California Forest Pest Conditions 2009

A publication of the California Forest Pest Council

California Forest Pest Conditions Report - 2009

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Cover Photos

Top: Female dwarf mistletoe plant on Jeffrey pine, Diamond Mountain, by Bill Woodruff
Center: Whitebark pine attacked by mountain pine beetle, June Mountain, by Beverly Bulaon
Bottom: June Lake area, Inyo National Forest, by Sheri Smith

THE CALIFORNIA FOREST PEST COUNCIL

The California Forest Pest Council, 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, pathologists, biologists, and others interested in the protection of forests from injury caused by biotic and abiotic agents. The Council's objective is to establish, maintain, and improve communication among individuals who are concerned with these issues. This objective is accomplished by five actions:

1. Coordinate the detection, reporting and compilation of pest injury, primarily forest insects, diseases and animal damage.

2. Evaluate pest conditions, primarily those of forest insects, diseases and animal damage.

3. Make recommendations on pest control to forest management, protection agencies and forest landowners.

4. Review policy, legal and research aspects of forest pest management, and submit recommendations thereon to appropriate authorities.

5. Foster 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, USDA Forest Service, Pacific Southwest Region in cooperation with other member organizations of the Council, published by the California Department of Forestry and Fire Protection and distributed by the two agencies.

The report is available in color at the following website:
http://www.fs.fed.us/r5/spf/publications/pestconditions/

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CALIFORNIA FOREST PEST CONDITIONS 2009

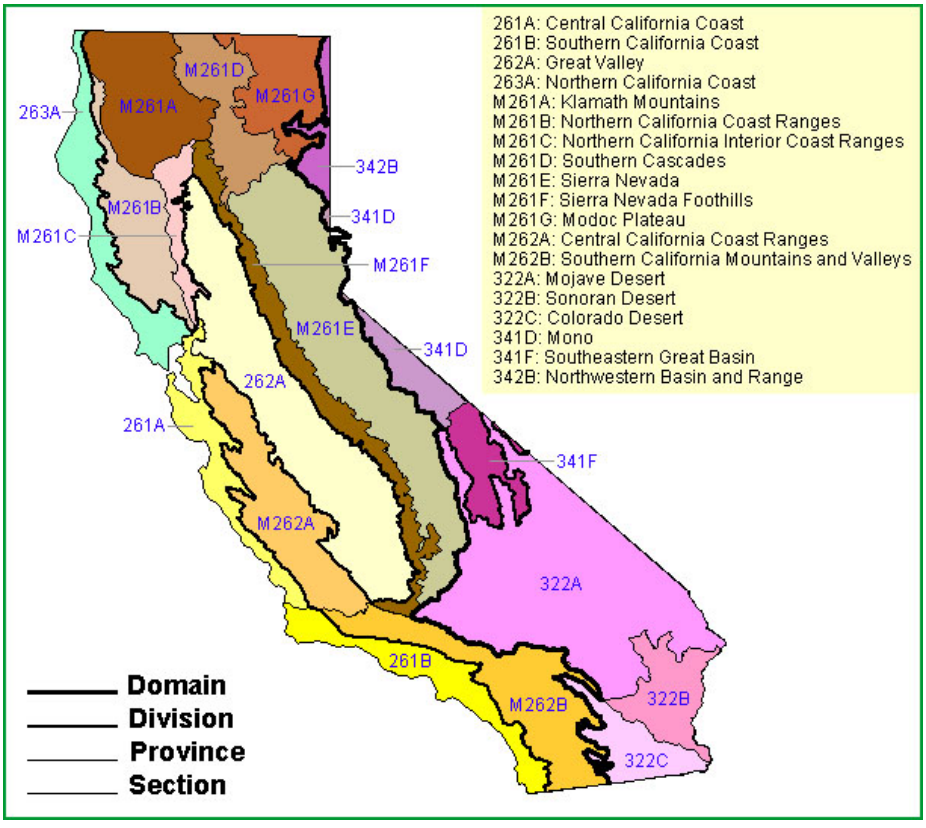
Introduction

By Lisa Fischer

California Forest Pest Conditions 2009 was compiled by and for resource professionals, public and private land managers, and other interested parties for the purpose of reporting on conditions and status of forest health across all forested lands in California. This report also serves as a historical record of forest pest activity, biotic and abiotic trends, and occurrences. Information for this report is provided by three main sources including data and information collected and generated by Forest Health Protection, Pacific Southwest Region, US Forest Service (FHP-FS), reports and surveys of conditions on private lands provided by the California Department of Forestry and Fire Protection (CALFIRE), and the statewide Cooperative Forest Insect and Disease Survey in which federal, state and private foresters and land managers participate.

This report helps to fulfill the amended Cooperative Forestry Assistance Act of 1978 that requires survey, monitoring, and annual reporting of the health of the forests and serves as an advisory document for the California Board of Forestry and Fire Protection. *California Forest Pest Conditions 2009* also paints the picture of our combined accomplishments through technical assistance to our partners and stakeholders, to you!

In 2009 the FHP-FS completed the development of a historic electronic database called the California Insect and Disease Atlas (CAIDA). Insect and disease records date back to the early 1930's to present and this database is searchable and spatially linked. There are over 7000 records of pest detection reports linked to spatial extents. This database is searchable and will soon be available for the public through an on-line web mapping service.



Map 1: Ecoregions of California, Bailey

This report is organized by biotic damage agents, insects, diseases and declines, animal damage, and abiotic activity and is displayed geographically according to the Ecological Units of California. These ecological sections were defined in Ecoregions and Subregions of the United States (Bailey, et. al., 1994). Bailey's map depicts ecosystems of regional and subregional extents, using a hierarchical order to define smaller ecosystems within the larger ecosystems. This report is also available on our website at www/fs.fed.us/r5/spf.

California Forest Health Synopsis

2009 Survey Season-at-a-Glance

State and Private Forestry, Forest Health Protection (SPF-FHP) conduct annual statewide aerial detection surveys across all land ownerships. In 2009, forty-one million acres were flown across the state of California and over 432,000 acres were reported with some type of damage due to insects, diseases, or abiotic stress agents. Compared to last season, there was a three-fold increase in mortality due to pine beetle activity and a ten-fold increase in fir engraver related mortality. In addition to flying the regular annual survey, SPF-FHP supported the central coast Sudden Oak Death (SOD) aerial survey and north coast SOD aerial survey. With several years of high temperatures in the early part of the summer, and three years of significantly lower than average rainfall amounts, many conifer and hardwood species showed drought–induced injury or mortality and increasing or continued insect attacks. Statewide average seasonal precipitation through April 2009 was just 80% of normal, and as the year progressed water conditions declined drastically in many areas. The South Coast area of the state recorded the lowest seasonal precipitation (60% of normal) in 2009. Bark beetle and drought-caused tree mortality in California may increase dramatically when annual precipitation levels are less than 80% of normal.

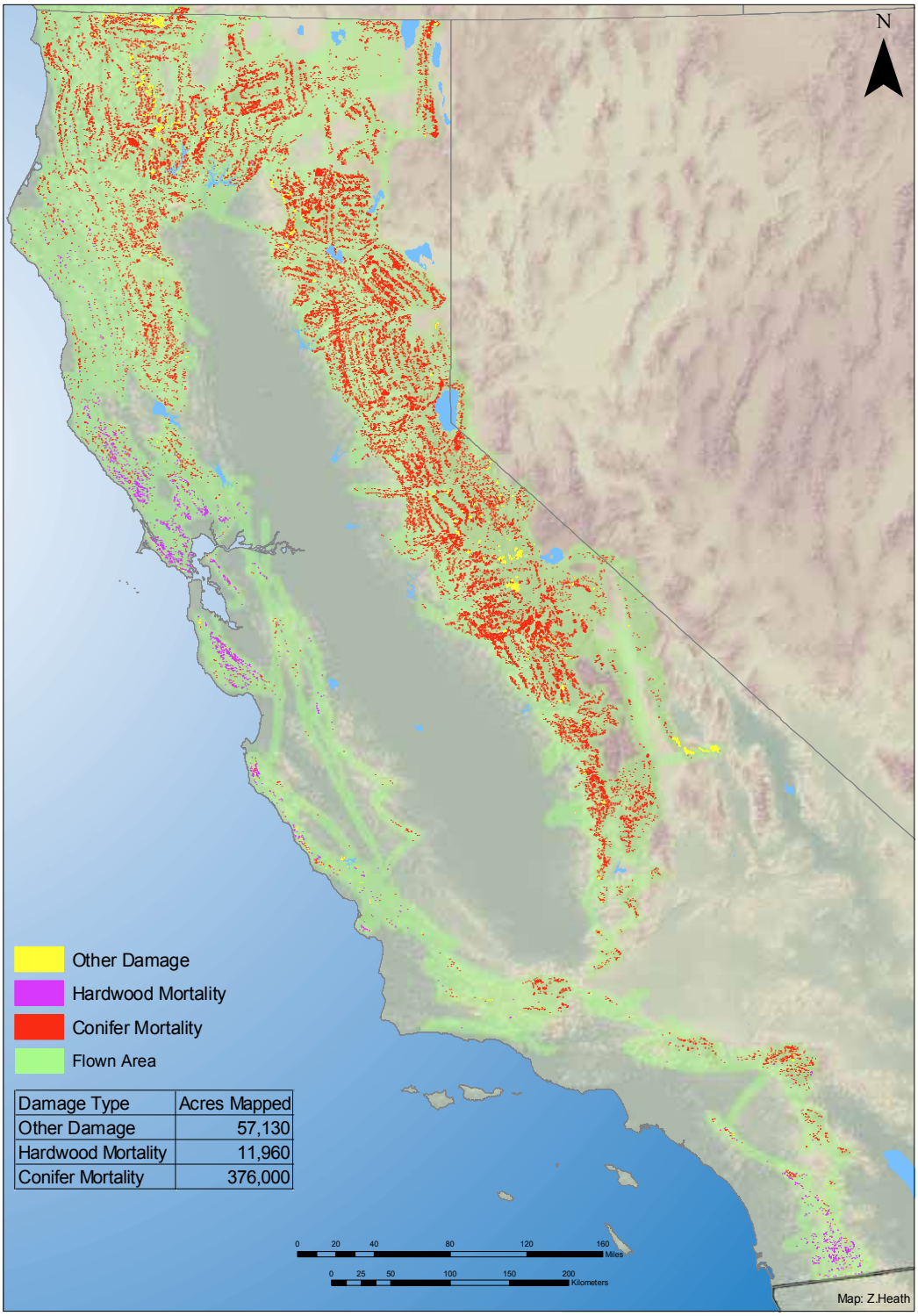
Insect Activity – 2009 At a Glance

The number of trees attacked and killed by bark beetles was higher in 2009, compared to 2008, in many areas of the southern Cascades, Sierra Nevada, and Southern California mountains, and on the Modoc Plateau. There was also a large increase in the number of dead fir trees and trees with topkill caused by fir engraver beetle attacks. Tree mortality caused by these beetles is expected to continue to increase next year if drought conditions persist. Stands in many areas are highly susceptible to increases in bark beetle-caused tree mortality primarily due to dense stocking and altered species composition. Wildfires that occurred during 2008 throughout northern California created extensive landscapes of dead and fire-injured trees which continued to be colonized by wood borers and red turpentine beetle during 2009.

Disease Activity – 2009 At a Glance

As with insect activity, the droughty conditions over the past three years have had an effect on diseases in California. Douglas-fir, incense cedar, and alder experienced drought-induced decline, especially where they are growing on the drier fringe of their native distribution. These species also experienced higher than previous years' mortality rates. Biotic pathogen-caused diseases such as *Phytophthora ramorum*, the pathogen that causes Sudden Oak Death, were less active and impacts were considerably reduced by the dry year. White pine blister rust continued to expand the area where it is impacting the five-needle pines in the northern Sierra Nevada range.

Map 2: 2009 Aerial Survey Area Flown and Acres of Mapped Damage



Status of Insects

Insects

By Sheri Smith

The number of trees attacked and killed by Jeffrey pine beetle, mountain pine beetle and western pine beetle was much higher in 2009, compared to 2008, in many areas of the southern Cascades, Sierra Nevada and Southern California mountains, and on the Modoc Plateau. There was also a large increase in the number of dead fir trees (primarily white fir) and trees with top-kill caused by fir engraver beetle attacks. Jeffrey pine beetle was active in the Lake Tahoe Basin as well as on the Modoc, Lassen, Tahoe, Toiyabe, Sequoia, and San Bernardino National Forests, with most mortality occurring in large diameter and pole size Jeffrey pine trees. Mountain pine beetle continued to be active in lodgepole, western white, and whitebark pine. Multiple areas throughout the state were reported to have an increase in the number of mountain pine beetle attacked trees compared to 2008. Areas of significant whitebark pine mortality areas included the Warner Mountain range (Modoc NF), Mt. Shasta, (Shasta-Trinity NF), and the June Mountain Ski Area (Inyo NF). In addition, mountain pine beetle continues to attack and kill single-leaf pinyon on the San Bernardino National Forest. Western pine beetle was most active in the southern Cascades, Sierra Nevada and Southern California mountains. At low to mid-elevations activity increased which became more apparent as groups of killed trees expanded in size, particularly in plantations in the southern Sierra Nevada range. Tree mortality ranged from individual trees to groups of trees that exceeded five acres in size. Limited Coulter pine mortality also occurred on the Angeles National Forest. Red turpentine beetle (RTB) activity increased in 2009, primarily in the 2008 wildfire areas. RTB activity (not associated with wildfires) was also reported to occur on ponderosa pine at the CALFIRE Shingletown Fire Station and at multiple campgrounds at Eagle Lake (Lassen National Forest).

Most forests in northern California and in the southern Sierra Nevada range experienced higher levels of fir engraver beetle-caused tree mortality in both red and white fir compared to 2008. Significant increases in white fir mortality were reported on the Lassen National Forest and Lake Tahoe Basin Management Unit. Fir engraver beetle attacks were commonly found in overstocked stands with dwarf mistletoe, cytospora canker and/or Heterobasidion root disease; some attacked trees were also fire-injured during 2008. Higher levels of activity by various *Ips* sp. was reported in 2009 compared to 2008. The most significant was near Blue Mountain, Modoc National Forest, where high levels of topkill and whole tree mortality occurred when large amounts of felled green host material remained in the stands following thinning activities.

Notable defoliation included continued blotch mining by the black oak leaf miner which increased in intensity and affected a much larger area in 2009 near Blue Canyon, Tahoe National Forest, and a Douglas-fir tussock moth outbreak south of Big Bear Lake, primarily along the eastern edge of forest road 2N10, San Bernardino National Forest.

Invasive Insects

For the past seven years, elevated oak mortality, caused by the goldspotted oak borer has occurred on federal, state, tribal, and private lands in southern California, principally among coast live and California black oaks. The extensive oak mortality is centered near the communities of Descanso and Pine Valley, and stretches as far north as Julian. A separate satellite infestation was found near La Jolla north of San Diego.

In 2009, one European gypsy moth was trapped in Los Gatos, Santa Clara County, and two Asian gypsy moths were trapped in Los Angeles County.

Status of Diseases

Diseases

By Phil Cannon

California's diverse forests were impacted by diseases, pathogens, and a drier than normal year in 2009.

Tree species including Douglas-fir, incense cedar, and alder experienced a drought-induced decline, especially where they were growing on the drier fringe of their native distribution. Lower-elevation mixed conifer stands, especially in the Stanislaus National Forest, showed very high mortality rates compared to 2008. Several individual incense cedar and stands of alder on the San Bernadino National Forest went into a decline and showed higher than normal mortality rates.

