Humboldt County, a large group of Monterey pines (approximately 5 acres in total) that had been declining for several years were also attacked by *P. mexicanus* along with a novel species of *Grosmannia* fungus in the roots.

(Left) Declining group of Monterey pine near Fernbridge (Humboldt County); (Right) Black stain in large Monterey pine root caused by unnamed *Grosmannia*/*Leptographium* species. Photo by: C. Lee, CALFIRE

Fall Webworm
(*Hyphantria cunea*)
Madrone trees (*Arbutus menziesii*) throughout the central foothills of the Sierra Nevada Range (Amador, El Dorado, Nevada, and Placer Counties) were defoliated by the fall webworm. Nearly all madrone trees throughout central California suffered defolia-

tion and showed conspicuous webbing. Other hardwood trees were also impacted by fall webworm, including maples (*Acer* spp.) and willows (*Salix* spp.). High levels of defoliation of madrone occurred in 2019 as well; however, the trees recovered.

Fir Mealybug (*Puto cupressi*)
The fir mealybug was observed attacking branches of coast redwood (*Sequoia sempervirens*), causing tumor-like swellings and stunted foliage. The trees were planted far off-site in a Christmas tree plantation in Nevada City (Nevada County). Approximately a dozen trees ranging in size from 6-10 feet in height were attacked.

Phloeosinus bark beetles (*Phloeosinus* sp.)
Adult *Phloeosinus* bark beetles (likely *Phloeosinus cupressi*) were found infesting cut Monterey cypress (*Hesperocyparis macrocarpa*), ranging from 1-10" DBH, near Trinidad (Humboldt County). Infested wood was located next to a row of 5-10" DBH live Monterey cypress. No live or standing trees were attacked.

Scale insects (unidentified)
An unidentified species of scale insect, similar to *Asterolecanium* sp., caused up to 30% branch dieback on individual shrub-size canyon live oak (*Quercus chrysolepis*) over a 10-acre area along the Sawyers Bar Road east of Etna (Siskiyou County), halfway between Etna and Etna Summit.

Western Oak Bark Beetle (*Pseudopityophthorus pubipennis*)
Western oak bark beetle activity was observed in two stands of healthy California black oak (*Quercus kelloggii*) trees in Nevada County. The first stand consisted of approximately two acres, and the second stand, located a half mile away, consisted of about one acre. Both stands were along a fire break under construction to protect local communities. Many oaks had been cut to form the firebreak. The beetles first infested the cut trees then attacked surrounding healthy trees. Attacks on healthy trees appeared to be unsuccessful, with beetles being killed in masses of foam, likely caused by a yeast fungus. None of the standing trees appeared to be dying.


California black oak attacked by western oak bark beetle.
Photo by: T. Smith, CALFIRE


Close-up of western oak bark beetle entrance holes exhibiting a foamy sap response to attack. Photo by: T. Smith, CALFIRE

Introduced Insects (Naturalized)

Balsam Woolly Adelgid (*Adelges piceae*)
Several new areas with balsam woolly adelgid activity on grand fir (*Abies grandis*) were observed in Del Norte and Humboldt Counties. In Del Norte County, an infested stand was found along the south shore of Lake Earl, within the Lake Earl Wildlife Area. In Humboldt County, the infested stand was immediately adjacent to the ocean, north of Trinidad. The Lake Earl infestation was most severe. Approximately 10 trees died within the 30-acre stand, and 20% of the trees had distorted crown growth or gouted branch tips. The Trinidad stand did not appear to experience tree mortality, but a colony of balsam wooly adelgids was found infesting a large branch near the roadside, an indication that the adelgids were well-established and likely causing appreciable harm.

At the College of the Redwoods campus in Eureka (Humboldt County), a large grand fir at the edge of campus died, and 3-4 nearby trees displayed crown distortion and branch dieback. Samples collected were identified as three conifer-infesting adelgid species: balsam woolly adelgid on grand fir, hemlock woolly adelgid (*Adelges tsugae*) on western hemlock (*Tsuga heterophylla*), and Cooley spruce


Gouting on grand fir branch at Tolowa Dunes State Park, Del Norte County.
Photo by: C. Lee, CALFIRE

gall adelgid (*Adelges cooleyi*) on Douglas-fir (*Pseudotsuga menziesii*).

A balsam woolly adelgid infestation was found in pure grand fir stands over 100 acres near Rockport in northwestern Mendocino County; there were varying levels of infestation per tree ranging from 0 to over 100 adelgids per square foot of visible trunk. Although mortality was not extensive, 80-90% of grand fir trees in this area had abnormally small crowns and signs of attack by other secondary insects and pathogens.

Adult, crawler, and eggs of balsam woolly adelgid on grand fir in Trinidad, Humboldt County. Photo by: C. Lee, CALFIRE

Eucalyptus Weevil (*Gonipterus platensis*)
Eucalyptus weevils were collected from a small group of bluegum (*Eucalyptus globulus*) trees in a private backyard in McKinleyville (Humboldt County). Herbivory by eucalyptus weevils, characterized by scalloped leaf edges, was also observed in a half-acre stand of bluegum trees in Arcata (Humboldt County).

Invasive Insects

Asian Gypsy Moth (*Lymantria dispar asiatica*, a subspecies of European Gypsy Moth)
On June 16, 2020, one male Asian gypsy moth was trapped in Sunnyvale (Santa Clara County). Delimitation trapping continued through October and will resume next year.

The delimitation project triggered by the 2018 find in Santa Cruz (Santa Cruz County) resulted in no new finds this year and will likely resume in 2021.

European Gypsy Moth (*Lymantria dispar*)
On July 31, 2020, one male European gypsy moth was trapped in Foresthill (Placer County). Delimitation trapping was done until September 1st and will continue next year.

The delimitation project triggered by the 2019 find in Olivehurst (Yuba County) resulted in no new finds this year and trapping will likely not occur next year.

Various life stages of gypsy moths were intercepted seven times at CDFA Border Protection Stations.

Goldspotted Oak Borer (*Agrilus auroguttatus*)
www.gsob.org

Los Angeles County
Goldspotted oak borer (GSOB) continued to kill coast live oak (*Quercus agrifolia*) trees in and around Green Valley, a small private inholding within the Angeles National Forest. Los Angeles County Fire Department – Forestry Division continued to survey and remove infested trees on private property (https://lacounty.maps.arcgis.com/apps/opsdashboard/index.html#/c8b5762089874127819eaabc8eb25218). A total of 7,713 coast live oak trees have been surveyed since 2015. Of the trees

Large coast live oak infested with GSOB being chipped onsite in Green Valley.
Photo by: Mike Takeshita, Los Angeles County Fire Department, Forestry Division

GSOB larvae in hairpin formation in infested coast live oak in Green Valley, CA.
Photo by: Mike Takeshita, Los Angeles County Fire Department, Forestry Division

surveyed, 35% (2,703) were infested with GSOB. In 2020, approximately 1,000 GSOB-infested trees remained on private land.