Biotic-pathogen-caused diseases, which require ample amounts of rainfall to grow, sporulate and spread, had their impacts considerably reduced by the droughty conditions over the past three years. *Phytophthora ramorum*, the pathogen that causes sudden oak death, did expand its range somewhat in Humboldt and Mendocino Counties. *Fusarium circinatum*, the fungus that causes pitch canker in several pine species, did have an impact in some of California's wettest coastal areas, but was generally not as aggressive as it has been in the past.

Heterobasidion occidentale and *Heterobasidion irregulare* (Note: both were collectively named *Heterobasidion annosum* before that and *Fomes annosus* before that) have always been widespread in California. Informal stump surveys conducted in the Sierra and the Los Padres National Forests indicate that they are even more widespread and more devastating than was previously appreciated in some areas. These two related fungi cause root rots of distinct sets of coniferous species and often make affected trees substantially more vulnerable to windthrow, drought and barkbeetles.

Blackstain root disease also killed patches of trees in several Douglas-fir stands in Northern California, tending to be more evident in some areas where there has been a history of ground disturbance. Port Orford Cedar root disease affected at least a few Port-Orford-Cedar trees throughout northwestern California.

White pine blister rust continued to expand the area where it is impacting the five-needle pines in the northern Sierras. However, California had a bumper crop of Sugar Pine seed collected in 2009 from trees that have been tested and found to be resistant to this rust.

There are many other pathogens affecting California's forests, including a number of mistletoes, foliar diseases, stem cankers, and air pollutants. Rarely do these pathogens kill trees outright by themselves; more commonly they just impose a tax on growth and this, coupled with drought, root rot or bark beetles, can contribute to the tree's decline and eventual demise.

Insect Conditions

Invasive Insects

Goldspotted oak borer
Agrilus coxalis
Contributions by: Kim Camilli, Tom Coleman and Sheri Smith

During 2009, the oak mortality due to *A. coxalis* continued primarily on and around the Descanso Ranger District, Cleveland National Forest (San Diego County, M262B). The range of goldspotted oak borer was confirmed north to Santa Ysabel, south to Campo, east to Boulevard, and west to Crest. A separate satellite infestation was also found near La Jolla north of San Diego. In 2009, mortality of coast live oak and California black oak was estimated at 2,800 trees from aerial surveys on federal, state, county, tribal, and private land. Mortality from this non-native species is now estimated at more than 20,000 trees since 2002.

The oak borer is similar to other *Agrilus* wood boring species found throughout the U.S. Early symptoms of infestation are dark-colored stains on the bark, D-shaped adult exit holes, and thinning crowns of infested hosts. The goldspotted oak borer aggressively attacks oaks along the main stem and largest branches. Larvae feed primarily at the interface of the wood and phloem resulting in patches of dead cambium. Tree mortality occurs after several years of continuous infestation. In addition to more localized spread by emerging adult beetles, the movement of goldspotted oak borer-infested firewood presents a significant pathway for introductions into non-infested areas. The level of oak mortality caused by goldspotted oak borer annually is expected to remain the same or increase in the coming years as the infestation intensifies and expands. Affected areas are primarily on National Forest (41%) and private lands (42%).

Figure 1: Goldspotted oak borer, *Agrilus coxalis*.

Photo: S. Blomquist, USFS, Southern Research Station

Preliminary surveys conducted on the Descanso Ranger District, Cleveland National Forest, indicate that infestation rates from the goldspotted oak borer on oaks average 65%, but are approaching 100% in areas with long-term tree mortality. Trees of high ecological, cultural, and aesthetic value located in campgrounds, on administrative sites, and on tribal lands have been greatly affected and are being removed at high costs. Susceptible tree species include: coast live oak (*Quercus agrifolia*), California black oak (*Q. kelloggii*), and canyon live oak (*Q. chrysolepis*). The geographic distribution for the three *Quercus* spp. currently being attacked by goldspotted oak borer in California encompasses 39 million acres. The existing and future oak mortality will impact ecosystems for years to come, in addition to the large increase in hazardous trees that threaten life and property.

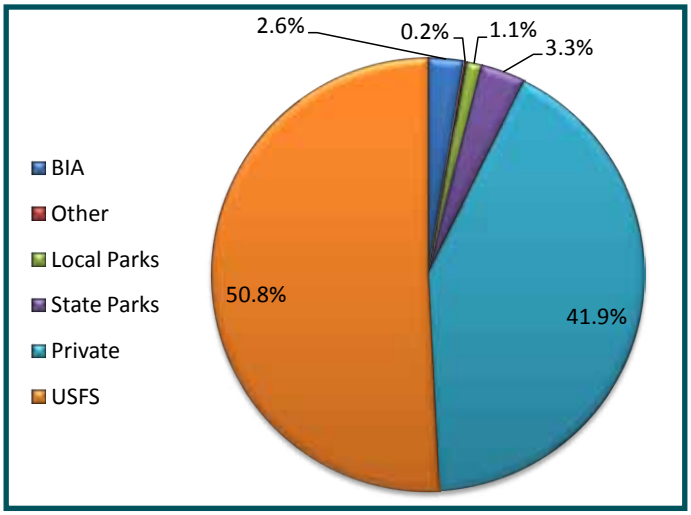


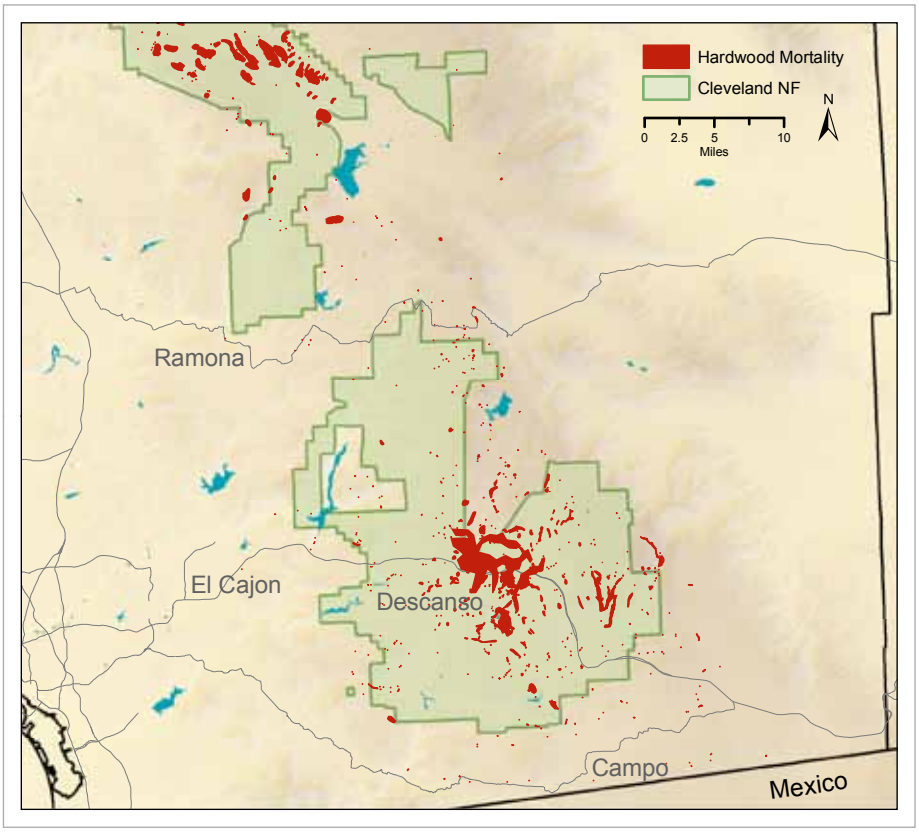
Table 1: Number of dead oaks detected via aerial survey and their percent distribution by ownership, 2002-2009.

Source: USFS, FHP Aerial Survey Detection Program

A Goldspotted Oak Borer Interagency Group has been

Map 3: Estimated tree mortality caused by goldspotted oak borer between 2002-2009, Cleveland NF.

Map: M. Woods



formed to coordinate survey and detection actions, regulatory and best management practices, research and technology development, restoration and sustainability, management and outreach, and education and technology transfer. More information can be found at the goldspotted oak borer website (http://groups.ucanr.org/GSOB/).

261A

261B

European Gypsy Moth (EGM), Asian Gyspy Moth (AGM)
Lymantria dispar, *Lymantria dispar* ssp.
Contributions by: Kim Camilli, Erin Lovig, Sheri Smith and Tom Smith

In 2009, one European gypsy moth was trapped in Los Gatos (Santa Clara County, 261A) and two Asian gypsy moths were trapped in Los Angeles County (261B) (see table below).

Also, during 2009, eradication efforts using *Bacillus thuringiensis* (Bt) were conducted in Ojai in areas where egg masses were detected in 2008. The eradication treatments were conducted by CDFA and APHIS. Trapping will be conducted in the treated areas in 2010 to see if the treatment was successful or if further treatments are necessary to eradicate this insect.

Table 2: 2009 EGM and AGM trap catches.

Date	County	City	Number	GM type	Treatment
June 25th	Los Angeles	Wilmington	1	AGM	Pending USDA recommendation.
July 16th	Los Angeles	San Pedro	1	AGM	Pending USDA recommendation.
August 28th	Santa Clara	Los Gatos	1	EGM	None planned at this time.

Walnut Twig Beetle
Pityophthorus juglandis

Contributions by: Steve Seybold

Figure 2: Native stand of *J. californica* infected with Thousand Cankers Disease.

Photo: S. Seybold

Walnut twig beetle, *Pityophthorus juglandis*, and canker formation caused by an unnamed *Geosmithia* sp. fungus continues to be a concern in California. *Geosmithia* spp. are associates of bark beetles of hardwood and conifer trees, but have not previously been reported as a pathogen of *Juglans* or as a fungal associate of *P. juglandis*. As of February 2010, the impacts of this pest complex have been recorded from CA, CO, ID, NM, OR, UT, and WA. No major changes in pest status or distribution have occurred in California since the 2008 Pest Conditions Report, and readers should refer to that report for photos of the insect and symptoms of the disease. The disease continues to be quite common in southern California in native stands of *J. californica*. UCD and PSW scientists are working on the host colonization behavior and life history of *P. juglandis* in California, including host attraction, pheromone biology, and attack density. An on-line field identification guide and a longer description of the disease have recently been made available through the UC-IPM program.

261B

Eucalyptus Redgum Lerp Psyllid
Glycaspis brimblecombei
Contributed by: Kim Camilli

Eucalyptus trees in Rancho Santa Fe are being attacked by the lerp psyllid across 6,000 acres (San Diego County, 261B). Eucalyptus trees in Santa Clara County (M262A, 261A) are also reported to be attacked by this insect over a much smaller area. These insects secrete copious amounts of honeydew and cause premature leaf drop. The honey results in sooty mold growth and the extensive leaf defoliation weakens trees and can increase their susceptibility to injury from other insects and diseases, and contributes to premature death of highly susceptible species.

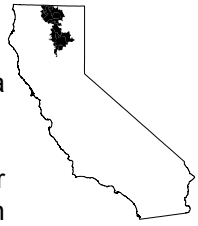
261A

M262A

Native Insects

Bark Beetles

Jeffrey Pine Beetle
Dendroctonus jeffreyi
Contributions by: Beverly Bulaon, Danny Cluck, Tom Coleman, Joel Egan, and Amanda Garcia-Grady



M261D

Scattered individual Jeffrey pine mortality (averaging approximately one tree per acre over 4,000 acres) was observed along Highway 139 on the Modoc National Forest, between Said Valley Reservoir and the Hayden Hill turnoff (Lassen County, M261D). In other areas of northeastern California, Jeffrey pine mortality declined in most locations previously described as having significant Jeffrey pine beetle activity in the 2007 and 2008 California Pest Conditions Reports (e.g. Campbell Mountain, Lassen National Forest, Lassen County, M261D and along Highway 89 near Truckee, CA, Tahoe National Forest, Nevada County, M261E).

M261E

Jeffrey pine beetle activity increased in individual trees and in small groups of trees throughout the Lake Tahoe Basin Management Unit in 2009 (El Dorado and Placer Counties, M261E). Mortality occurred around the perimeter of Fallen Leaf Lake in small groups of

Figure 3: Jeffrey pine beetle-caused mortality near Fallen Leaf Lake, Lake Tahoe Basin Management Unit.

Photo: J. Egan

M261E

Figure 4: Jeffrey pine beetle pitch tubes on a tree injured in the 2007 Angora fire.

Photo: J. Egan

5-25 trees (El Dorado County, M261E). Adjacent to Fallen Leaf Lake Campground, grouped mortality increased in trees that averaged 20" DBH from 10 to 25 trees between 2008 and 2009. Jeffrey pine beetle-caused mortality continued in scattered groups of 5-15 trees and large diameter individual pines along State Highway 89 between Meyers and the junction of State Hwy 89 and State Hwy 88 into Hope Valley. Mortality was similar to 2008 levels as grouped mortality centers expanded in 50% of 2008 pockets and new mortality was detected in approximately ten new groups and individually scattered, large-diameter (>30" DBH) Jeffrey pines. Jeffrey pine beetle also caused mortality in 3-4 tree groups adjacent to South Lake Tahoe High School and Panther Road. These pines had severe fire injury (moderate to severe bole char and >60% crown kill) from the 2007 Angora Fire.

Jeffrey pine beetles continued to attack physiologically stressed Jeffrey pines on the Sequoia National Forest in 2009 (Kern County, M261E). Mortality occurred in small groups (≤3 trees) of large diameter (range 20-55" DBH) trees on poor sites across 1,000 acres between Forest Service Road 22S12 and Horse Meadows Campground. Seventy-five percent of attacked trees had moderate to severe bole char and no crown kill from the McNally Fire of 2002, while 25% had no fire injury at all. Jeffrey pine beetles also caused mortality across 50 acres in trees that averaged 13" DBH in small scattered groups of 2-5 trees at a rate of one group for every two acres near Burton Camp, Sequoia National Forest. Trees were physiologically stressed from fire-injury, dwarf mistletoe, and poor site conditions.

M262B

Jeffrey pine mortality continued in the area northwest of Big Bear Lake on the San Bernardino National Forest (San Bernardino County, M262B). Newly infested trees were detected around Grays Peak Trailhead and adjacent to private land in Fawnskin; tree mortality was static from 2008, covering approximately 280 acres.

Mountain Pine Beetle

Dendroctonus ponderosae

Contributions by: Beverly Bulaon, Danny Cluck, Tom Coleman, Joel Egan, Amanda Garcia-Grady, Jack Marshall, Don Owen and Cynthia Snyder

M261D

Extensive mortality of whitebark pine was observed over approximately 80 acres on the northern flank of Mt. Shasta in the Bolam Bench area, Shasta-Trinity National Forest (Siskiyou County, M261D). Trees heavily infected with limber pine dwarf mistletoe (*Arceuthobium cyanocarpum*) and experiencing a severe winter drought cycle (2006-2009)

Figure 5: Extensive whitebark pine mortality on Mt. Shasta, Shasta-Trinity NF, caused by mountain pine beetle in association with limber pine dwarf mistletoe and drought.

Photo: C. Snyder

M261D

are being attacked and killed by mountain pine beetle.

Figure 6: Whitebark pine mortality on Mt. Shasta, Shasta-Trinity NF, caused by mountain pine beetle in association with limber pine dwarf mistletoe and drought.

Photo: C. Snyder

On research plots east of Tamarack Flat, Goosenest Ranger District, Klamath National Forest (Siskiyou County, M261D), mountain pine beetle is causing scattered mortality of lodgepole and ponderosa pines. The plots encompass an area of approximately 1,500 acres, but mortality extends over a larger area. Comparison of current versus past infestation rates indicate a declining outbreak. Cumulative mortality in the most heavily impacted areas exceeds 80% over the past several years. Mountain pine beetle killed scattered western white pine growing in serpentine soils on Horse Mountain, Six Rivers National Forest (Humboldt County, M261A). Some of the pines were also infested with dwarf mistletoe and armillaria root disease (*Armillaria* sp.).

M261A

Throughout northeastern California in 2009, mountain pine beetle-caused tree mortality continued at various levels in lodgepole pine stands. Some areas that had high levels of tree mortality over the past three to four years, such as Mt. Bidwell in the northern Warner Mountains, experienced a decrease in mortality due to the depletion of suitable host material. Mountain pine beetle activity continued to increase in adjacent stands on Yellow Mountain and Dismal Swamp in the northern Warner Mountains where suitable host material still exists (Modoc County, M261G). Mortality of lodgepole and whitebark pine in the South Warner Mountains near Patterson Guard Station also continued in 2009 where several thousand acres are affected. The Warner Mountains continue to have the most significant bark beetle-caused tree mortality in northeastern California forests.

M261G

Mountain pine beetle activity continued in lodgepole pine near Lake Davis, Plumas National Forest, on 300 acres (Plumas County, M261E). On the Tahoe National Forest, beetle activity along Alder Creek has finally decreased as suitable host material has been depleted and thinning projects have opened up dense stands and increased species diversity. Currently these treated areas appear to be resistant to additional mountain pine beetle activity (Nevada County, M261E).

M261E

Figure 7: Lodgepole pine mortality caused by mountain pine beetles near Caples Lake, Eldorado NF.

Photo: J. Egan

M261E

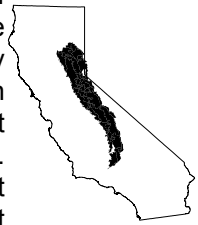
Lodgepole and whitebark pine mortality continued to decrease at High Meadows, Lake Tahoe Basin Management Unit (El Dorado County, M261E). In 2009, beetles attacked large diameter (22-29" DBH) lodgepole pines spatially adjacent to trees killed in 2008. Low oleoresin exudation from attacked trees indicated severe physiological stress, likely from overstocking (basal area averaged 360 ft^2/acre) and multiple years of below average precipitation. Stalactiform canker rust (*Cronartium coleosporioides*) infection was common throughout these stands but rust-infected trees were not preferentially attacked. Mountain pine beetle activity was minimal in drainages near Ward Creek, Lake Tahoe Basin Management Unit (El Dorado County, M261E) and near Eagle Meadows, Stanislaus National Forest (Tuolumne County, M261E) where activity was reported in 2008.

Mountain pine beetle activity increased around the perimeter of Caples Lake and along State Hwy 88 on the Eldorado National Forest (El Dorado County, M261E) in scattered, 20 tree groups of dense lodgepole pines (480 ft^2/acre of basal area) where trees averaged 20" DBH. Extensive grouped mortality also occurred in drainages west of Caples Lake that increased approximately 80% from 280 to 500 trees killed from 2008 to 2009. Mortality occurred in pines that averaged 11" DBH in dense stands (400-600 ft^2/acre of basal area) where 10% of the lodgepole mortality had stalactiform blister rust and 20% were infected with western gall rust (*Endocronartium harknessii*).

Mountain pine beetle activity increased near June Mountain and Gibbs Lake on the Inyo National Forest (Mono County, M261E). On June Mountain, mortality in lodgepole and whitebark pines and was most extensive along high-elevation ridges and on north-facing slopes. Mortality rates increased from 15% to 50% in severely impacted stands. Beetles attacked individual logdepole pines and groups (2-25 trees) of whitebark pines between the ski runs. All trees appeared susceptible regardless of diameter, age class, or injury. Upper ridge stands composed of whitebark pine with quaking aspen and/or red fir had minimal pine mortality. Mortality also increased near Gibbs Lake in isolated, large-diameter (>25" DBH) lodgepole pines and in groups of dense stands (240-300 ft^2/acre of basal area) of lodgepole and/or whitebark pines of all ages and size classes. The largest group kills of lodgepole and whitebark pine mortality recorded were 150 and 27 trees, respectively, where mortality has expanded to adjacent trees annually since 2006. On the north-facing

mountain above Gibbs Lake, up to 50% of all lodgepole and/or whitebark pines were successfully attacked in 2009.

Mountain pine beetle activity continued at reduced rates compared to 2008 levels of mortality in isolated, large diameter sugar pines (>35" DBH) in various locations in the central and southern Sierra Nevada range. Mortality along the Western Divide Highway on the Sequoia National Forest (Kern County, M261E) and near the Tuolumne Grove in Yosemite National Park (Mariposa County, M261E) occurred in approximately one dominant sugar pine every ten acres. Attacked trees were also infected with white pine blister rust. Ten western white pines were also killed near Bear Mountain, Stanislaus National Forest (Calaveras County, M261E); trees had branch and bole infections by white pine blister rust (*Cronatrium ribicola*).

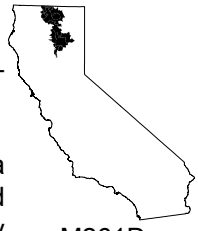


M261E

In southern California, mountain pine beetle killed single-leaf pinyon pine around the Cougar Crest Trailhead, San Bernardino National Forest (San Bernardino County, M262B). Mortality was limited to five acres north of the trailhead and west of the Big Bear Discovery Center. Evidence of Heterobasidion (*Heterobasidion* sp.) and armillaria (*Armillaria* sp.) root rots were found in previously killed pine stumps, and likely contributed to the continuing tree mortality.

M262B

Western Pine Beetle
Dendroctonus brevicomis
Contributions by: Beverly Bulaon, Danny Cluck, Tom Coleman, Joel Egan, Amanda Garcia-Grady, Don Owen, Tom Smith and Cynthia Snyder



M261D

Western pine beetle-caused tree mortality was scattered in small pockets of ponderosa pine across northwestern California. Multiple years of drought combined with high stand density were contributing factors. In particular, the McCloud Flats area on the Shasta-Trinity National Forest (Siskiyou County, M261D), had extensive mortality due to overstocking, drought, and black stain root disease (*Leptographium wageneri*). Another notable area where extensive mortality occurred was in the Oak Bottom Campground, Whiskeytown National Recreation Area (Shasta County, M261A), where more than125 dead ponderosa pine trees were removed from the campground in early spring. Fire injury from the many extensive wildfires of 2008 also contributed to pockets of mortality observed in 2009.

M261A

Western pine beetle-caused ponderosa pine mortality was detected at a number of locations in the Shingletown area (Shasta County, M261D) where an exceptionally dry spring in 2008 resulted in extreme drought stress by mid summer of 2008. At the CALFIRE Fire Station

Figure 8: Removal of ponderosa pine after attack by western pine beetle at Oak Bottom Campground, Whiskeytown Lake NRA.

Photo: C. Snyder

in Shingletown (a 40 acre mixed-conifer parcel), two pockets of mortality were detected in April and May of 2009. These groups were composed of trees killed in late 2008 that overwintered with green foliage. Between May and mid August 2009, 11 additional trees were killed by western pine beetle.

M261D

Scattered mortality of ponderosa pine occurred over approximately 100 acres of pine and oak woodland at Black Ranch and adjoining properties near Johnson Park (Shasta County, M261D). The western pine beetle is the principal cause of mortality with drought and dwarf mistletoe serving as predisposing factors. A similar situation is occurring on residential properties along South Cow Creek Road west of Whitmore, Shasta County. Here also, dwarf mistletoe and drought are contributing to scattered western pine beetle-caused mortality of ponderosa pine.

Two pockets of dead and dying ponderosa pine were noted on the Montesol Ranch in northern Napa County (263A). All had lower bole galleries of western pine beetle. No root diseases or turpentine beetles were found in association with the beetle-killed trees.

263A

Western pine beetle-caused tree mortality increased across northeastern California with some group killing observed in a few locations. Specific areas of activity were in Lake Britton State Park and adjacent areas on the Lassen National Forest (Shasta County, M261D), where up to 200 dead trees were observed in 12 groups spanning 300 acres.

Approximately six large group kills (~20-30 ponderosa pines each) were also observed on the Plumas National Forest (Butte County, M261E), east of Lake Oroville, and on the Tahoe National Forest (Nevada County, M261E), east of Bullards Bar Reservoir. Increased western pine beetle activity was also reported from areas burned in 2008 near Concow Reservoir (Butte County, M261E).

M261E

Increased levels of western pine beetle activity attack were detected throughout the central and southern Sierra Nevada range, particularly in Amador, El Dorado, Calaveras, Nevada, Placer, and Tuolumne Counties (M261E). Scattered groups of mortality occurred primarily in the true pine belt from 1,500 to 4,000 feet in elevation. Although the number of attacked trees in 2009 increased over 2008 levels, mortality was still less than anticipated with the ongoing drought.

A high amount of mortality occurred over approximately two acres in the Grizzly Flats area (El Dorado County, M261E) where stands were underburned to reduce fuels and protect the community from wildfire. The burn was hotter than anticipated and scorched most of the trees. Tree mortality reached nearly 100% throughout the treated area due to western pine beetle and other bark beetles.

Figure 9: A group of 50 ponderosa pines killed by western pine beetle attacks in the Forest Creek Plantation, Stanislaus NF.

Photo: J. Egan

Western pine beetle also caused mortality throughout overstocked ponderosa pine plantations in the southern Sierra Nevada range groups of trees (6-100 trees/group) encompassing 2-5 acres each. Several 25-60 tree groups were killed in 30 year old plantations near the Grizzly Canyon Trail, Eldorado National Forest (Placer County, M261E); about half of the plantations where the tree mortality occurred were masticated in 2008. Western pine beetle attacked and killed 20 pines that had previous *Ips*-caused topkill and averaged 16" DBH near Sweetwater Campground along Highway 120 and in 30-tree groups on Mount Lewis,

Figure 10: Western pine beetle-killed natural stand of large diameter ponderosa pines in east of Central Camp Road, Sierra NF.

Photo: B. Bulaon

Figure 11: Ponderosa pine trees killed by western pine beetle in a residential development, along Highway 41 in Mariposa County.

Photo: B. Bulaon

Stanislaus National Forest (Tuolumne County, M261E).

Near Forest Creek on the Stanislaus National Forest (Alpine County, M261E), mortality continued in stands consisting of 80% ponderosa pine (trees averaged 15" DBH) with a stand density index of 350. Six new groups of mortality occurred and averaged 30 trees per group (range 20-100). Overall, 18 groups of mortality have been detected from 2006-2009 and approximately 540 trees were killed in this 230 acre plantation. Near Breckenridge Mountain on the Sequoia National Forest (Kern County, M261E), western pine beetle activity increased in ponderosa pine plantations with scattered groups of mortality encompassing 5-10 trees each.

Western pine beetle-caused tree mortality also increased in naturally regenerated stands throughout the southern Sierra Nevada range in 2009. Along Highway 120 west of Yosemite National Park on the Stanislaus National Forest (Tuolumne County, M261E), mortality occurred in scattered large-diameter pines (~35" DBH) and in groups of smaller diameter (~15-30" DBH) trees. Affected stands were dense (basal area ranged from 200-280 ft^2/acre) and had an extensive understory component of *Arctostaphylus* sp. or *Ceanothus* species. Mortality also occurred in six large-diameter (~53-67" DBH) ponderosa pines injured in a 2005 prescribed fire near Lily Creek, Stanislaus National Forest (Tuolumne County, M261E).

M261E

Western pine beetle-caused mortality occurred in large-diameter roadside trees (~11-38" DBH) near Browns Creek and Whiskey ridge and along Central Camp and Cedar Valley Roads, Sierra National Forest (Mariposa County, M261E) that were stressed due to soil compaction and drought. Additional tree mortality on the Sierra National Forest occurred along Highway 41 (Mariposa County, M261E) in small groups of ponderosa pines that were located in a residential development, and along Big Creek Road (Fresno County, M261E) in pines adjacent to untreated slash piles.

In southern California, western pine beetle-caused mortality continued in Crystal Lake Campground, Angeles National Forest (Los Angeles County, M262B). High-value, large diameter ponderosa pines succumbed to bark beetle attacks near established camp sites. Twelve trees in the campground were killed in 2009 over an estimated 15 acres. Level of infestation and tree mortality was constant from 2008. Fire-injured Coulter pine succumbed to western pine beetle attacks on the Pauma Indian Reservation (San Diego County, M262B). Mortality of 13 Coulter pines spanning ten acres occurred in remnant

M262B

M262B

M261B

M261D

M261E

stands that were impacted by the Poomacha fire on the northwestern edge of Palomar Mountain.

Red Turpentine Beetle
Dendroctonus valens
Contributions by: Beverly Bulaon, Danny Cluck, Joel Egan, Amanda Garcia-Grady, Don Owen, Tom Smith and Cynthia Snyder

During 2009, red turpentine beetle attacked mature, fire-killed ponderosa pine in many of the 2008 fire areas across northwestern California. Attacks on some of the surviving pines in the Back Fire, Upper Lake District, Mendocino National Forest (Lake County, M261B), were typical with the lower five feet of the bole having higher numbers of pitch tubes. Many of the attacked trees also had evidence of western pine beetle attacks higher on the bole.

The red turpentine beetle colonized all ponderosa pines killed by western pine beetle at the CALFIRE Shingletown Fire Station (Shasta County, M261D) as well as unsuccessfully attacking 14 nearby pines that were not attacked by western pine beetle. Two ponderosa pines had between 50 and 100 red turpentine beetle attacks each after wood chips from some of the killed pines were spread around the bases of these two live trees.

Red turpentine beetle activity continued this year at Merrill Campground, Lassen National Forest (Lassen County, M261D) in ponderosa and Jeffrey pine. Attacks were on trees previously injured during campsite reconstruction. Pitch tubes were also observed in the adjacent Eagle and Aspen campgrounds, where attacked trees appeared to be at the edges of Heterobasidion root disease centers, or within overstocked stands with high levels of soil compaction. There are approximately five acres currently affected by red turpentine beetle and other bark beetles which are causing tree mortality; mortality may continue as stand conditions remain highly susceptible to bark beetle attacks over more than 400 acres in this recreation area.

Red turpentine beetle activity was also observed in prescribed and wildfire areas in northeastern California such as the 2008 Concow Fire, Plumas National Forest (Butte County, M261E). This particular fire burned in late June 2008 after the peak flight period of red turpentine beetle (mid to late May in this area). Consequently, a significant number of attacks on fire-injured trees were not observed until June of 2009. A significant outbreak is occurring in Mountain Home State Forest (Tulare County, M261E) on sugar pines throughout the forest property. The beetle appears to be attacking mostly trees with good vigor and high live crown ratios and ignoring the poor phenotype trees that are infected with white pine blister rust.

Figure 12: Red turpentine beetle pitch tubes on ponderosa pine following the Back Fire on the Upper Lake District, Mendocino NF.