The Angeles National Forest treated 430 healthy, large-diameter (>15" DBH) coast live oak trees with carbaryl at Green Valley Community Club and Spunky Campground to prevent further attack by GSOB. A total of 25 GSOB-infested trees were removed around the Green Valley community.

Orange County

Orange County Fire Authority (OCFA) and their contractors treated 3,150 oak trees (GSOB-infested and non-infested trees) with the insecticide carbaryl. These treatments occurred in a 70-acre area of Trabuco Canyon and over a 142-acre area in Weir Canyon Nature Preserve. Both areas are unincorporated communities on the eastern edge of Orange County.

From the fall of 2019 through the spring of 2020, Irvine Ranch Conservancy staff surveyed 1,453 coast live oak trees in Upper Weir Canyon and Gypsum Canyon on land managed by Orange County Parks. Of the trees surveyed, 323 were infested with GSOB. Seven trees with a high level of infestation were determined to be potential amplifier trees and were removed, two from upper Weir Canyon and five from Gypsum Canyon.

In Lower Gypsum Canyon (Gypsum Canyon and California State Route 91), a single GSOB-infested tree was removed in May, and another potentially infested tree was identified in June.

Removed GSOB infested coast live oak in Trabuco Canyon. Photo by: D. Erickson, OCFA

On the Trabuco Ranger District of the Cleveland National Forest, carbaryl insecticide was applied for the second consecutive year to 588 uninfested and lightly-infested coast live oak trees (> 10" DBH) in and around the Blue Jay and Falcon campgrounds to prevent further impacts and infestation by GSOB (Cleveland National Forest, El Cariso to Long Canyon Goldspotted Oak Borer Management Project).

Riverside County

A survey was conducted in and around the communities of the San Jacinto Mountains. To date, 284 trees have been surveyed of which 173 were infested with GSOB. The Riverside County Dead, Dying, and Diseased Tree Removal grant program funded the removal of 15 of those infested trees, and 40-50 additional trees have been marked for removal.

On the Trabuco Ranger District, Cleveland National Forest, a GSOB-infested high-cut coast live oak stump was found in El Cariso campground, the first confirmed infested tree in this area. In response, carbaryl insecticide was applied to 521 uninfested coast live oak trees in the El Cariso campground, picnic area and fire station to prevent further infestation of GSOB (Cleveland National Forest, El Cariso to Long Canyon Goldspotted Oak Borer Management Project).

GSOB galleries from removed infested coast live oak in Trabuco Canyon. Photo by: D. Erickson, OCFA

San Bernardino County

In the town of Big Bear, a windshield survey for GSOB-infested trees was conducted in the community of Sugarloaf. Surveyors looked for large, standing dead California black oak (*Quercus kelloggii*) trees with dead leaves still attached. Four trees were identified as potentially infested. Discussions with landowners regarding treatment and/or removal were initiated.

In Oak Glen, Inland Empire Resource Conservation District (IERCD) staff surveyed oak trees (Fall 2019) and identified 8 heavily-infested trees. Of those trees, 6 were removed and the wood properly treated with the assistance of the CALFIRE Oak Glen Conservation Camp Tree Crew. The remaining two trees were logistically challenging and required specialized crews for removal.

In the town of Wrightwood, windshield and ground surveys for GSOB-infested trees were conducted by CALFIRE and IERCD staff. No infested trees were identified.

San Diego County

CALFIRE staff confirmed a GSOB infestation at the CALFIRE Warner Springs Station in Warner Springs. A total of 10 GSOB-infested coast live oak trees were identified. Infested trees had significant dieback in the crown and D-shaped exit holes. This was the furthest north along Hwy 79 that GSOB has established through natural spread.

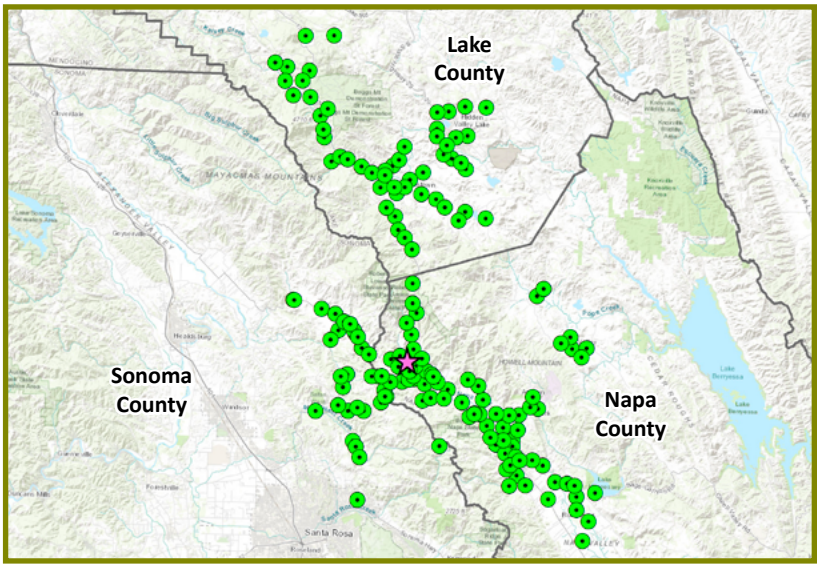
During the past year, the La Jolla Band of Luiseño Indians began active management of GSOB including mitigation of GSOB-caused tree injury and mortality. In 2020, over 40 coast live oak and 2 canyon live oak (*Quercus chrysolepis*) trees were killed by GSOB in the La Jolla Indian Campground. Cumulative GSOB-caused oak tree mortality in the campground was estimated to be 150 trees over 100 acres. Nearly 50% of susceptible oak trees in the campground were estimated to be infested with GSOB, with a 5% annual mortality rate in some areas. In the campground, insecticides were applied to 150 coast live oak trees to prevent further GSOB attack and injury. Tree injury and mortality was also observed throughout the reservation and to the east and west of the reservation boundaries. On the La Jolla Indian Reservation, an estimated 500 trees killed by GSOB require removal. The La Jolla Band of Luiseño Indians has been severely impacted, culturally and financially, by this infestation.

For the fourth consecutive year, carbaryl insecticide was applied to lightly infested or uninfested coast live oak trees on the Palomar Ranger District of the Cleveland National Forest. Treated trees (269) were located at Oak Grove Campground and Fire Station, Pine Hills Fire Station, and Inaja Memorial Picnic Area, encompassing approximately 75 acres. The rate of infestation on treated trees, estimated by new exit holes on the main stem of individual trees, remained low.