Photo: C. Snyder

Red turpentine beetle attacks increased in Jeffrey pines injured in the 2007 Angora fire along Panther Road and adjacent to South Lake Tahoe High School, Lake Tahoe Basin Management Unit (El Dorado County, M261E) and in large-diameter (>30” DBH) ponderosa pines injured in a 2005 prescribed fire adjacent to Lily Creek, Stanislaus National Forest (Tuolumne County, M261E).

Additionally, red turpentine beetles attacked fire-injured ponderosa and sugar pines after a 2008 prescribed burn north of Cow Creek on the

Stanislaus National Forest (Tuolumne County, M261E). Duff/litter depth was surveyed in adjacent units sampled in 2009 and averaged 7" depth to bare mineral soil (range 0.1"-24"). No beetle attacks occurred post-burning in 2008 and the earliest 2009 attacks were initiated in late April. Large diameter (>30" DBH) pines were surveyed for beetle attack and averaged 41" DBH (range 30-78"), 4% live crown kill, and 20% had 1-2 quadrants with high severity bole char. Red turpentine beetle attacks coincided with bole char and pitch tubes averaged 8 per tree (range 1-84). Ponderosa and sugar pines were spatially inter-mixed throughout this location; however, red turpentine beetles attacked approximately three times the number of sugar pines (47%) compared to ponderosa pines surveyed (18%).

M261E

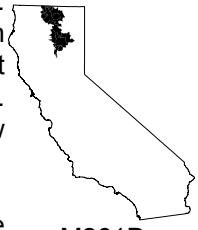
Engraver Beetles

Fir Engraver
Scolytus ventralis
Contributions by: Beverly Bulaon, Danny Cluck, Joel Egan, Amanda Garcia-Grady, Don Owen, Tom Smith and Cynthia Snyder

Most of northwestern California experienced slightly elevated levels of fir engraver beetle activity. Most of the affected areas were closely associated with overstocking and Heterobasidion root disease. A notable exception is a band of mortality at about 5,600 feet elevation around Castle Lake, Shasta-Trinity National Forest, where drought-stressed trees were attacked by fir engraver beetle (Siskiyou County, M261A).

M261A

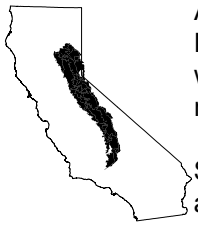
Scattered fir mortality occurred across most of northeastern California, above 2008 levels, in response to the drier than normal conditions. Most of the affected areas are closely associated with lower average annual precipitation zones (<30"/year). However, one or more of the following contributing factors are present in nearly every affected stand: overstocking, dwarf mistletoe, cytospora canker, and Heterobasidion root disease. Significant white fir mortality (approximately two trees/acre) was observed on the Lassen National Forest, and on private timber land, from Cornaz Peak to Sugarloaf Peak and east of the Thousand Lakes Wilderness (about 20,000 acres affected, Shasta County, M261D). Increased fir engraver activity was also reported from areas burned in 2008 near Concow Reservoir (Butte County, M261E).



M261D

There was a significant increase in fir engraver beetle activity throughout the Lake Tahoe basin, particularly on the northern and western shores of the lake. The beetles caused topkill of larger trees and mortality of small diameter trees over a large area (Placer County, M261E). Small amounts of scattered mortality and topkill (1-2 trees/acre) occurred extensively along roadsides of Ward Creek, and topkill occurred in mature white fir near housing developments west of McKinney Bay along State Hwy 89. Fir engraver and drought-associated white fir mortality (1-2 trees/acre) and topkill (3 trees/acre) also occurred over 1,000 acres between Fallen Leaf Lake and Christmas Valley, as well as near Heavenly Creek (El Dorado County, M261E). Seventy percent of the tree mortality occurred in trees smaller than 12" DBH with subordinate crown positions, and 30% occurred in larger than 12" DBH trees with dominant crown positions. The foliage of this dying fir transitioned from green to red at a quick rate of 2-3 weeks and many faded by mid-May 2009.

Fir engraver activity was also widespread throughout the southern Sierra Nevada range and was most extensive on poorer sites in stands with high stocking levels and areas with Heterobasidion root disease; however, some amount of white fir topkill and whole tree mortality was detected across all levels of forest density and site class. Along Highway 108 near Beardsley Reservoir, Stanislaus National Forest (Tuolumne County, M261E), fir engraver activity occurred initially in the tops of larger diameter white fir (>25" DBH) and progressed to whole-tree mortality in these and adjacent smaller diameter (<15" DBH) fir.



M261E

M261D

Along the Silver Fork Road (El Dorado County, M261E) and State Hwy 88 (Amador County, M261E) on the Eldorado National Forest, mortality in higher elevation (5,500-7,000 ft) red/white fir stands occurred primarily in white fir at a rate of one tree every four acres. This mortality occurred primarily in mixed conifer stands that had 200-500 ft^2/acre of basal area.

Scattered fir engraver-caused mortality occurred on the Kern Plateau and in a 200 acre area near Sherman Pass, Sequoia National Forest (Kern County, M261E), at a rate of 1-2 trees/acre, primarily (70%) in white and red fir in subordinate crown positions. These trees typically had dwarf mistletoe and cytospora canker infection. A pocket of about 20 recently dead firs with fir engraver galleries was found ten miles north of Strawberry in Tuolumne county (M261E), nearby were several stumps with fresh Annosum conks. Fir engraver beetles also caused mortality in white fir trees near Horse Meadow, Sequoia National Forest (Kern County, M261E) over 1,000 acres, at a rate of 1-2 trees/acre (trees averaged 15" DBH); trees had been injured in the 2002 McNally fire.

Pine Engraver
Ips pini
Contributions by: Danny Cluck, Amanda Garcia-Grady and Cynthia Snyder

Pine engravers are primarily slash-breeding insects which normally infest only slash, and diseased, injured, or drought-stressed pine trees. In the La Honda pre-commercial thinning project (600 acres) on the Goosenest Ranger District, Klamath National Forest (Siskiyou County, M261D), thinned and piled pole-size ponderosa pine trees were infested with pine engraver beetles. Bundles are remaining on-site to allow the trees to dry out prior to being chipped, to reduce the haul cost. Thousands of acres have been treated in a similar manner over the past several years on the Goosenest Ranger District without any elevated level of mortality in the residual live trees. Piles of cut trees also exist on approximately 200 acres following thinning projects on Scott Bar Mountain, Scott River Ranger District, Klamath National Forest (Siskiyou County, M261A).

Figure 13: Piles of boring dust created during attacks by pine engraver beetle in ponderosa pine slash on the Goosenest RD, Klamath NF.

Photo: C. Snyder

M261A

The pine engraver beetle caused topkill and whole tree mortality of ponderosa and Jeffrey pine near Blue Mountain, Modoc National Forest, where thinning activities created green host material within the stand (Modoc County, M261G). Trees were cut in the fall of 2008 and left scattered throughout the stand in doodle piles. These trees were of a larger average diameter (up to 14" DBH) than found in most pre-commercial thinning operations and may explain why this material didn't dry in time to prevent pine engraver population build-up. Additional green doodle piles were created in July of 2009 in the same area. These new piles and adjacent residual trees were subsequently attacked. This is the first

Figure 14: Mortality in residual trees associated with an *Ips pini* outbreak in green slash near Blue Mountain, Modoc NF.

Photo: D. Cluck

M261G

noted case of pine engraver beetles causing significant tree mortality as a result of thinning operations on the Modoc National Forest.

California Fivespined Ips
Ips paraconfusus
Contributions by: Beverly Bulaon, Tom Coleman, Joel Egan and Tom Smith

California fivespined ips activity increased throughout the central and southern Sierra Nevada range in conjunction with western pine beetle and red turpentine beetle. El Dorado County reported a serious increase of the California fivespined Ips-beetle related to slash piles left on the ground. The economic return for timber has been so low and many lumber mills have closed, resulting in landowners selling sawtimber for firewood and wood remaining on-site longer than normal. The increased number of slash piles have acted as breeding centers for *Ips* beetles and facilitated spread to surrounding standing trees.

M261E

Ips spp. activity increased and was often paired with attacks by western pine beetles or occurred in isolation after populations increased in slash or snow breakage material in the southern Sierra Nevada range. Ponderosa pine mortality and topkill increased in multiple plantations on the Bass Lake Ranger District, Sierra National Forest (Mariposa County, M261E). Beetle populations increased in injured limbs and subsequently infested up to 15% of all trees in stands with snow breakage. *Ips* populations also increased in shaded log decks and piled slash created in spring 2009 thinning treatments occurred in plantations along Tollhouse and Linson Roads, High Sierra Ranger District, Sierra National Forest (Fresno County, M261E). Infested logs were removed and slash was treated by late May; however, by this time *Ips* populations attacked green trees and caused mortality in 15 small diameter trees (<8" DBH) in an adjacent, untreated plantation.

Figure 15: A high level of *Ips* activity in untreated ponderosa pine slash piles adjacent to a plantation, High Sierra RD, Sierra NF

Photo: B. Bulaon

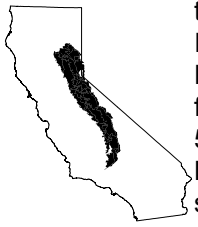
On the Stanislaus National Forest, *Ips* and subsequent western pine beetle attacks resulted in topkill and whole tree mortality in a stand of dense ponderosa pines along Forest Service Road 2N07 (Tuolumne County, M261E). At the base of Summit Ridge, also on the Stanislaus National Forest (Tuolumne County, M261E), a deck of pole-sized logs were heavily infested by

Figure 16: *Ips paraconfusus*-caused topkill in Jeffrey pines near Sherman Pass, Sequoia NF.

Photo: J. Egan

Figure 17: *Ips* attacks in very small diameter ponderosa pine along highway 108, Stanislaus NF.

Photo: B. Bulaon


M261E

the California fivespined Ips and removed before beetles emerged. California fivespined Ips also caused mortality alongside Highway 108 near Long Barn, Stanislaus National Forest (Tuolumne County, M261E) in a small thicket of 25 sapling-sized pines that were fire-injured when slash piles were burned in 2008. *Ips* beetles caused topkill in a group of 50 Jeffrey pines (trees averaged 15" DBH) near Fish Creek and Sherman Pass, Sequoia National Forest (Kern County, M261E). Mortality occurred in five of these pines after subsequent attacks by Jeffrey pine beetle and *Ips emarginatus* beetles.

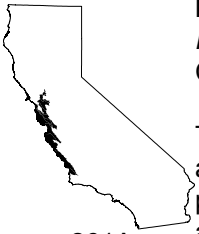
In southern California, Coulter pine on the Trabuco Ranger District, Cleveland National Forest, succumbed to attacks by the California fivespined Ips in areas along Highway 74 (Riverside County, M262B). Dry sites and dense pockets of pine most likely led to the mortality of ten pines near the Firefighter Memorial Picnic Area.

Pinyon Ips
Ips confusus
Contributions by: Tom Coleman


M262B

Pinyon ips killed an estimated 45 single-leaf pinyon pine across 30 acres on the San Bernardino National Forest (San Bernardino County, M262B). Tree mortality likely resulted from the interaction of black stain root disease and beetle attacks. Black stain root disease was also found in three pockets south of Arrastre Creek. Pinyon ips-caused mortality also continued in areas along Tecuya Ridge, Mt. Pinos Ranger District, Los Padres National Forest (Kern County, M262B). Dense stands of pine contributed to tree mortality that covered an estimated 30 acres.

Ips
Ips spp.
Contributions by: Jack Marshall and Tom Smith


261A

Three years of drought resulted in an increase in activity of *Ips* beetles in the Monterey area (Monterey County, 261A). *Ips* beetles and red turpentine beetles attacked Monterey pines throughout the city. Attacked trees were often infected with pitch canker; the beetle attacks caused the trees to finally succumb. All ages and sizes of pines were affected.


263A

Along the bluffs south of the town of Mendocino (Mendocino County, 263A), pine engraver beetles killed about two dozen Bishop pine. Of adult beetles recovered, 70% were *Ips plastographus maritimus* and 30% were *Ips mexicanus*.

Wood Boring Beetles

Flatheaded Fir Borer
Melanophila drummondi
Contributions by: Beverly Bulaon, Danny Cluck, Joel Egan, Amanda Garcia-Grady, Jack Marshall, and Don Owen

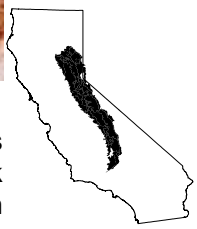
Flatheaded fir borer continues to be a factor in the dieback and decline of Douglas-fir on low elevation, drier sites in the general vicinity of Shasta Lake, including private lands near Cedar Creek, Little Cow Creek, Gregory Creek, and the Pit River Arm of Shasta Lake (Shasta County, M261A). Trees exhibit various degrees of resin streaming and branch and top dieback, symptoms that are typical of chronic stress and attack by the flatheaded fir borer and other borers. Dissection of a number of trees revealed that the Douglas-fir engraver, *Scolytus unispinosus*, was attacking the tops and limbs of trees colonized by *M. drummondi*.
Flatheaded fir borer activity continued and spread over a larger area (100 acres total)

Figure 18: Flatheaded fir borer in dying Douglas-fir on the Hat Creek RD, Lassen NF.

Photo: B. Woodruff

in drought stressed Douglas-fir on the northeast flank of Brown's Butte and in a new activity center south of Lake Britton, Lassen National Forest (Shasta County, M261D). Many Douglas-fir trees in this same area exhibited substantial resin flow in response to attacks, which was not observed in 2008. This borer was also found in about 200 dead and dying, large diameter Douglas-fir over 600 acres south of Antelope Lake on the Plumas National Forest (Plumas County, M261E). These trees were growing on a southwest facing, rocky slope which may have contributed to more extreme drought stress than in surrounding stands.

M261D



M261E

Inland Douglas-fir populations in Santa Cruz, Napa, Sonoma, Mendocino, Lake, and Humboldt Counties (261A, 263A and M261B) have been dying for two to three years. Infestations are greater in dry inland areas where Douglas-fir has encroached over the years into oak woodlands. Observations on these sites of many green, thin-crowned standing trees with mid-bole pitch streamers, is indicative that many more trees may continue to die in the near future. Many of the green, symptomatic trees observed in 2008 died in 2009.

261A

In Humboldt County (263A), black stain root disease was associated with the flatheaded fir borer attacks of Douglas-fir off Old Briceland Road near Garberville. In northern Napa County (263A), borer attacks were also prevalent in pockets of mixed conifer and hardwoods on the Montesol ranch. In southern Lake County (M261B), borer attacks were scattered in a mixed stand up Western Mine Road. In Santa Cruz County (261A), several acres in the Las Cumbres area east of Castle Rock State Park have dead and dying Douglas-fir due to a combination of Schweinitzii root disease and attacks by flatheaded fir borer. There was also a high concentration of flatheaded fir borer in Sonoma County (263A) occurred off Trinity Road, northeast of Glen Oaks.

263A

Along the Rubicon River on the Eldorado National Forest (Placer County, M261E), flatheaded and roundheaded fir borers were associated with mortality in isolated, large-diameter (25-32" DBH) Douglas-fir located on steep slopes with shallow, rocky soils.

California Flatheaded Borer
Melanophila californica
Contributions by: Tom Coleman and Jack Marshall

M261B

A pocket of large sugar pines (average 21.5" DBH) was killed by California flatheaded borer on Boggs Mountain Demonstration State Forest (Lake County, M261B). Trees may have been predisposed to attack as they occurred near a dried watercourse with a low water table. Density may also have played a role on the dry site, with 280 ft^2/acre of basal area.

California flatheaded borer continued to kill Jeffrey pine along Pine Mountain and Tecuya Ridge, Mt. Pinos Ranger District, Los Padres National Forest (Kern County, M262B). Levels of tree mortality were constant from 2008, impacting approximately 100 acres. Mortality most likely resulted from increased competition in dense stands and interaction with Heterobasidion root disease found throughout the area.

M262B

Defoliators

Figure 19: Black oaks, above a mixed conifer stand, defoliated by black oak leaf miner, Blue Canyon.

Photo: D. Cluck

Figure 20: Black oak leaf miner adult on elongating black oak shoot.

Photo: D. Cluck

M261E

Black Oak Leaf Miner
Eriocraniella aurosparsella
Contributions by: Danny Cluck and Amanda Garcia-Grady

Blotch mining of California black oak leaves by this insect increased in intensity and affected a much larger area in 2009 near Blue Canyon, Tahoe National Forest (Placer County, M261E). This is the first time since this activity was first detected in 2005 that the affected area has significantly increased. Nearly every black oak was partially defoliated over approximately 7,000 acres of mixed conifer and hardwood forest along Highway 20 near Bear Valley and along Interstate 80 from Baxter to Emigrant Gap. This is the fifth year of partial defoliation in some areas but neither tree mortality nor individual branch kill has been detected.

Douglas-fir Tussock Moth
Orgyia pseudotsugata
Contributions by: Kim Camilli, Danny Cluck and Tom Coleman

M262B

Douglas-fir tussock moth reached outbreak numbers south of Big Bear Lake primarily along the eastern edge of forest road 2N10, San Bernardino National Forest (San Bernardino County, M262B). This is the first year defoliation of white fir was detected; high levels of defoliation may continue in 2010. The last known activity of Douglas-fir tussock moth in the San Bernardino Mountains occurred in the early 1970's. White fir is primarily being defoliated over about 200 acres, but high densities of caterpillars are also feeding on Jeffrey pine. Trees commonly had 10-25% defoliation with some defoliation on white fir reaching 70%. Infestations occurred on about 90% of white fir in these forest stands.

Western Tussock Moth
Orgyia vetusta
Contributions by: Tom Coleman

Defoliation of coast live oak from the western tussock moth occurred in Marion Bear County Park in northern San Diego (San Bernardino County, M262B). Defoliation covered less

Table 3: Number of Douglas-fir tussock moth pheromone detection survey plots by trap catch for 2000-2009 for California

Year	Total # of Plots	NUMBER OF PLOTS WITH AN AVERAGE MOTH CATCH PER TRAP OF:													
		0<10	10<20	20<25	25<30	30<35	35<40	40<45	45<50	50<55	55<60	60<65	65<70	70<75	75+
2000	185	154	15	4	4	0	1	2	2	2	0	0	1	0	0
	100%	83%	8%	2%	2%		<1%	1%	1%	1%			<1%		
2001	183	95	57	13	10	6	0	1	1	0	0	0	0	0	0
	100%	52%	31%	7%	5%	3%		<1%	<1%						
2002	168	126	31	5	3	3	0	0	0	0	0	0	0	0	0
	100%	75%	18%	3%	2%	2%									
2003	163	53	42	11	11	10	14	13	3	1	4	0	1	0	0
	100%	32%	26%	7%	7%	6%	8%	8%	2%	1%	2%		1%		
2004	174	68	43	6	16	11	6	5	3	0	2	1	1	0	0
	* 93%	39%	25%	3%	9%	6%	3%	3%	2%		1%	<1%	<1%		
2005	195	139	15	11	7	4	3	2	3	1	0	0	0	1	1
	*95%	71%	8%	5%	4%	2%	2%	1%	2%	<1%				<1%	<1%
2006	164	98	26	8	8	5	3	4	3	4	2	0	1	1	1
	100%	60%	16%	5%	5%	3%	2%	2%	2%	2%	2%		<1%	<1%	<1%
2007	164	157	6	0	0	1	0	0	0	0	0	0	0	0	0
	100%	96%	4%			<1%									
2008	155	155	0	0	0	0	0	0	0	0	0	0	0	0	0
	100%	100%													
2009	147	144	3	0	0	0	0	0	0	0	0	0	0	0	0
	*93%	98%	2%												

*Some plots were not collected due to weather

Figure 21: Douglas-fir tussock moth defoliation of white fir on the San Bernardino NF.

Photo: T. Coleman

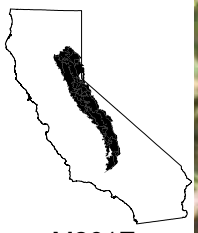
M261D

than five acres, impacting an estimated 12% of the stand. Defoliation ranged from minor to moderate levels, but has not caused tree mortality.

White Fir Sawfly
Neodiprion abietis
Contributions by: Danny Cluck, Amanda Garcia-Grady and Don Owen

Figure 22: White fir sawfly larvae feeding on white fir, Lassen NF.

Photo: A. Garcia-Grady



M261E

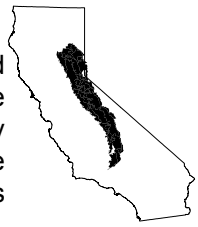
White fir sawfly continues to defoliate white fir on the Lassen National Forest and private land, expanding another 1,000 acres from last year. The 2009 defoliation occurred southwest of Antelope Mountain towards McCoy Flat (Lassen County, M261D). Injury ranged from light to heavy defoliation of older needles with most injury affecting understory trees and lower crowns of mid- and overstory trees. A visit to the previously defoliated area of 2008 revealed no further insect feeding or subsequent tree mortality. White fir sawfly activity was also noted in the Walker Mine area west of Lake Davis, Beckwourth District, Plumas National Forest (Plumas County, M261E) and around residential properties at Donner Lake (Nevada County, M261E).

341D

Pinyon Sawfly
Neodiprion edulicolus
Contributions by: Beverly Bulaon and Joel Egan

Pinyon sawflies caused severe defoliation along State Highway 168 on the Inyo National Forest (Inyo County, 341D) in a group of five single-leaf pinyon. This was the fall-winter generation as larvae were large and active in late summer 2009.

Lodgepole Pine Needleminer
Coleotechnites milleri
Contributions by: Beverly Bulaon and Joel Egan


M261E

Lodgepole pine needleminer in Yosemite National Park (Mariposa County, M261E) caused minimal defoliation in 2009 due to low populations levels. High numbers of predators were reared from sampled needles and likely contributed to the reduced populations. Injury levels were less than 1 needle per bundle. Pine mortality associated with lodgepole pine needleminer defoliation occurred near May Lake in 2008; these areas also had low levels of needleminer-caused needle injury in 2009.

Fruittree Leaf Roller
Archips argyrospila
Contributions by: Tom Coleman


M262B

High levels of defoliation from the fruittree leaf roller occurred in areas (~60 acres) northeast of Crestline and adjacent to Highway 138, San Bernardino National Forest (San Bernardino County, M262B). Defoliation of California black oak ranged from low to severe. Defoliation has been persistent in the area for several years, but tree mortality caused solely by this insect has not been observed.

California Tortoise Shell
Nymphalis californica
Contributions by: Cynthia Snyder


M261A

Hundreds of acres of *Ceanothus* spp. defoliation was noted in Douglas-fir plantations on Hoopa Tribal Land (Humboldt County, M261A). Hoopa Tribal Forestry showed interest in trying to rear California tortoiseshell butterfly to augment populations for the purpose of releasing Douglas-fir seedlings from shading by *Ceanothus* spp. Abundant populations throughout the state migrate at intervals of six or seven years in search of food sources.

Other Notable Insects

Western Pineshoot Borer
Eucosma sonomana
Contributions by: Danny Cluck, Amanda Garcia-Grady and Cynthia Snyder


M261D

Over 1,000 acres of ponderosa pine plantations on the Goosenest Ranger District, Klamath National Forest (Siskiyou County, M261D), have shown damage from western pineshoot borer infestation. Affected trees were often the dominant individuals in the plantation and infestation levels were generally about 50%. No mortality was associated with these attacks; only marked reduction in growth and occasional stem deformities.

Western pine shoot borer activity was also detected in 8-20 foot tall ponderosa and Jeffrey pines on 300 acres in the Lost Fire plantation, Hat Creek District, Lassen National Forest (Shasta County, M261D). Surveys indicated that Jeffrey pine was more likely to be attacked than ponderosa pine in previous years at this site. An attract and kill formulation was hand applied to individual trees (pheromone and insecticide combined) just prior to moth flight to reduce attack levels and minimize negative impacts on tree growth.

Twig Beetles
Pityophthorus spp. (possibily *P. collinus*), *Pityophthorus boycei*
Contributions by: Beverly Bulaon, Danny Cluck, Joel Egan, Amanda Garcia-Grady, and Bill Woodruff

Figure 23: Pupae and callow *Pityophthorus boycei* adults in lodgepole pine twigs.

Photo: J. Egan

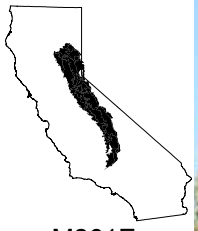
M261G

Twig beetles were found in dead twigs of whitebark pine in the South Warner Wilderness, Modoc National Forest, near Squaw Peak (Modoc County, M261G). Approximately 3,000 trees were affected over 150 acres. This is in an area where mountain pine beetle has killed hundreds of whitebark pines.

Lodgepole pine twig dieback increased in vegetation along Hwy 88 between Silver and Caples Lakes, Eldorado National Forest (Amador and Alpine Counties, M261E). Branch flagging occurred in trees that averaged 4" DBH (range 5-30" DBH) after successful attack by twig pruning beetles identified as *Pityophthorus boycei* by Dr. Donald Bright. Attacked twigs were generally less than 0.25" in diameter located on pole-sized pines (<6" DBH). Terminal branch mortality averaged 20% (range 5-50%). Beetle attacks started near mid-June, coincident with bud break for lodgepole pines in this area. Eighty percent of the twigs initially attacked had dwarf mistletoe or western gall rust infection; however, as beetle populations increased, attacks on uninfected twigs were common. Stalactiform blister rust was also evident in a few (3%) of the attacked trees. Attacked trees were located roadside, on poor sites with shallow, rocky soils. Beetles typically invaded twigs 6" from the axillary bud and excavated reproductive galleries directionally towards the bud. Periodic samples throughout 2009 indicated that beetle maturation can occur in approximately 4 weeks and it appeared at least 3 distinct generations of beetles were produced between mid-June and late September.

Figure 24: Branch flagging near Silver Lake, Eldorado NF, caused by *Pityophthorus boycei*.

Photo: J. Egan



M261E

Ponderosa Pine Tip Moth
Rhyacionia zozana
Contributions by: Don Owen

M261D

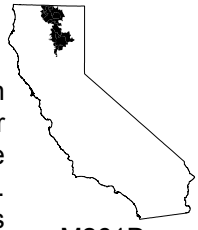
Ponderosa pine tip moth continued to damage ponderosa pine in plantations near Goose Valley (Shasta County, M261D), and near Fleener Butte north of Lookout (Modoc County, M261G). At both locations there is an increasing disparity in height between trees that have become stunted due to chronic infestations and trees that have received little damage. The tallest trees range from 20-25 feet in height, while the most heavily damaged trees range from 2-4 feet. Trees over 7 feet in height show little or no evidence of current damage. The infestation near Goose Valley is highly variable with pockets of damage scattered across several Sections. In one of the most severely damaged areas (~10 acres in size), approximately 80% of the trees are stunted from chronic infestation. The infestation near

Fleener Butte covers roughly 200 acres and most trees have reached a height were they are no longer damaged.

Gouty Pitch Midge
Cecidomyia piniinopis
Contributions by: Don Owen

Branch tip flagging caused by the gouty pitch midge was common for the third consecutive year across Hatchet Mountain, Shasta County. Scarring on branches indicates that the infestation was present prior to the onset of widespread branch flagging. The impact of the midge is greatest in areas with the poorest growing conditions. In stands of good site quality, many ponderosa pines have grown well in spite of being infested. Damage this year appears to be slightly less than the previous two years.

Pine Needle Sheathminer
Zelleria haimbachi
Contributions by: Cynthia Snyder


M261D

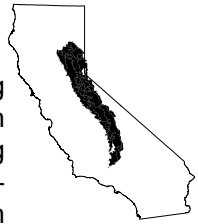
A 25 acre outbreak of pine needle sheathminer was found in ponderosa pine plantations in the Shasta View thinning project about 3 miles south of Deer Mountain, Goosenest Ranger District, Klamath National Forest (Siskiyou County, M261D). These plantations were thinned in the summer of 2009 and the trees with the greatest damage were removed. Long-term impacts should be minor. Significant defoliation by this insect rarely extends beyond 1-2 years.

Sequoia Pitch Moth
Synanthedon sequoiae
Contributions by: Don Owen


M261F

Sequoia pitch moth infestations were observed on ponderosa pines on residential properties in Redding and Whitmore, Shasta County (M261F). Trees at both locations had been pruned and were irrigated.

Pine reproduction weevil
Cylindrocopturus eatoni
Contributions by: Beverly Bulaon and Joel Egan


M261E

Pine reproduction weevils caused mortality in 50 acres of planted pine seedling stands along Road 222 on the Sierra National Forest (Mariposa County, M261E). Mortality occurred in 52 trees prior to 2008, 150 trees in 2008, and 35 trees in 2009. High levels of adult feeding were observed on live trees with slightly faded foliage and/or topkill. Treatments in mid-summer to eradicate infested seedlings and reduce competition from brush may have been effective as no new attacks were found by late summer 2009.

Redhumped Caterpillar
Schizura concinna
Contributions by: Beverly Bulaon and Joel Egan

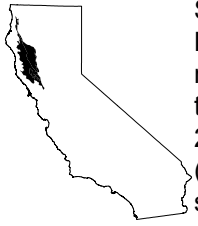
This caterpillar caused 10% crown defoliation in a single big leaf maple along Highway 108 on the Stanislaus National Forest (Tuolumne County, M261E). This was the first time the insect was detected on the tree and monitoring will continue.

M261E

Hepialid Caterpillar
Contributions by: Don Owen

A caterpillar in the family Hepialidae girdled the root collars of Nordmann fir seedlings at a Christmas tree plantation in Camino (El Dorado County, M261E). Caterpillars in this family are known as root feeders on a variety of plants, but damage to trees is rare. An attempt to rear the caterpillars to adults, for identification, was unsuccessful.

Incense Cedar Scale
Xylococculus macrocarpae
Contributions by: Jack Marshall



M261B

Scores of seedling- and small sapling-sized incense cedars near Salmina (Lake County, M261B) were infested with incense cedar scale. Heavy infestations led to either direct mortality or ensuing attacks by *Phloeosinus* sp. From random 1-square-inch counts along the stem of a representative 1" DBH sapling, the average crawlers per square inch equaled 22.8. Comparable with other research done on this pest, the lower bole had fewer crawlers (8.6 per square inch) than the upper half of the bole (37.0 per square inch). Many larger saplings remain infested with the scale. Infested stems and branches had a build-up of an unidentified, black, spongy, sooty mold.

Cedar Bark Beetle
Phloeosinus sp.
Contributions by: Don Owen

M261D

Scattered twig flagging on incense cedar was noted in the Shingletown area (Shasta County, M261D). Cedar bark beetles, *Phloeosinus* sp., were found feeding in the twigs. Drought stress was a likely contributor to the beetle activity.