Mediterranean Oak Borer/Pest Complex (*Xyleborus monographus*)

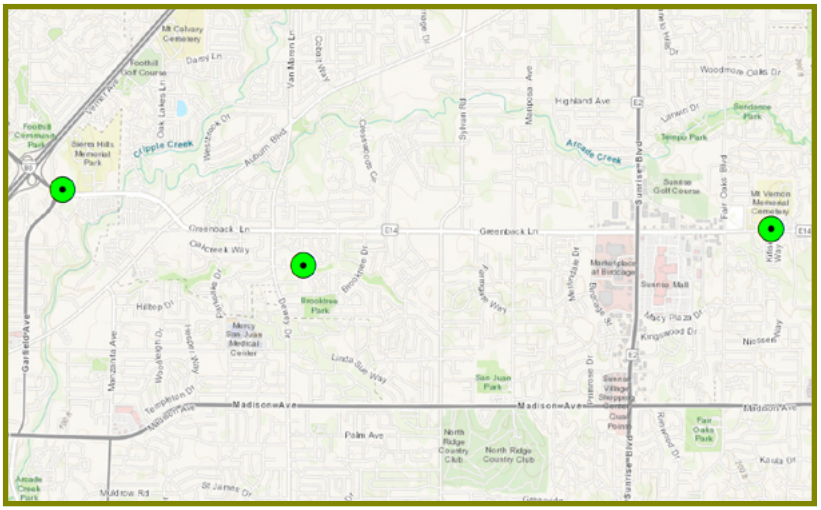
https://ucanr.edu/sites/mobpc/

The Mediterranean oak borer (MOB) continued to spread from its original known location near Calistoga in Napa County (November 2019). Surveys of dead trees suggested the beetle had been established in this area for 5 or more years. Delimiting grids were set up by California Department of Food and Agriculture and County staff to determine the extent of the infestation. The initial infestation appeared to be centered around the city of Calistoga (Napa County). From there the beetle likely spread northeast into Lake County and west into Sonoma County. Approximately 200,000-300,000 acres are infested. Delimit trapping will resume in spring 2021.



CDFA/County Ag. Commission funnel trap catches of *Xyleborus monographus* for Sonoma, Napa, and Lake Counties. The star indicates the apparent epicenter.
Map by: C. Ewing, CALFIRE

A satellite population of MOB was detected in August-September 2020 in Sacramento County in the city of Citrus Heights (greenway at cul-de-sac, Hickorywood Way), and in an adjacent unincorporated area of the county (Greenback Ln. and Verner Ave). Two infested valley oak (*Quercus lobata*) trees were removed in Citrus Heights. Infestation levels suggested that the beetles had been present in this area for several years. Delimit trapping will likely occur in Sacramento County in 2021.



Hand collections of *Xyleborus monographus* from valley oaks in Sacramento county.
Map by: C. Ewing, CALFIRE

The MOB creates extensive galleries in California native oaks in the white oak section (sec. *Quercus*). The majority of infestations have been found in valley oak and to a lesser extent in blue oak (*Q. douglasii*). No infestations have been found in Oregon oak (*Q. garryana*), but this may be due to the rarity of this species within the areas surveyed. A single branch on a California black oak (*Q. kelloggii*) was infested, but it had considerable rot, and no other infestations in that species have been reported.

In addition to direct injury to host trees, the MOB vectors several species of fungi, including potential plant pathogens. Evidence of a possible wilt disease associated

with this pest included distinctive staining throughout the ray parenchyma of infested trees and sudden browning of the foliage. Affected trees typically die from the top down, and preliminary evidence suggests that tree mortality takes several years.

Research occurred on plant pathogens, trapping methods, potential lures, beetle life cycle and control options. Genetic data suggested France was the source of the MOB infestation in California. Both the Sonoma-Napa-Lake infestation and the Sacramento infestation shared the same haplotype. Based on the extent of the infestation in Napa County, MOB may have originally been introduced into Napa County and was transported from there to Sacramento County, possibly in firewood.

Gallery pattern of the Mediterranean oak borer in valley oak, Citrus Heights, CA. Photo by: T. Smith, CALFIRE

Removal of valley oak infested with the Mediterranean oak borer, Citrus Heights, Sacramento County. Photo by: T. Smith, CALFIRE

South American Palm Weevil (*Rhynchophorus palmarum*)
Canary island palm (*Phoenix canariensis*) trees continued to be impacted by South American palm weevil in San Diego County parks (San Diego County). Three San Diego County parks have been affected by the beetles: Lamar Park (7 acres), Bancroft Park (4.37 acres) and Otay Lakes (4.5 acres). Canary island palm tree mortality occurred at Otay Lakes (1 tree), Lamar (2 trees), and Bancroft County Park (4 trees). Preventive and curative treatments, which were initiated at the end of 2019, appeared to successfully control the infestations as no new signs of infestation were observed in 2020.

Canary island palm killed by South American palm weevil. Photo by: D. Lombardo, San Diego County State Parks

Invasive Shot Hole Borers (ISHB) (*Euwallacea fornicatus* and *E. kuroshio*) and associated **Fusarium Dieback** (*Fusarium* spp.)
http://www.iscc.ca.gov/ishb.html
http://www.ishb.org

California Assembly Bill No. 2470 - Invasive Species Council of California (Grayson, 2018) allocated $5 million towards the execution and development of an invasive shot hole borer suppression plan for the state. The California Invasive Species Advisory Committee (CISAC) coordinated the formation of a statewide strategic initiative to respond to the pest-disease complex via the following categories: 1) Research and Technology Development; 2) Survey, Detection, and Rapid Response; 3) Greenwaste and Firewood as Pathways; 4) Outreach and Education.

As outlined in the statewide strategic initiative, two full-time positions were filled to help coordinate survey/trapping and communications. In January, the statewide survey and trapping coordinator was hired and began communicating with County Agricultural Commissioners and other relevant agencies to establish protocols and guidelines for trapping and surveying, in-field trainings, and advancing tools to collect and present data. A related initiative investigated the potential of using citizen scientists as data gatherers.

Also appointed in January, the statewide communications coordinator supported increased efforts in education and outreach for ISHB. Due to COVID-19 restrictions on in-person meetings, much of the education and outreach occurred online. The ISHB website was redesigned to improve ease of navigation and to update and simplify information. The ISHB online course was relaunched and qualified for continuing education credits. A new video outlining best practices for sampling ISHB was developed and hosted online. A flyer in digital and print versions was also developed on the same subject. Digital versions of all University of California-generated outreach materials were updated. Other outreach materials, in traditional and social media, included targeted

articles for use by homeowners associations, a YouTube channel, as well as Facebook and Instagram pages. In the absence of live workshops and events, several webinars and online trainings occurred through programs hosted by the Los Angeles Center for Urban Natural Resources Sustainability, Project Learning Tree, University of California Cooperative Extension, and others.