Cooley Spruce Gall Adelgid
Adelges cooleyi
Contributions by: Jack Marshall

263A

In Humboldt County (263A) infestations by the Cooley spruce gall adelgid were noted on Sitka spruce in Eureka and Arcata, and inland on Douglas-fir near Maple Creek.

Douglas-fir Engraver Beetle
Scolytus unispinosus
Contributions by: Jack Marshall

Scattered, black stain diseased Douglas-fir were killed by the Douglas-fir engraver beetle near Sulfur Creek and Kuntz Canyon, tributaries of the Van Duzen River (Humboldt County, 263A). These were in young stands all harvested within the past 50 years. Also, scattered pole-sized Douglas-fir were killed in Lake County (M261B) in the upper reaches of Western Mine Road.

Redwood Bark Beetle
Phloeosinus sequoiae
Contributions by: Jack Marshall

One large redwood was killed in the Ukiah Valley (Mendocino County, M261B). The dry, interior valley site and significant soil compaction were likely contributing factors.

Douglas-fir Needle Midge
Contarinina sp.
Contributions by: Jack Marshall

263A

A *Contarinina* species had made unsellable several Douglas-fir Christmas trees grown south of Ft. Bragg (Mendocino County, 263A).

Western Oak Bark Beetle
Pseudopityophthorus pubipennis
Contributions by: Jack Marshall

This beetle continues to be commonly associated with dying trees infected with sudden oak death, ranging from Monterey County northward within coastal counties (263A, 261A).

261A

Tuliptree Scale
Toumeyella liriodendri
Contributions by: Tom Smith

The tulip tree scale has been reported as a major problem on *Liriodendron tulipifera* (tulip tree or yellow poplar) and deciduous magnolias in the cities of San Jose and Sunnyvale resulting in streets, sidewalks, and vehicles being covered with honeydew (Santa Clara County, 261A). Trees that have been attacked with repeated infestations for 4-5 years are declining and dying.

Asian Woolly Hackberry Aphid
Shivaphis celti
Contributions by: Tom Smith

The Asian woolly hackberry aphid attacked Chinese hackberry trees (*Celtis sinensis*) in San Jose and Sunnyvale and caused concerns regarding the honeydew on trees and sidewalks (Santa Clara County, 261A). Fortunately, few trees have shown any indications of serious decline or mortality.

Disease Conditions

Introduced Diseases

Pitch canker
Fusarium circinatum
Contributions by: Tom Gordon and Jack Marshall


261B

Pitch canker, caused by *Fusarium circinatum*, is a cause of dieback in Monterey pines in primarily coastal counties from San Diego (261B) in the south through San Francisco County (261A) and up into Sonoma County (263A) in the north. In Marin County (263A), pitch canker is causing extensive mortality in Bishop pine stands that developed after the Mt. Vision fire in 1995. Also, pitch canker continues to spread and intensify in and adjacent to the Point Reyes National Seashore area in western Marin County. Both Bishop pine and non-native Monterey pine are infected.


261A

This is in sharp contrast to the impact of pitch canker on Bishop pines in Monterey County (261A), where stands that developed after the Huckleberry Hill fire in 1987 have sustained only limited damage from pitch canker. Pitch canker is still evident throughout the San Francisco Bay Area but the intensity of the disease does not appear to be increasing in most areas. On the Monterey Peninsula, there has been an increase in the amount of activity by the pitch canker fungus. All ages of Monterey pine trees have been impacted throughout the city. This is a departure from the downward trend that has been evident since 2000.


263A

Statewide, pitch canker remains a problem of coastal forests, with Monterey pine being the most severely affected species, followed by Bishop pine.

Phytophthora Diseases

Phytophthora cinnamomi
Contributions by: Tom Smith and Jack Marshall


262A

Approximately a dozen blue oaks were determined to be declining and dying due to *Phytophthora cinnamomi* in a stand in the Marysville area (Yuba County, 262A). The site was downhill from a residence with extensive plantings of exotic landscape plants; these may have been the source of the infection.

Mature madrone trees were found to be infected with *P. cinnamomi* at sites in Sonoma and Napa Counties (263A). The infection foci at both sites appeared to be expanding over time, trees that had been dead for several years were located near the center of the foci and were surrounded by recently dead trees. Outside of the foci, there were trees with fading or stressed crowns. The sites were relatively isolated and the source of the inoculum is not known. Similar activity by the root disease on madrones was noted at China Camp State Park in Marin County (263A).

Two large Pacific madrone mortality centers, 1-3 acres in size, are located in the Palmer Creek drainage, a tributary drainage to Mill Creek west of Healdsburg in Sonoma County (263A). The centers were inspected in 2008, but isolations of *Phytophthora cinnamomi* were not successful until 2009.

Sudden Oak Death
Phytophthora ramorum
Contributions by: Janice Alexander, Kim Camilli, Susan Frankel, Chris Lee, Jack Marshall, Don Owen, and Katie Palmieri


M261E


M261F

Statewide Survey

California's 2009 northern Sierra Nevada stream-based detection survey for P. ramorum was conducted in Butte, Yuba, Nevada, Placer, and El Dorado Counties for the sixth consecutive year (M261E, M261F). A total of 31 watercourse sites in the Feather, Yuba, Bear, American, and Consumnes Rivers were surveyed during May and June using rhododendron leaves as bait for *Phytophthora* spp. This produced 118 sets of baits that were cultured at the University of California, Davis (UCD) for the presence of *P. ramorum*. The pathogen was not detected in any of the samples, although other *Phytophthora* spp. were recovered.

Monitoring – Aerial and Ground Surveys


263A


261A

Sudden oak death mortality rates are reduced from prior years based on information collected during the FHP-FS Sudden Oak Death aerial survey. Approximately 6,000 acres of mortality were mapped in Marin, Napa, Sonoma, parts of Solano, Lake, and Mendocino Counties (263A). That represents about half of what was mapped in 2008 and one tenth of the acreage mapped in 2007 in the same area. Mortality for tanoak and coast live oak was relatively low, and the number of dead trees per acre has greatly diminished. Less mortality than in previous years was also found during the the north and central coast aerial surveys that included Mendocino, Humboldt, Del Norte, Monterey, Santa Cruz, Santa Clara, and San Mateo Counties (261A, 263A). Decreased levels of mortality can be attributed to weather patterns over the last couple of years, which have been relatively dry and therefore not conducive to activity by this pathogen.

P. ramorum was detected in leaves from bay laurel trees growing at the Humboldt Redwoods State Park Visitors' Center along the Avenue of the Giants near Weott (Humboldt County, 263A), slightly farther north along the Avenue than it had been found before. A delimitation survey and sampling followed immediately, and examination of resulting cultures is ongoing.

Sudden oak death monitoring was conducted for northern San Luis Obispo County (261A). The area was flown with a fixed wing aircraft in May and oak trees with red crowns indicating recent mortality were recorded using a digital aerial sketch mapping system. Twenty nine polygons were recorded during the aerial flights to be ground checked. Fourteen polygons were within Hearst Castle boundaries, 12 polygons were on private property, and three polygons were in the Los Padres National Forest. The Hearst Castle locations were surveyed by a local forester and five of the private property locations were surveyed.

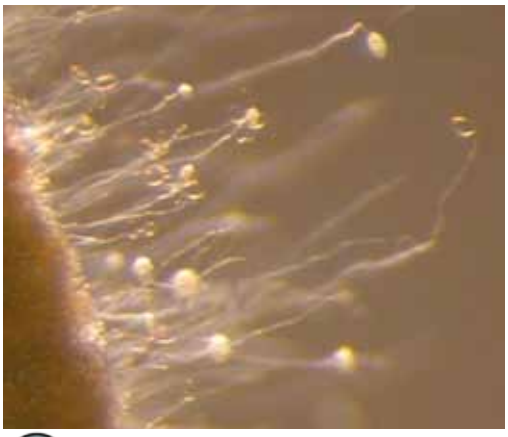


Figure 25: Sporangia of *Phytophthora ramorum*.

Photo: J. Parke

Figure 26: Coast live oak mortality in Marin County.

Photo: Marin Municipal Water District

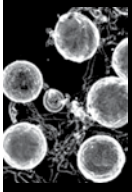


Figure 27: Canyon live oak killed by *P. ramorum*. The black globular fructification on the bark are *Hypoxylon thouarsianum*, a non-pathogenic fungus associated with dead oaks.

Figure 28: *P. ramorum* caused canker inside the bole of a Canyon live oak.

Photos: T. Swieki

There were no suspicious symptoms and samples were not collected from any trees.

P. ramorum likely kills canyon live oak (*Quercus chrysolepsis*) according to a recent investigation by Ted Swieki and Elizabeth Bernhardt (Phytosphere Research). The study of recent mortality among large canyon live oaks at the Mid peninsula Regional Open Space District's Los Trancos Preserve was conducted in cooperation with Kamyar Aram and Elizabeth Fichtner (UC Davis, Rizzo lab). This was in a forest dominated by canyon live oak and California bay laurel, a species mix unlike most stands where SOD studies had previously been conducted. *P. ramorum* has been isolated from symptomatic bay and coast live oak at the Los Trancos Preserve (261A). In addition, positive PCR results (tested by the UC Berkeley, Garbelotto lab) were obtained from internal bole canker tissue in two sampled canyon live oaks, suggesting that *P. ramorum* DNA was present in the symptomatic host tissues. The canyon live oak SOD diagnosis is further supported by symptoms and epidemiological data; however, *P. ramorum* has not yet been isolated from canyon live oak trunk cankers in this area.

261A

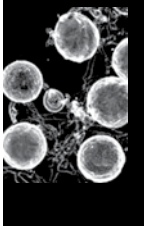
263A

Terrestrial Confirmations

P. ramorum was confirmed in MacKerricher State Park in 2009, three miles north of Fort Bragg in Mendocino County, and approximately 40 miles south of the nearest known positive site in Humboldt County (263A). The MacKerricher site is now the northernmost location within Mendocino County from which the pathogen has been isolated. The previous northernmost site was a stream-bait positive in the Little River in Van Damme State Park, approximately 16 miles south of MacKerricher State Park. The closest known terrestrial collection of *P. ramorum* is near the mouth of the Navarro River, approximately 20 miles south of MacKerricher State Park. Ground surveys have yielded the discovery of 13 dead and eight symptomatic tanoak within the well-used Pinewood Campground loop. California bay laurel, commonly associated with newly infected, isolated sites, is not found within or adjacent to the infested campground area. CALFIRE is currently working with State Parks personnel to develop a management plan for the park. This will include removal of dead and infected trees as well as preventative measures such as

Map 4: New terrestrial confirmations of Sudden Oak Death, 2009

Map: M. Woods



Map 5: Distribution of Sudden Oak Death in California and Oregon.

Courtesy of Kelly Lab, UC Berkeley

putting wood chips or gravel on exposed soil of parking spaces and trails near the infected location.

263A

Another Mendocino County watershed was also confirmed *P. ramorum* positive in 2009. At the far eastern reaches of Big River, a hillside above the Orr Hot Springs resort has infected California bay laurel and tanoak. The immediate area drains into the South Fork of the Big River (263A). From an early July 2009 investigation conducted by CALFIRE, eight red-crowned tanoaks were symptomatic, and several more dead trees were noted in the area. The other dead trees had an array of pests including *Armillaria* sp., flathead borers, *Hypoxylon* sp., and ambrosia beetles. Many of the symptomatic tanoaks had symptomatic bay crowns overhanging them (which is significant because bay leaves can develop large amounts of *P. ramorum* inoculum). This new find is 11 miles north of one of the earliest confirmed Mendocino County infection centers found off Peachland Road in the Indian Creek drainage north of Boonville in 2002. Orr Hot Springs is about 10 miles northwest

Figure 29: Stream monitoring bait leaves infected with a pathogen; possibly *P. ramorum*

Photo: K. Aram

Figure 30: Stream monitoring. Bait leaves left in a mesh pouch for a period of several days will attract *P. ramorum* zoospores if they are present in this stream.

Photo: K. Aram

261A

263A

M261B

M261A

M262A

of Ukiah and just east of Montgomery Woods State Park, a popular hiking spot. The lightning-caused fires in the area in 2008 stopped just short of consuming trees in this area. California bay laurel and tanoak are abundant in the drainage and susceptible.

A third confirmation was found in Alameda County (261A) (see Map 4).

Stream Confirmations

The north coast 2009 *P. ramorum* stream monitoring effort sampled 51 watercourses in Mendocino, Humboldt, and Del Norte Counties (263A, M261B, M261A) from January to June. To implement the survey, UCCE Humboldt-Del Norte and the UC Davis Rizzo Lab enlisted the help of personnel from a variety of organizations in the north coast, including the Del Norte County Agriculture Department, Redwood State and National Parks, Hoopa and Yurok Tribes, Humboldt Redwood Company, and Mattole Restoration Council. *P. ramorum* was detected in May in stream water in Blue Slide Creek, a tributary to the Mattole River. This is the first find of the pathogen in this watershed, which lies between the South Fork of the Eel River and the ocean, paralleling the rugged Lost Coast. Additionally, *P. ramorum* was once again detected in stream water in McKinleyville, just north of Arcata.

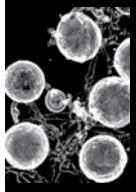
A stream-based detection survey conducted in Monterey and San Luis Obispo Counties (261A, M262A) in Southern California surveyed a total of 19 watercourse sites during February through the beginning of June using rhododendron leaves as bait for *Phytophthora* spp. These produced 38 sets of baits which were put out and collected during each collection period. These were cultured for the presence of *P. ramorum* at UC Davis.

In 2009, *P. ramorum* was detected in four California nurseries; nationwide, the quarantine pathogen was found in 11 states at 33 sites: 26 nurseries, six ornamental landscapes, and one nursery perimeter. These detections trigger mandatory eradication, they do not include the widely infested areas in California or southwestern Oregon. At ten sites in seven states (CA, OR, WA, GA, MS, AL, FL), *P. ramorum* has been found in waterways and associated habitats just outside of nurseries. In Washington state, run-off from an infested nursery resulted in native salal (*Gaultheria shallon*) becoming infected with the NA2 lineage along an adjacent river. Regulatory officials herbicided and removed the infected plants in the two infested areas. Also noteworthy, the UK reported Japanese larch (*Larix kaempferi*), western hemlock (*Tsuga heterophylla*), and birch (*Betula pendula*), as new *Phytophthora ramorum* hosts. Both birch and western hemlock (*Tsuga heterophylla*) were found with bole cankers. All three lineages (EU1, NA1, and NA2) have been detected

in Washington state nurseries, increasing the risk of hybridized species occurring as a result of sexual recombination.

P. ramorum has been confirmed in McKinleyville's Mill Creek (Humboldt County, 263A). The pathogen was recovered by the UC Davis Rizzo Lab from leaf baits deployed and recovered in February. This is the fourth year that *P. ramorum* has been recovered from McKinleyville streams with no obvious symptomatic hosts (the second year for Mill Creek). Of the two streams from which the pathogen has been recovered, Widow White Creek drains directly into the ocean, while Mill Creek drains into the Mad River a short distance from the ocean. Both streams primarily drain developed residential areas. Few *P. ramorum* wildland hosts are present at the Mill Creek site; the area is vegetated mostly with Sitka spruce, alder, willow, and eucalyptus. The Humboldt County Department of Agriculture has begun plans for further symptomatic host surveys along the streams during the spring of 2010.