Los Angeles County

Three new locations were identified as infested with ISHB: 1) Lakeside Park in Chatsworth, 2) near the Chatsworth Nature Preserve, and 3) near El Escorpión Park in West Hills. Several trees were removed by the LA County Agricultural Commissioner in these areas.

Orange County

University of California Cooperative Extension and the Orange County Fire Authority surveyed trees in Carmel and Vista Pointe Ridge. A total of 197 trees and stumps were surveyed. A total of 179 California sycamore (*Platanus racemosa*), 8 coast live oaks (*Quercus agrifolia*) and 11 stumps were found to be infested. Four coast live oak trees had heavily-infested branches, and those branches were removed and treated.

Orange County Parks has inventoried 40,000 trees within their park system to date. Of the trees inventoried, 7,020 trees were infested by ISHB (18% infestation rate). The most frequently infested species were California sycamore (*Platanus racemosa*; 51% infested), arroyo willow (*Salix lasiolepis*, 16% infested), Fremont cottonwood (*Populus fremontii*, 9% infested), London plane (*Platanus* × *acerifolia*, 4% infested) and red willow (*Salix laevigata*, 3% infested). Since 2013, a total of 2,852 ISHB-infested trees have been removed in the parks. An estimated 250 trees were removed this year, and a total of 850 trees were treated with chemicals. Chemical treatments for infested trees were applied up to three times per year (spring, summer, and fall) using a combination of imidacloprid (soil injection), bifenthrin (trunk spray), tebuconazole (trunk injection), *Bacillus subtilis* (trunk spray), Pentra-Bark (AgBio, Inc.; trunk spray), and/or NU-FILM (trunk spray). In the future, Orange County Parks may standardize treatment of infested trees, including pre-emptive removal of low-value/poor health host tree species to reduce the available ISHB host material in its regional parks.

San Luis Obispo County

No infestations have been found in San Luis Obispo County to date, and no further beetles have been trapped in the county since the single Kuroshio shot hole borer was found in a trap in 2016.

Santa Barbara County

At the Hedrick Ranch Nature Preserve in the Santa Clara River floodplain in Santa Paula, approximately 3,500 acres have been infested by ISHB (Ventura County). Since the beetles were first found in this area in 2016, the total number of affected hosts has increased considerably. However, the spread of infestation has slowed, and recovery of infested trees has occurred in some areas. In areas where recovery was observed, there was minimal tree mortality, as well as evidence of healed ISHB entrance holes and re-sprouting of willow species. Tree species infested in this area included white alder (*Alnus rhombifolia*), California sycamore, Fremont cottonwood, black cottonwood (*Populus trichocarpa*), red willow and arroyo willow.

***Leptographium* Root Disease on Monterey Pine** (*Leptographium* sp.)
An unidentified species of *Grosmannia* (sexual form)/*Leptographium* (asexual form) was recovered from a primary root of a dying Monterey pine (*Pinus radiata*) at the Loleta/Fernbridge exit of Highway 101 in central Humboldt County (**see photo on page 10**). The entire Monterey pine stand in this location has been dying on both sides of the highway for several years, and several secondary pests have been recovered, including pine needle sheathminer (*Zelleria haimbachi*), Monterey pine ips (*Pseudips mexicanus*), and species of *Fusarium* related to *Fusarium avenaceum*. The symptoms caused by the unknown *Grosmannia*/*Leptographium* species strongly resembled those caused by *Leptographium wageneri* var. *ponderosum* in ponderosa pine (*P. ponderosa*): black longitudinal streaking in the root xylem limited to the first few annual rings and slowly fading foliage in the crown, eventually leading to tree death. California Department of Food and Agriculture pathologists will continue to work on describing and identifying/naming this fungal species.

Black stain root disease on ponderosa pine near the Oregon border. Photo by: W. Woodruff, USFS

Black Stain Root Disease (*Leptographium wageneri*)
Black Stain Root Disease (*Leptographium wageneri*)-infected Jeffrey pine (*Pinus jeffreyi*) wood samples were taken from two trees at two locations in Modoc County, two miles south of the Oregon border north of Crowder Flat. They will be used to isolate the fungus for evaluation at the USDA Forest Service Pacific Northwest Research lab in Corvallis, Oregon, as part of an investigation of genetic variability of the pathogen. Collections made in 2019 in Plumas, Modoc and, Lassen Counties failed to yield usable cultures.

Heterobasidion Root Disease (*Heterobasidion* spp.)
Signs of infection by *Heterobasidion occidentale* (fruiting bodies and laminated white-rot decay) were observed in monitored stands of grand fir (*Abies grandis*) near Rockport in northwestern Mendocino County. Preliminary analysis of wood samples from 25 trees gathered on five 0.1 ha plots revealed a small incidence of *H. occidentale*, as the two trees that yielded the pathogen were near each other. *Ganoderma* and *Armillaria* spp. were also frequently noted on the root systems of blown-down grand fir in the same stands. Farther north, along Highway 197 in Del Norte County (on the same site as new finds of *Phytophthora ramorum*), very large fruiting bodies of *H. occidentale* were observed on widely separated redwood (*Sequoia sempervirens*) stumps.

Large fruiting body of *Heterobasidion occidentale* on redwood stump near Highway 197 in Del Norte County. Photo by: C. Lee, CALFIRE

Pitch Canker (*Fusarium circinatum*)
A planted stand of mature Monterey pine (*Pinus radiata*) near the Briones Reservoir in Contra Costa County suffered from severe pitch canker infections. The stand is over-mature for the species and shows indications of general decline. The trees are growing directly next to the reservoir in a micro-climate likely suitable for the disease due to cool humid conditions in a site otherwise farther inland from typical coastal pitch canker locations in California.

Port-Orford-Cedar Root Disease (*Phytophthora lateralis*)
Port-Orford-cedar root disease-related mortality of Port-Orford-cedar (*Chamaecyparis lawsoniana*) generally increased in Del Norte County in 2020. Although no specific areas of mass die-off were observed, many areas had scattered new mortality along roads and watercourses. A few of the areas observed were along Terwer and Blue Creeks in southern Del Norte County, the hillsides on both sides of Highway 101 just north of Klamath, and an area from Hiouchi south along the South Fork of the Smith River.

***Ilyonectria* Root Disease**
(*Ilyonectria lusitanica*)

The root disease-causing pathogen *Ilyonectria lusitanica* was recovered from roots of declining redwoods (*Sequoia sempervirens*) in an approximately 1-acre stand along Olson Road in Santa Cruz County. Other root-infecting pathogens, including a species from the *Phytophthora cryptogea* complex and *Fusarium oxysporum*, had previously been recovered from redwood roots or soil at the site.

***Phytophthora* Root and Stem Diseases** (*Phytophthora* spp.)

Several soil-borne *Phytophthora* species were detected in association with tree decline and mortality in northwestern California counties in 2020. These included *P. cinnamomi* associated with tanoak (*Notholithocarpus densiflorus*), madrone (*Arbutus menziesii*), and Douglas-fir (*Pseudotsuga menziesii*) decline in an approximately 30-acre area along North Bank Road in Del Norte County; *P. cambivora* causing scattered bleeding cankers, root rot, and mortality of entire clumps (4-5 trees each) of chinquapin (*Chrysolepis chrysophylla*) along Forest Service 16N38 Road northwest of Dry Lake, and to a lesser extent along French Hill Road near the lake, in Smith River National Recreation Area, Six Rivers National Forest, Del Norte County; *P. siskiyouensis* causing bleeding cankers, branch dieback, and mortality in 3-4 clumps of white alder (*Alnus rhombifolia*) growing along Hayfork Creek in Hayfork (Trinity County) and also large bleeding cankers and gradual decline of three red alders in Hiller Park in McKinleyville (Humboldt County); *P. nemorosa* in the soil below a 0.5-ac area of declining and dead Douglas-firs (*Pseudotsuga menziesii*), bay laurels (*Umbellularia californica*), and big leaf maples (*Acer macrophyllum*) in Hiouchi (Del Norte County); and *P. cactorum* in forest soil of a stand also affected by sudden oak death (*P. ramorum*) for many years above Connick Creek near Garberville (Humboldt County).

Symptoms underneath bleeding canker on a chinquapin newly killed by *Phytophthora cambivora* near Dry Lake, Smith River National Recreation Area, Del Norte County. Photo by: C. Lee, CALFIRE

Bleeding canker symptom caused by *Phytophthora siskiyouensis* on red alder in McKinleyville, Humboldt County. Photo by: C. Lee, CALFIRE

Bleeding canker symptom caused by *Phytophthora siskiyouensis* on white alder near Hayfork, Trinity County. Photo by: C. Lee, CALFIRE

***Armillaria* Root Rot** (*Armillaria* spp.)

Armillaria spp. were consistently associated with tree decline and mortality in the north coast in 2020. Specific examples included grand fir (*Abies grandis*) in research plots at Westport in northwestern Mendocino County, where numerous rhizomorphs and white spongy decay were found in the large roots of fallen firs; in association with red turpentine beetle attack in a stand of Monterey pine (*Pinus radiata*) at College of the Redwoods in Eureka (Humboldt County), where three-four large pines/year have been dying and falling for the past several years; and in association with dead and declining hardwoods, particularly tanoaks (*Notholithocarpus densiflorus*) and maples (*Acer* spp.) (in some cases causing sudden oak death-like symptoms on tanoaks), in the main stem Smith River corridor in Del Norte County.

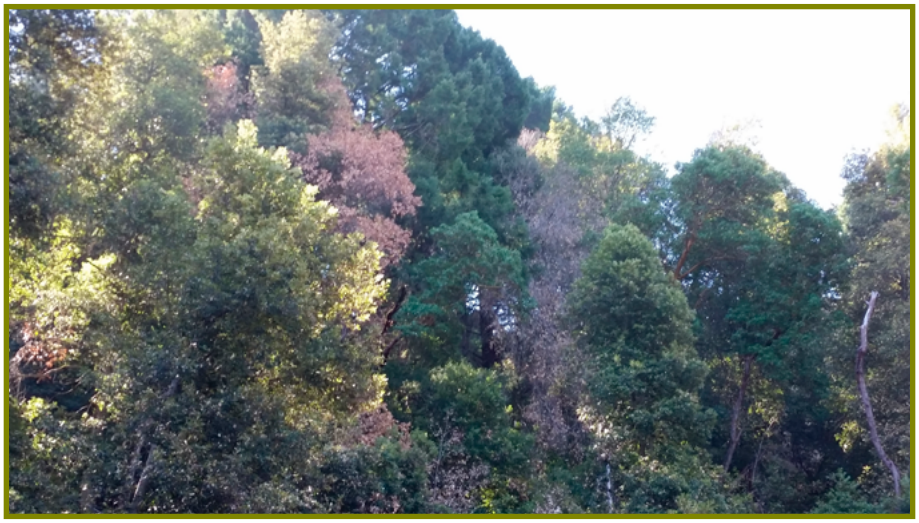
(Left) Sudden oak death-like branch wilt symptoms caused by *Armillaria* spp. on tanoak at Jedediah Smith State Park in Del Norte County; (Right) mycelium of the fungus at the base of the same branch. Photo by: C. Lee, CALFIRE

Sudden Oak Death (*Phytophthora ramorum*)
https://www.suddenoakdeath.org/

2020 saw variable activity by the sudden oak death (SOD) pathogen, *Phytophthora ramorum*. Given that observed mortality in a given year reflects pathogen activity in previous years (since a lag time exists between infection and mortality), the pattern in 2020 was more marked in some places and much less in others, and did not have a clear relationship to length of time since first infestation of the sites. Along with UC Cooperative Extension contributors in the north coast, two sources contributed much of this information: The UC Berkeley-led SOD Blitz (*P. ramorum* surveys utilizing citizen scientists), which proceeded this year under strict Covid-safe protocols, and the UC Davis – California Polytechnic State University San Luis Obispo long-term *P. ramorum* monitoring plots throughout California coastal counties.

North Central Coast and South Bay
Intensive efforts were made in 2020 to locate possible *P. ramorum*-infected trees in San Luis Obispo and southern Monterey Counties. Helicopter reconnaissance and ground surveys found infected trees, and positive stream samples were found in Salmon Creek in southern Monterey County, and no infested trees but positive stream samples in San Carpoforo Creek in San Luis Obispo County. There were no positive trees or stream samples in other creeks that were surveyed. Those streams include Santa Rita, Santa Rosa and San Simeon in San Luis Obispo County.

Farther north in Monterey County, the unburned area south of Plaskett Creek had severe, advanced SOD mortality in 2020. Current conditions included many standing dead tanoaks (*Notholithocarpus densiflorus*) of varying ages with accumulated fuels in the understory. Portions of the 2020 CZU Complex burn area include some heavily infested areas in the Big Creek, Devils Creek, Vaciente Creek, and Mill Creek drainages.



Tanoak mortality and tip dieback caused by *Phytophthora ramorum* along Highway 9 near Saratoga Gap (Skyline Boulevard) in Santa Clara County. Photo by: C. Lee, CALFIRE

Areas of Santa Cruz and Santa Clara Counties also had highly visible mortality caused by *P. ramorum* in 2020 including the east sides of the ridge between these two counties, including Highways 152 and 17 and Highway 9 leading up to Saratoga Gap. Generally, open oak woodlands had scattered coast live oak mortality, while more heavily wooded areas had patches of continuous tanoak mortality and numerous understory tanoaks with symptoms. In monitoring plots by Phytosphere Research in Midpeninsula Regional Open Space District areas along Skyline Boulevard, mortality did not increase appreciably between 2019 and 2020 in coast live oaks (*Quercus agrifolia*), canyon live oaks (*Q. chrysolepis*), or Shreve oaks (*Q. parvula*), although infections increased slightly.