263A



Port-Orford-Cedar Root Disease
Phytophthora lateralis
Contributions by: Pete Angwin, Frank Betlejewski, and Jack Marshall

A new infestation of Port-Orford-cedar (POC) root disease was identified on the Smith River National Recreation Area, Six Rivers National Forest, along FS Road 4803 near the outflow of Sanger Lake (Del Norte County, M261A). Approximately nine dead POC were found above the road and 15 below the road. Presence of dead foliage in killed trees indicated that the mortality occurred within the last two to four years. The dead and surrounding live POC were subsequently removed in order to eradicate the pathogen from the area.

Figure 31: POC tree dying from infection by POC root disease; red, infected wood is visible at the base of the tree.

Photo: F. Betlejewski

M261A

An approximately 50 acre infestation of POC root disease was discovered on the Orleans Ranger District, Six Rivers National Forest, along an unnamed stream immediately south of Notice Creek, where it crosses FS Road 12N10 at Mile Post 5.35 (Del Norte County, M261B). The unnamed stream flows into Bluff Creek, which in turn flows into the Klamath River. The infestation appears to have been in the area for several years, and mortality is extensive in a boggy flat above the road. Introduction of the pathogen may have come from a marijuana grower's camp that was recently discovered above the road. Initial diagnosis of the disease was made in the field, and was confirmed by genetic (PCR) analysis of symptomatic tissue at Oregon State University.

Figure 32: Port-Orford-cedar mortality along unnamed stream between Raspberry Lake and Clear Creek in the Siskiyou Wilderness Area, Klamath NF.

Photo: C. Snyder

M261B

In 2006, POC root disease was identified in POC and Pacific yew along Clear Creek in the Siskiyou Wilderness Area, Happy Camp Ranger District, Klamath National Forest (Siskiyou County, M261A). In 2009, a detailed analysis of existing aerial photographs identified typical POC root disease symptoms along a stream

263A

M261A

that empties into Clear Creek, starting about 1,500 feet downstream from Raspberry Lake. Field reconnaissance of the area confirmed the presence of a POC root disease center approximately five acres in size. Smaller, newer root disease pockets were scattered downstream along the length of the creek to its confluence with Clear Creek. Presence of *Phytophthora lateralis* was confirmed using a pocket ELISA diagnostic kit and by genetic (PCR) analysis of symptomatic tissue at Oregon State University.

In addition, there may be 32 new *P. lateralis* sites on the Six Rivers National Forest, and 7 new diseased sites in the Redwood National and State Parks (Humboldt County, 263A) based on interpretation of aerial photographs.

Port-Orford-cedar root disease killed trees in the high reaches of Willow Creek just east of Berry Summit in Humboldt County (263A). In Del Norte County (263A), several miles north of Hiouchi and off Low Divide Road, several trees were recently killed along an unnamed tributary of Peacock Creek and also along Sultan Creek, both in the Smith River drainage.

The Trinity River drainage (Trinity and Shasta Counties, M261A) continues to be the only major uninfested river drainage within the range of Port-Orford-cedar.

Rust Diseases

White Pine Blister Rust
Cornartium ribicola
Contributions by: Joan Dunlap and Joel Egan

The Region 5 Genetic Resources staff has a program of screening sugar pine and western white pine (*Pinus lambertiana*) for natural genetic resistance to white pine blister rust (*Cronartium ribicola*). Screening for major gene resistance (MGR) occurs at the Placerville Nursery, Eldorado National Forest, and for slow rust resistance (SRR) at the Happy Camp Outplant Site (HCOPS), Klamath National Forest. In the winter of 2009, 568 sugar pine families were screened for major gene resistance (MGR) and 51 had MGR. For the third year, rust-resistance screening has included a large number of families from southern California, resulting in the cumulative discovery of 64 MGR parent trees. To date, 7-8% of the candidate trees from that region have proven to have MGR. Continued testing of southern California trees will occur once cones are collected from new candidates. Similarly, the Lake Tahoe Basin area now has 38 MGR trees (including trees on both federal and non-federal land). More seedling families from the Basin along with those from Lassen National Forest and private industry lands will make up the majority of screened families in the winter of 2010. In California, a total of 1,762 MGR sugar pines have been identified on federal, state, and private lands.

Figure 33: Two seedlings inoculated with *C. ribicola*. The seedling on the left shows a susceptible reaction; the seedling on the right shows a hypersensitive reaction, preventing the fungus from growing down the needle into the limb.

Photo: D. Vogler

Figure 34: Bole canker caused by white pine blister rust.

Photo: J. Dunlap

On the Klamath National Forest, activities related to slow rust evaluations continue with the planting of 2,270 MGR seedlings at the Happy Camp Outplant Site (HCOPS) and 3,294 non-MGR seedlings at the Classic field site, all from the Placerville Nursery. Evaluations led to the selection of 52 sugar pines with SRR traits from 730 surviving trees (out of 4,735 planted in 1991 and 1993) and their collection for seed orchard establishment.

This year's cone crop on sugar pine was impressive in most areas. Cones were collected from 688 new MGR-candidate sugar pines in areas across the northern forests and as far south as the Lake Tahoe Basin. Large cone collections from known MGR trees were made in those areas, as well as the southern Sierra Nevada. These concerted efforts resulted in about 2,013 bushels being received at the Placerville Nursery; of these, 48 bushels were from the oldest of three seed orchards targeted to supply MGR seed to the western slope of the Sierra Nevada mountains. Small collections were also made from California's five high-elevation white pine species, i.e., foxtail, limber, Great Basin bristlecone, western white, and whitebark pine, for genetic conservation.

White pine blister rust (WPBR) infections throughout Bear Valley on the Stanislaus National Forest (Calaveras County, M261E) contributed to western white pine decline. Near the Mokulmne West ski run, more than 85% of the mature western white pines and virtually all of the pine regeneration had blisters, branch cankers, branch flagging, and/or top-kill characteristic of WPBR infection. Mortality of pine regeneration was common, as were groups of overstory western white pine mortality due to mountain pine beetle attack. Western white pine species composition averaged 13% (range 7 to 18%) in this area and their presence in these stands may decline in subsequent years due to overstory mortality and unsuccessful pine recruitment.


M261E


M261D


263A

Western Gall Rust
Endocronartium harknessii
Contributions by: Don Owen, Jack Marshall, Joel Egan and Martin MacKenzie

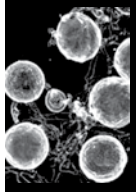
Western gall rust (caused by *Endocronartium harknessii*) was reported on ponderosa pine in the Paradise and Cohasset areas, Butte County (M261D). Older rust infections were responsible for stem cankers and some stem failures of ponderosa pine at a site east of Shingletown, Shasta County (M261D).

Both young plantation and large, native ponderosa pine had bole and branch infections caused by western gall rust at the Montesol Ranch in northern Napa County (263A). Branch flagging of Bishop pine increased slightly along Mendocino County's south coast (263A).

Western gall rust infection was also noted on branches of small-diameter lodgepole pines near Silver Lake and on the boles (hip-cankers) of large-diameter pines along State Hwy 88 near Silver and Caples Lakes, respectively, on the Eldorado National Forest (Amador County, M261E). Aecial sporulation was noted as of June 22nd, 2009, which was concurrent with lodgepole pine budbreak in this area. Branch cankers contributed to subsequent attacks from twig pruning beetles in the smaller trees and bole infection increased physiological stress that contributed to successful mountain pine beetle attack in the larger trees.

Figure 35: Western gall rust, caused by *Endocronatium harknesii*, on the main stem of a mature ponderosa pine near Shingletown, Shasta County.

Photo: D. Owen



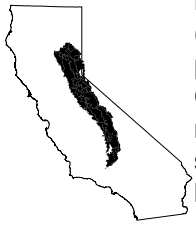
Eucalyptus / Guava / Myrtle Rust
Puccinia psidii
Contributed by: Paul Zambino


M262B

Although Eucalyptus is a host of *Puccinia psidii* in South America, this introduced fungus has only been detected as a pathogen on other, ornamental members of the myrtle family (Myrtaceae) in California. Despite concerted efforts to find *Puccinia psidii* during nursery inspections in San Diego County, this exotic pathogen remains extremely rare. This pathogen has been reported six times in California from 2004 to the present, with the most recent detection in November 2008 on true myrtle, *Myrtus communis*, in Fallbrook, northern San Diego County (M262B). The main concern in California has been past effects of the pathogen's presence on state trade. A temporary quarantine by the Hawai'i Board of Agriculture banned all shipments from California that contain plants or parts of plants in the myrtle family. This quarantine was lifted as of October 2008.

Leaf Scorch

Maple Leaf Scorch
Xylella fastidiosa
Contributions by: Don Owen and Bill Woodruff


M261E

Maple leaf scorch (MLS) was first reported on bigleaf maple in Tulare and Plumas Counties (M261E) in *Forest Pest Conditions in California - 1985* (www.fs.fed.us/r5/spf/publications/pestconditions/index.shtml). Since the first report, MLS has been reported in subsequent Conditions Reports as being present in many areas in central and northern California. The reports attributed MLS to a combination of suspected causes such as desiccation (cool wet springs followed by hot dry windy summers), xylem-sucking insects, and/or xylem-limited bacteria spread by those insects.

In 2009, MLS is again obvious along Indian Creek and the Feather and Yuba Rivers in Plumas and Sierra Counties (M261E). In 2008, pathologists from Rutgers University isolated the bacteria *Xylella fastidiosa* from symptomatic maple branches collected in these areas.


M261A

In 2009, MLS was observed along CA Hwy 36, west of Mineral and along the Oroville-Quincy Highway (M261E). In addition, MLS was observed along CA Hwy 299 between Redding and Willow Creek and along CA Hwy 96 between Willow Creek and Horse Creek (M261A).

Figure 36: A typical symptomatic leaf on a MLS tree.

Photo: B. Woodruff

Figure 37: A maple tree with leaf scorch along the Klamath River.

Photo: B. Woodruff

Symptomatic maple branches from trees widely distributed in northern California were collected and submitted to Rutgers University for testing to learn if the same strain of *X. fastidiosa* is causing MLS in all areas.

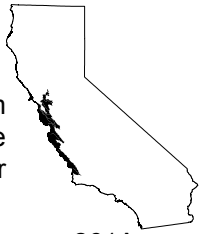
Canker Diseases

Twig Canker
Colletotrichum sp.
Contributed by: Jack Marshall

M261B

Several California bay laurel trees along Road 100 in the Mill Creek drainage of Boggs Mountain Demonstration State Forest (Lake County, M261B) had branch flagging due to cankers caused by a species of *Colletotrichum*.

Seiridium Canker (*Seiridium cardinale*):
Contributed by: Tom Smith



261A

In 2009, Seiridium canker (also called Coryneum canker) became a serious problem throughout Monterey (Monterey County, 261A) on planted Leyland cypress trees. The disease is common after periods of drought when the trees are stressed. Many trees over various ages and sizes have been dying from the disease in the city.

Canker Rot
Inonotus andersonii
Contributed by: Kim Camilli

Figure 38: Canker rot caused by *Inonotus andersonii* on coast live oak.

Photo: K. Camilli

Inonotus andersonii canker rot fungi was found on coast live oaks on approximately 3-4 acres in O'Neill Regional Park, Trabuco Canyon, CA in Orange County (261A). These fungi can cause a white rot of the heartwood of living oaks and also cause decay in strips of the sapwood. When the sapwood decay reaches the cambium it can cause externally visible cankers. The cankers on these oaks in this park were elongated with callus edges. The crown of the trees showed general decline symptoms, including poor growth, thinning, dieback and branch and trunk failures. These trees were declining over a period of many years and some were reaching stages of advanced decline. These fungi are frequently observed in decaying wood of living oaks.

Foliage Diseases

Oak Anthracnose
Apiognomonia sp.
Contributed by: Jack Marshall

Blue oaks in and around the upper campground section of Clear Lake State Park (Lake County, M261B) had severe amounts of leaf blotch or leaf mortality from *Apiognomonia* sp. Several days of rain the first week of May 2009 could have contributed to the spread of this pathogen.

Diplodia Blight of Pines
Sphaeropsis sapinea, Diplodia pinea
Contributions by: Don Owen and Tom Smith

Branch flagging due to Diplodia blight was noted on ponderosa pines around Paradise and Magalia in Butte County and near Nevada City in Nevada County (M261D, M261E). Pines along the entire Highway 49 corridor in the Nevada City/Grass Valley area are impacted. Effects vary in severity from only a few tips showing dieback to entire trees covered with tip and branch dieback. Although no trees have died from the disease in the area, the additional stress is likely to make the pines more vulnerable to attacks by bark beetles.

Figure 39: Dead ponderosa pine branch tips caused by Diplodia blight near Whitmore, Shasta Co. Caused by *Sphaeropsis sapinea* (*Diplodia pinea*).

Photo: D. Owen

Shoot dieback caused by *Sphaeropsis sapinea* was also observed on ponderosa pines in the upper Sacramento River Canyon (Shasta and Siskiyou Counties, M261A), on Mc Cloud Flats (Siskiyou County, M261F), between Shingletown and Whitmore (Shasta County, M261D), and on Paradise Ridge (Butte County, M261D). Infection rates appear to have increased relative to the previous two years which had drier spring weather. Infected trees are widely scattered. Top and branch dieback and whole tree mortality were occasionally seen.

M261E

Elytroderma Shoot Blight
Contributed by: Don Owen

Elytroderma disease on ponderosa pine was reported from Heartstrand Gulch on the southeast side of Scott Valley, Siskiyou County (M261A).

M261F

Root Diseases

Heterobasidion Root Disease
Heterobasidion annosum, H. occidentale, H. irregulare
Contributions by: Pete Angwin, Beverly Bulaon, Joel Egan, Martin Mackenzie and Paul Zambino

Heterobasidion root disease (formerly annosus root disease) caused scattered pockets of mortality in white fir of all sizes throughout the 15 acre McBride Springs Campground on the Shasta-McCloud Management Unit, Shasta-Trinity National Forest (Siskiyou County, M261D). Fruiting bodies were found in four white fir stumps. Fir engraver beetles (*Scolytus ventralis*) attacked and killed the larger root-disease-infected fir. Because of the hazard posed by the presence of the root disease, the campground was closed for the 2009 season, pending management action.

Figure 40: White fir stump with fruiting body of *Heterobasidion annosum* at Pingri-La Resort, west of Castella, California.

Photo: P. Angwin

M261A

White fir stumps scattered throughout the ten acre Carter Meadows Horse Camp (Siskiyou County, M261A) had hollow interiors and laminant decay, typical of heterobasidion

root disease, and a *Heterobasidion occidentale* fruiting body was found in one of these stumps. Although the remaining standing white fir have rounded tops, they show no additional symptoms of root disease. Dead and dying firs are removed annually from this campground; the presence of symptomatic stumps throughout the area suggests that the disease is widespread.

Figure 41: White fir killed by Heterobasidion root disease and fir engraver beetle at McBride Spring Campground, Shasta-Trinity NF.

Photo: P. Angwin

Scattered heterobasidion root disease centers are present in approximately five acres of white fir above the visitor cabins at the private Pinegri-La Resort, 11.5 miles west of of Castella (Shasta County, M261A). *H. occidentale* fruiting bodies were found in four stumps. Fir engraver beetles have attacked and killed many of the root diseased firs.

M261A

Heterobasidion root disease caused scattered pockets of mortality in white fir throughout the 37 acre Unit 160 of the Elk Late Successional Reserve, Shasta-McCloud Management Unit, Shasta-Trinity National Forest (Siskiyou County, M261D). Groups of white fir blowdown had laminant decay in the roots and fruiting bodies of *Heterobasidion occidentale* were found in three stumps. Fir engraver beetles were also present in the dead and dying white fir.