SOD Blitz volunteers collected evidence of significant infection increases in Carmel from 2019 to 2020 (5.4% in 2019 vs. 9% incidence in 2020, 245 samples), Santa Cruz (0.4% in 2019 vs. 14.2% incidence in 2020, 46 samples), and the northern and eastern part of the San Francisco Peninsula (6.3% vs.11.4% and 1.7% vs 11.1% respectively between 2019 and 2020 with 92 combined samples), although an increase was not recorded in the western part of the peninsula.

San Francisco Bay Area
SOD Blitz samples collected in 2020 showed varying results for areas close to San Francisco Bay. A large increase was recorded in the East Bay counties east of the Oakland Hills (7.8% in 2020 vs. 0.5% in 2019, 164 samples) but not in the area west of the hills. A similar increase was recorded for Marin County (9.5% in 2020 vs. 7.1% in 2019, 219 samples). Noteworthy outbreak areas included Tilden Regional Park in Alameda/Contra Costa Counties, John Muir National Historic Site and Sobrante Ridge Regional Preserve in Contra Costa County, and the Napa River Trail in Napa County.

North Coast
Long-term sudden oak death monitoring sites throughout the north coastal counties that had not been visited since 2012 were revisited in 2020. Few tanoak twig symptoms were observed north of Sonoma County. Although bole cankers were frequently encountered, none of them yielded *Phytophthora* growth on selective media. It is possible that some of these cankers were produced by other *Phytophthora* species, such as *P. cactorum*, which has previously been observed to cause *P. ramorum*-like

cankers on tanoak boles but does not readily produce pathogen growth from cankers. Other pathogens sometimes associated with tanoak bole cankers include *Armillaria* spp., *Phytophthora nemorosa*, *Diplodia corticola*, and *Neonectria* spp. Tanoak twig dieback symptoms that superficially resembled sudden oak death symptoms but more closely matched the symptom patterns of *Tubakia californica*, *Diplodia corticola*, and/or *Diaporthe nothofagi* were seen in some areas of Humboldt, Mendocino, and Del Norte Counties, including along Highway 96 between Willow Creek and Hoopa and Highways 101 and 1 near Leggett in northern Mendocino County. Areas of note for sudden oak death in the north coast included the following:

In Sonoma County, Armstrong Redwoods State Park was invaded by a new *P. ramorum* wave that resulted in standing dead trees on the hillsides above the redwood (*Sequoia sempervirens*) dominated valley floor. Much of this infestation burned in the Wallbridge Fire (part of the LNU Lightning Complex). SOD Blitz samples reflected an infection increase in northern Sonoma County, but not in the western part, consistent with the general pattern of increases in inland infections but not in coastally-located ones. Data collected by Phytosphere Research in Sonoma County matched these observations, as there was little to no increase in infection in plots near the coast, but mortality has gradually increased from 17% to 20% from 2017-2020 in plots closer to Healdsburg.

In Mendocino County, both old and recent tanoak mortality was very visible in Salt Point State Park, and surveyors recovered the pathogen from plots that had never previously tested positive for *P. ramorum*. At the Sonoma State University Galbreath Preserve in Yorkville, along Highway 128 between Cloverdale and Boonville, numerous symptoms on tanoak were seen, but not significant mortality, indicating that sudden oak death is likely on the increase. *P. ramorum* has begun causing disease and was isolated from tanoaks in Van Damme and Russian Gulch State Parks near the town of Mendocino, although in Van Damme SP many SOD-like symptoms are caused by *Diplodia corticola*. In Jackson Demonstration State Forest, east of Fort Bragg and Mendocino, expansion of the pathogen continued, especially in areas upslope of Mendocino Woodlands State Park. There were additional unconfirmed reports of sudden oak death symptoms from the upper part of the Big River watershed. SOD Blitz samples confirmed the increase in infection in Mendocino County, particularly along the Highway 128 corridor between Cloverdale and Boonville.

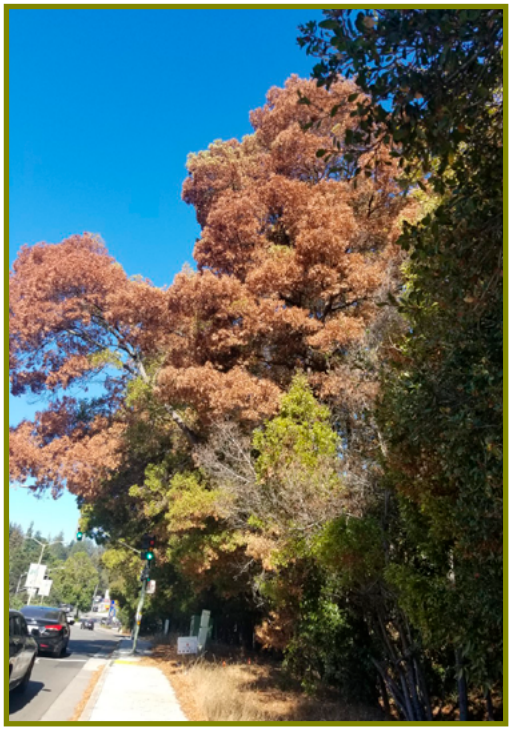
In Humboldt County, some long-time infested areas showed little to no increased mortality, such as areas near the town of Redway, while others, such as the Whitethorn area, displayed an apparent acceleration in infection and mortality. Symptoms were noted for the first time in Richardson Grove State Park, where Durphy Creek has been known to be infested for over ten years. The same situation (long-time infested watercourses but only recent symptom development on infested trees) was seen near the Dinner Creek and China Creek areas along Briceland Road west of Redway. The disease was detected numerous times in the Humboldt Redwoods State Park between Albee and Mill Creeks and at the Bull Creek South Trailhead, indicating the beginning of an increase in sudden oak death activity in that area. The northernmost pathogen detections along the Avenue of the Giants were made just downstream of the Bull Creek/Main Stem Eel River confluence. Additionally, the pathogen was detected on vegetation east of Bridgeville along Highway 36, near the confluence of Little Larabee Creek and the Van Duzen River. In general, visible symptom development in southern Humboldt County appears to be following the sequence in which the pathogen was detected in streams but with a considerable time lag between stream discovery and terrestrial symptom development. In northern Humboldt County, the pathogen continued to expand in areas along Redwood Creek within Redwood National Park. The Tall Trees Grove once again had many symptomatic bay laurel and tanoak trees, although pathogen isolations during the warmest parts of summer were unsuccessful.

In Del Norte County, the pathogen was detected along Highway 197 between the Hiouchi area along Highway 199 and the Smith River area along Highway 101. This was the first official regulatory confirmation of the pathogen in the area, since the 2019 find in the Mill Creek drainage in Jedediah Smith State Park had never been successfully repeated. Additionally, genotyping of the 2020 Highway 197 find revealed this population of *P. ramorum* to belong to the EU1 genetic lineage, unlike the Jedediah Smith find, which was from the NA1 lineage. The nearest EU1 infections in wild forests are approximately 35 miles to the north in the area between the Pistol River and the Rogue River in Curry County, Oregon. Management activities designed to limit the spread of the new EU1 find in Del Norte County are underway. This is the first detection of the EU1 lineage in trees in California.

Tanoak sprout symptoms caused by the EU1 lineage of *Phytophthora ramorum* along Highway 197 in Del Norte County. Photo by: C. Lee, CALFIRE

Black Acacia Mortality (cause unknown)

Widespread mortality and decline of blackwood acacia (*Acacia melanoxylon*), was observed in Oakland (Alameda County). The dying trees were reported in October 2020 by the City of Oakland - Tree Services, Friends of Sausal Creek and others. The cause of the die-off is being investigated. Dead *Acacia melanoxylon* were commonly observed along Highways 13 and 580, in Dimond Canyon, Joaquin Miller Park, Leona Heights and many other areas. The decline is patchy, but in some areas the mortality is extensive with hundreds of standing dead trees. There is no indication of insect activity on the dead and dying trees and no gummosis or bleeding. Many of the trees had cankers near the base of the trunk, but the importance of the cankers is not known. In affected trees, the leaves (phyllodes) appeared chlorotic or brown, and eventually the entire crown was comprised of brown leaves. This tree species is considered an invasive species and is common in the area. Drought is being investigated as a cause or contributing factor.



Dying blackwood acacia in Oakland.
Photo by: T. Smith, CALFIRE

Close-up of canker symptoms on blackwood acacia.
Photo by: T. Smith, CALFIRE

Leaf Spot of California Bay Laurel (*Mycosphaerella umbellulariae*)

A leaf spot and tip dieback of California bay laurel (*Umbellularia californica*) was found in Stebbins Cold Creek Canyon (Yolo County) and the North Fork of the Middle Fork of the American River Trail (Eldorado County). Symptoms appeared like that of sudden oak death (*Phytophthora ramorum*) on bay, but neither county is known to be infested. Samples proved to have fruiting bodies of *Mycosphaerella umbellulariae*, a previously known but rarely detected pathogen of bay laurel leaves throughout California. The fungus is thought to cause few disease issues. The two locations will be monitored next spring to see if disease symptoms return or cause any lasting damage.

Incense Cedar Canker (cause uncertain)

Unexplained incense cedar (*Calocedrus decurrens*) dieback continued in certain locations in northern California, although many areas were not affected as intensely as in 2019. In southern Humboldt County, dieback in one affected stand (approximately 2 acres) that included all sizes of incense cedars yielded *Seiridium* sp. The pathogen did not match any specific isolates in genetic databases but was closest to *S. pseudocardinale* (not known from North America) or potentially *S. cardinale*, cause of cypress canker.

Incense cedar trees along a stretch of the Sierra Nevada foothills from Sierra to Calaveras Counties exhibited symptoms of branch and top dieback, loss of foliage, thinning crowns, and occasional mortality. Symptoms were most severe at mid- and upper-elevations, particularly along the Mormon Emigrant Trail Road in El Dorado County. Again, a canker disease, possibly caused by the fungus *Seiridium* sp.,

Dieback and decline of incense cedar along the Mormon Emigrant Trail in Eldorado County. Photo by: T. Smith, CALFIRE

combined with environmental stress from past drought years and extreme heat, is considered the likely culprit. However, the exact cause is still uncertain, and the full extent of the problem is not yet known.

Calonectria (*Calonectria* sp.)

At the end of January, *Calonectria/Cylindrocladium* sp. nov. was recovered from multiple hosts in an area of Jedediah Smith State Park in Del Norte County where *Phytophthora ramorum* (the sudden oak death pathogen) had also been recovered in July 2019. *Calonectria* caused profuse symptoms throughout the forest understory in this old-growth redwood stand. The pathogen was recovered from tanoak (*Notholithocarpus densiflorus*), mock-orange (*Philadelphus* sp.), salal (*Gaultheria shallon*), Oregon-grape (*Mahonia aquifoliam*), bay laurel (*Umbellularia californica*), and rhododendron (*Rhododendron macrophyllum*).

Symptoms caused by novel *Calonectria/Cylindrocladium* sp. on (clockwise from upper left) salal, bay laurel, native rhododendron, and tanoak at Mill Creek along Howland Hill Road in Del Norte County. Photo by: C. Lee, CALFIRE

Witches' Broom of Birch (cause uncertain)

An unusual witches'-broom of planted birch (*Betula* sp.) was observed in various locations in Arcata, McKinleyville, and Trinidad (Humboldt County). Only one location had more than one broom in the crown. Although sampling had not yet taken place, the symptoms match the description of those caused by *Taphrina betulina* in Europe.

Witches'-broom of planted birch in McKinleyville, Humboldt County. Photo by: C. Lee, CALFIRE

Heart and Butt Rot of Pin Oak (*Ganoderma* sp.)

A species of *Ganoderma* identified as being in the *G. adspersum/G. brownii* complex was responsible for dramatic butt rot of a living pin oak (*Quercus palustris*) in Arcata (Humboldt County). In this instance the pathogen *G. adspersum* has recently been reported to act in California almond (*Prunus dulcis*) orchards, causing severe decay that caused the tree to blow down without warning while still green and vigorous-looking.

Red-Belted Conk (*Fomitopsis pinicola*)

Numerous examples of the red-belted conk (aka the red banded polypore), a stem decay fungus, were found on extremely mature white fir trees (*Abies concolor*) in the Sequoia National Forest.

Blowdown of pin oak (left) and fruiting bodies of *Gandoderma* sp. in Arcata, Humboldt County. Photo by: E. Buck, Humboldt State University

Maple Leaf Scorch (cause unknown)

Maple Leaf Scorch (MLS) on bigleaf maple (*Acer macrophyllum*) again occurred along many of the same highways reported in the past (Highways 3, 70, 89, 96, 299 and Interstate 5). Most of the foliage on up to half the maples along portions of these highways had MLS. Some of the large maples with dead tops and recurring heavy MLS had died. Maples along Highway 89 and Indian Creek in Plumas County have

Maple leaf scorch on bigleaf maple.
Photo by: W. Woodruff, USFS

Close-up of typical symptoms of maple leaf scorch along Highway 89. Photo by: W. Woodruff, USFS

Maples showing leaf scorch symptoms, Highway 3, northeast of Hayfork. Photo by: W. Woodruff, USFS

exhibited MLS for 25 years. It is possible that the xylem-limited bacterium *Xylella fastidiosa* or a root disease is contributing to this MLS mortality.

In locations where bigleaf maple seedlings, saplings and young trees are growing on highway fill banks or other dry sites, it is possible that early-season soil drying is causing MLS. Therefore, a warmer and drier climate may be the primary cause of MLS. Xylem-feeding insects are sometimes found associated with MLS and may be transmitting a causal pathogen.

Tar spot on bigleaf maple along Highway 49.
Photo by: W. Woodruff, USFS

Symptoms of *Xylella fastidiosa* on sweetgum.
Photo by: C. Barnes, USFS

From 2009 through 2016, approximately 350 collections of scorched maple leaves from trees in northern California were analyzed at four university labs for the bacterium *Xylella fastidiosa* using ELISA and DNA-based tests. The first years of testing found evidence of *X. fastidiosa* in the leaf petioles. Refined testing in later years was unsuccessful in finding evidence of the bacteria in the petioles. The fact that MLS persists in big leaf maples in many locations in northern California and Oregon, probably since the 1960s, suggests a pathogen, climate, climate change, or a combination of factors is causing observed MLS symptoms; with xylem-feeding insects involved in some locations. Perhaps *X. fastidiosa* resides in xylem tissue elsewhere in the maples and not in the leaf petioles being examined. More study is needed to identify the cause(s) of MLS.

Leaf Scorch of Sweetgum (*Xylella fastidiosa*)

Scattered sweetgum (*Liquidambar styraciflua*) street trees in the greater Los Angeles area (Los Angeles, Riverside, San Bernardino and Orange Counties) have exhibited leaf burn symptoms for several years. DNA analysis confirmed the presence of *Xylella fastidiosa* subspecies *multiplex* within the impacted tissues.

Tar Spot of Maple (*Rhytisma punctatum*)

In 2020, most leaves of bigleaf maples (*Acer macrophyllum*) along Highway 49 between Downieville and Sierra City in Sierra County exhibited tar spot disease. The fungus is an endophyte. Nearly all big leaf maple leaves appeared to be infected. The fungus does not cause serious damage to the maples. Some maples along Hwy 49 also exhibited symptoms of maple leaf scorch.

Overstocking

Multiple eucalyptus species including blue gum (*Eucalyptus globulus*) experienced tip and crown dieback in San Luis Obispo County. The primary affected stand was located on California State Parks property in Montaña de Oro State Park and covered 19 acres. No pathogen or insect was associated with the dieback, which was presumed to be due to overcrowding. Overstocking and dieback symptoms were seen throughout all species in the stand.

Eucalyptus dieback in Montaña de Oro State Park. Photo by: K. Corella, CALFIRE

Early leaf fall and browning of blue oaks, Calaveras County. Photo by: T. Smith, CALFIRE

Galls likely caused by herbicide damage on coast redwood street trees. Photo by: T. Smith, CALFIRE

Blue Oak Early Season Leaf Browning (heat and drought)

Blue oak (*Quercus douglasii*) stands throughout Calaveras County exhibited early leaf browning and leaf fall during the summer months. The cause was attributed to the hot and dry summer weather. Stands appeared nearly dead but the trees were still living and are likely to leaf out again with the return of normal rainfall.

Branch Galls on Coast Redwood (suspected herbicide damage)

A group of five very large coast redwoods (*Sequoia sempervirens*) exhibited signs of dieback and decline in the city of Gold River (Sacramento County). The affected trees all had large galls along the impacted branches. No insect or disease organisms could be found. The ground around the impacted trees had been repeatedly treated with herbicides for weed and grass control leading to the assessment that the symptoms may have been a phytotoxic reaction to the chemicals.

Fire

See Wildfire section, page 6.

In Fiscal Year 2020, over 1,650 acres of invasive plant and noxious weed species were treated on National Forests. The most commonly treated species included: Canada thistle (*Cirsium arvense*) and other thistles, medusahead (*Taeniatherum caput-medusae*), yellow star-thistle (*Centaurea solstitialis*), broadleaved pepperweed/tall whitetop (*Lepidium latifolium*), Peruvian peppertree (*Schinus mole*), and saltcedar (*Tamarix ramosissima*). In addition, about 150 acres of aquatic invasive species were treated on the Plumas National Forest.

Collaborative work was initiated by USDA Agricultural Research Station via USFS funding to develop methods to mass rear, store, and release the rosette weevil (*Trichosirocalus horridus*), a new biological control agent of yellow star-thistle, and the University of California, Santa Barbara continued their work on control of giant reed (*Arundo donax*) and Cape-ivy (*Delairea odorata*) in southern California.

The USFS and partners were especially concerned about, and monitoring for, newly established invasive species such as: knapweeds (*Centaurea* spp.) (i.e. spotted, meadow), which are especially problematic for forest regeneration; Dyer's Woad (*Isatis tinctoria*), which can be difficult to control due to its deep root system and tolerance for a wide range of environmental conditions; North Africa grass or wire grass (*Ventenata dubia*), which can easily out-compete native grasses, skeletonweed (*Chondrilla juncea*), and stinkwort (*Dittrichia graveolens*).

Invasive spotted knapweed, Plumas County. Photo by: M. Friend, USFS

California Department of Food and Agriculture Border Stations

During the one-year period from October 1, 2019 through October 1, 2020, the sixteen California Border Stations maintained by the California Department of Food and Agriculture inspected numerous pieces of firewood, other wood products and materials being brought into the State. Inspections included 358 separate samples totaling over 212,590 lbs. of woody material arriving from nearly every state within the lower forty-eight states. Various intercepted insects of potential concern to forests included metallic wood borers, pine sawyers, bark beetles, flat-headed borers, long-horn beetles and weevils. Some samples raised concerns, including seven interceptions of gypsy moths in various life stages. There were also 912 inspections of yard furniture and other outdoor materials entering California to look for potential gypsy moth (*Lymantria dispar*) life stages; there were no positive finds on these other materials.

In 2020, scientific publications concerning California forest pests and wildland conditions included:

Audley, J.P.; Bostock, R.M.; Seybold, S.J. 2020. Trap assays of the walnut twig beetle, *Pityophthorus juglandis* Blackman (Coleoptera: Curculionidae: Scolytinae), reveal an effective semiochemical repellent combination. Journal of Chemical Ecology. 46(11): 1047-1058.

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Davis, F.W. 2020. More trees are dying due to drought and wildfire, but don't lose sight of forest pathogens. Earth's Future. 8(10): e2020EF001792.

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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.

There were no Committee field trips in 2020 due to statewide COVID-19-related restrictions The CA Forest Pest Council annual meeting was held Nov. 18-19, 2020 and was virtual, also due to statewide COVID-19-related restrictions. No resolutions were passed during the annual meeting.

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