M261D

Heterobasidion root disease in true fir continued to impact high-value recreation and administration sites in the south Sierra Nevada range. Mortality had an average rate of one tree every two acres near Pinecrest Lake in recreation-residence areas, Cow Creek housing tracts, and Baker Campground on the Stanislaus National Forest (Tuolumne County, M261E). A mortality pocket of 20 red fir was located ten miles north of Strawberry along State Hwy 108 adjacent to stumps infected with Heterobasidion root disease. In addition, there are many overstory red fir trees dying throughout the Huntington Basin, Sierra National Forest (Fresno County, M261E). All of the dying fir that were examined indicated that they had Heterobasidion root disease and most had also been attacked by the fir engraver.

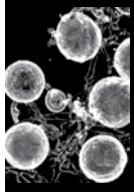
M261E

Heterobasidion occidentale root disease fruiting bodies were found along State Hwy 88 on the Eldorado National Forest (Amador County, M261E) in a 60” DBH red fir stump that was estimated to have been felled in the early 1980s. Three distinct age classes of *Heterobasidion occidentale* fruiting bodies were found, indicating that fungi in this isolated stump were likely sporulating for decades.

Figure 42: Three age classes of viable, *Heterobasidion occidentale* reproductive conks in a large-diameter red fir stump estimated at 20-30 years since the host tree was felled.

Photo: J. Egan

There were new detections of




M262B

heterobasidion root disease at the Mount McGill Campground and near the Chula Vista Trail, Mt. Pinos Ranger District, Los Padres National Forest (Ventura County, M262B). Stringy rot, caused by *Heterobasidion irregulare*, contributed to windthrow of six large Jeffrey pines at scattered locations in the Mount McGill Campground. On the Chula Vista Trail, both Jeffrey pine and white fir had heterobasidion root rot. Pockets of fallen trees of both species had stringy rot and were broken at major roots very close to the bole. Also, beneath dead bark, fire scars caused by underburns on five living white fir in one root rot pocket had abundant stringy rot typical of *Heterobasidion* sp. It was unknown if the fungus in the fire scars was the fir-infecting *H. irregulare* or saprophytic colonization by *H. occidentale* that might affect adjacent legacy Jeffrey pine. Historic infection centers of *H. irregulare* were still active at the Mil Potrero Boy Scout Camp, Mil Potrero Road, Mt. Pinos Ranger District, Los Padres National Forest (Ventura County, M262B). In one five acre infection center where mature pinyon and Jeffrey pine had been killed and only brush remained, there was heavy mortality of planted Jeffrey pine seedlings. Sage (*Artemisia* sp.) and rabbitbush (*Chrysothamnus* sp.) predominate in the brush field; both are known hosts of *Heterobasidion* sp. Roots of large dying clumps of sage had delamination that indicate the brush as a potential source of inoculum.

Heterobasidion root disease was found in stumps of several windthrown single-leaf pinyon pine near the Cougar Crest Trailhead, San Bernardino National Forest (San Bernardino County, M262B), and likely contributed to their attack by mountain pine beetle (*Dendroctonus ponderosae*) (see report on mountain pine beetle, page 10). Also, heterobasidion root disease was present and likely contributed to the continued Jeffrey pine mortality caused by California flatheaded borer (*Melanophila californica*) along Pine Mountain and Tecuya Ridge on the Mt. Pinos Ranger District, Los Padres National Forest (Kern County, M262B) (see report on California flatheaded borer, page 20).


M261B

Armillaria Root Disease
Armillaria mellea
Contributed by: Jack Marshall


263A

Single tree and large patches of blue oak have been killed by *Armillaria mellea* at Clear Lake State Park (Lake County, M261B) over the past few years, as noted in last year's conditions report. The site is dry and rocky, with the oaks growing in association with grey pine and manzanita. Surveys in 2009 revealed a lack of new mortality. However, the blue oaks suffered from anthracnose this year.

During ground visits a recently killed tanoak, as a rapid response inspection of a new possible sudden oak death incidence in Del Norte County (263A), was found to have advanced decay and girdling from *Armillaria* sp. The tree was between North Bank Road and Smith River, one mile east of the intersection of North Bank Road and Highway 101.


M261A

Armillaria root disease was also noted on several western white pine on Horse Mountain in Humboldt County (M261A). These trees, some of which also had dwarf mistletoe, were killed by mountain pine beetle.

Black Stain Root Disease
Leptographium wageneri
Contributions by: Pete Angwin, Beverly Bulaon, Jack Marshall and Bill Woodruff


M261E

Mortality caused by *Leptographium* sp. in the Inyo National Forest continues to spread in Single-leaf pinyon pine along National Forest Road 01 and up towards the Ancient Bristlecone Pine Forest (Inyo County, White Mountain Ranger District, M261E). The Forest Health Protection South Sierra Shared Service Area has been monitoring this hillside for 20 years. About one tree per five acres showed decline symptoms in this 60 acre

area. The boles of three declining trees were examined and all showed evidence of staining in the sapwood. Black stain root disease was also found in Douglas-fir in Sonora and was one of several factors contributing to the decline of Douglas-fir in that area (please refer to the "Decline" section of this report for more details).

Figure 43: Black stain root disease in ponderosa pine at Algoma-Shasta-McCloud Management Unit, Shasta-Trinity NF.

Photo: P. Angwin

M261D

Conspicuous concentrations of mortality around black stain root disease centers (caused by *Leptographium wageneri*) have been evident in ponderosa pine at the Mud Flow Research Natural Area, Shasta-McCloud Management Unit, Shasta-Trinity National Forest (Siskiyou County, M261D) for many years. A windstorm during the winter of 2008-2009 blew down large numbers of root-diseased pines.

One new infection of black stain root disease was noted this year in Humboldt County (M261B), where scattered Douglas-fir (5-20" DBH) were killed. These trees were found in areas that had been harvested within the last 50 years near Sulphur Creek and the creek in Kuntz Canyon. Both of these tributaries feed into the Van Duzen River near Dinsmore. Dead and dying trees also had galleries from the Douglas-fir engraver beetle.

Figure 44: Active black stain root disease center on the Modoc NF, near the Oregon border.

Photo: B. Woodruff

M261B

Black stain root disease was also found in association with flatheaded fir borer-killed Douglas-fir along Old Briceland Road near Garberville in Humboldt County (263A).

An active black stain root disease center in ponderosa pine was found along Forest Road 48N28 near the Oregon border on the Modoc National Forest (Modoc County, M261D). About 50 trees have been killed on a half acre over the last decade.

263A

Schweinitzii Root Disease
Phaeolus schweinitzii
Contributed by: Jack Marshall

In Santa Cruz County (261A), several acres in the Las Cumbres area, east of Castle Rock State Park, have dead and dying Douglas-fir due to a combination of Schweinitzii root disease and attacks by the flatheaded fir borer.

261A

Laminated Root Rot
Phellinus weirii
Contributed by: Pete Angwin

Two areas with laminated root rot (caused by *Phellinus weirii*) were identified in mixed conifer stands on the Happy Camp Ranger District, Klamath National Forest near the

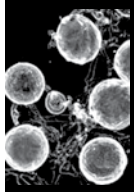


Figure 45: White fir stump with laminated root rot, Klamath NF.

Photo: P. Angwin

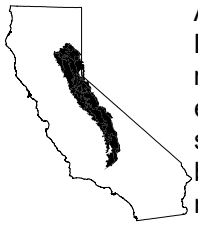
M261A

California-Oregon state line (Siskiyou County, M261A); white fir and Douglas-fir were affected in both areas. The first area consisted of a single mortality pocket less than one acre in size, and was located above FS Road 19N07 in the SW corner of T.19N, R.6E, Sec. 35. At the second area, located approximately ½ mile east of the Poker Flat Botanical Area, adjacent to the east side of FS Road 18N33 (T.18N, R.6E, Secs. 20 and 21), root disease centers were scattered over approximately ten acres. Only a small number of areas with laminated root rot are known to exist in California.

Declines

Decline of Douglas-fir

Contributed by: Martin MacKenzie



M261E

Analysis of aerial photos covering a swath along Highway 20 from the Groveland Ranger District to the Big Oak Flat gates of Yosemite National Park showed approximately 1-2 recently dead trees per acre (Mariposa County, M261E). Twenty $^{1}/_{10}$ acre plots were established in forest areas below 4,000 feet elevation to ascertain an estimate of the host species and mortality. Based on the plot data, Douglas-fir accounts for 40% of the living basal area, 97% of the dead stems, and 99% of the dead basal area. It was evident that more drought tolerant species such as incense cedar, ponderosa pine, and sugar pine are replacing the Douglas-fir in the area.

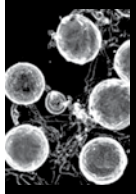
Examination of a few Douglas-fir saplings indicated that blackstain (caused by the fungus *Leptographium wageneri* var *pseudtsugae*) was present in a few saplings, but in general was not a factor in causing the decline in most of the dead Douglas-fir. More than five years of drought coupled with the lower elevation (Douglas-fir in the area seemed to be fine above 5,000 feet) and shallow rocky soils all contributed to the tree mortality.

Figure 46: Douglas-fir along Highway 20, outside Yosemite NP.

Photo: M. MacKenzie

Figure 47: Decline in white alders (*Alnus rhombifolia*) at Thurman Flats Recreation Area along Mill Creek.

Photo: P. Zambino



Alder decline
Contributed by: Paul Zambino

M262B

There was decline in large white alders (*Alnus rhombifolia*) at multiple locations in southern California. Stands with decline and unaffected stands occurred side by side, although stands with decline were generally further from flowing water than unaffected stands. They also had understories containing plants adapted to drier conditions, indicating lower levels of available soil moisture. Stands in decline were observed along 7.7 miles of Mill Creek from near the Thurman Flats Picnic Area upstream to past the Vivian Creek Recreation Site on the Front Range Ranger District of the San Bernardino National Forest (San Bernardino County, M262B). The greatest mortality observed along Mill Creek was at the Thurman Flats Picnic Area, where 90% of a nearly pure alder stand of over 200 trees larger than 12" DBH died in recent years and where the remaining trees are also all nearly dead. Alder decline was also seen in riparian areas along Pine Canyon Road and Lake Hughes Road, Santa Clara/Mojave Ranger District, Angeles National Forest (Los Angeles County, M262B), and in narrow gallery forests of pure alder along Millard Creek, Millard Canyon, Morongo Indian Reservation (San Bernardino County, M262B). Unidentified bark beetles, borers, and several species of canker fungi were present in declining alders. There was high incidence of large-leafed mistletoe (*Phoradendron tomentosum* ssp. *macrophyllum*), with up to 20 large mistletoe plants per alder in most large trees at Thurman Flats and Millard Canyon, but roughly equal incidence in declining and healthy trees of the same size, so mistletoe was discounted as a deciding factor in the decline.

Incense Cedar Decline
Contributed by: Paul Zambino

Decline of incense cedar (*Calocedrus decurrens*) occurred in approximately 50 trees along one mile in the Mill Creek drainage around Vivian Creek Recreation Site, Front Range Ranger District, San Bernardino National Forest (San Bernardino County, M262B). Mortality was seen in two stands on the far side of the creek. In one of these stands, 18 of 20 incense cedars with a DBH greater than 10" had been killed in recent years and 8 of 10 large incense cedars had been killed in the other stand. Counts could not be accurately made of dead trees in the recreation area because dead trees are routinely removed from recreation areas. Nonetheless, around 90 live incense cedar (of mixed ages) had initial decline symptoms which included scattered branchlets of current year foliage on the forest floor. These branchlets had became necrotic and brown and readily abscised, due to infection by a fungus allied with *Phoma* sp. Foliage of other trees, presumed further advanced in the decline, was uniformly dull or chlorotic and no longer retained brown necrotic branchlets due to their earlier abscission. Mortality occurred for some trees when all remaining foliage in the canopy died at once while other dying trees, those with severely reduced foliage density, developed cankers that are slowly progressing until mortality ensues. There was no evidence of windthrow to suggest heterobasidion root disease.

Figure 48: Foliage disease on declining incense cedars at Vivian Creek Recreation Area along Mill Creek.

Photo: P. Zambino

Figure 49: White pocket rot of ponderosa pine caused by *Phellinus pini*, Paradise, Butte County.

Photo: D. Owen

The true mistletoe, *Phoradendron juniperinum* ssp. *libocedri*, was present and abundant in the trees of some but not all areas with decline.

Rots

Red Ring Rot
Phellinus pini
Contributed by: Don Owen

A large number of ponderosa pines exhibit conks of *Phellinus pini* on their lower stems at the CALFIRE Shingletown Fire Station, Shasta County (M261D). This same condition was previously noted at the Paradise Fire Station in Butte County (M261D). The high incidence of rot is associated with lower-bole branch pruning at both locations.

Mistletoes

Douglas-fir Dwarf Mistletoe
Arceuthobium douglasii
Contributed by: Don Owen

M261D

Several stands of Douglas-fir, totaling approximately 200 acres, are heavily infested with dwarf mistletoe in Lime Gulch east of Gazelle, Siskiyou County (M261D). In the most heavily damaged areas, there are trees with dead tops and mistletoe brooms throughout the crown. The severe mistletoe likely resulted from selective harvesting practices. Mistletoe-infected trees that remain following such cuts serve as a source of infection for young trees in the regenerating stand.

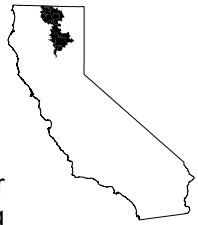
Western Dwarf Mistletoe
Arceuthobium campylopodum
Contributions by: Pete Angwin

Ponderosa pine in Black Ranch and some adjoining properties near Johnson Park, Shasta County (M261D) are heavily infected with dwarf mistletoe. Scattered mortality occurred among the most heavily infected individual trees over an area of roughly 100 acres. Dwarf mistletoe is also a factor in the mortality of scattered ponderosa pine along South Cow

Creek Road west of Whitmore, Shasta County (M261F). At both of these locations, the western pine beetle ultimately killed the mistletoe-infected trees.

M261F

Scattered western dwarf mistletoe infestations were identified in Cedar Mountain Unit 722-12 in the Round Valley Wildlife Urban Interface (WUI) on the Goosenest Ranger District, Klamath National Forest (Siskiyou County, M261D). Dwarf mistletoe from an infested residual ponderosa overstory was infecting 20-year-old understory ponderosa pines. DMR ratings of most infected overstory pines were moderate, ranging from 2 to 4.



M261D

Dwarf Mistletoe on True Firs
Arceuthobium abietinum
Contributed by: Tom Smith

Infections by dwarf mistletoe of high altitude true firs are frequent and severe in the fir belt of Amador, Calaveras, and El Dorado Counties (M261E). Many trees are showing damage and branch dieback distal to the point where the parasitic seed plants have fastened themselves into the limbs of these fir. Heavily infected trees are also showing especially intense drought symptoms in response to the abnormally dry conditions that have prevailed in these counties over much of the past decade.

M261E

Dwarf Mistletoe on White Fir
Arceuthobium abietinum f.sp. *concoloris*
Contributed by: Pete Angwin

White fir dwarf mistletoe (*Arceuthobium abietinum* f. sp. *concoloris*) was identified in the branches of approximately 50 white fir in a mixed conifer stand on Forest Service land on the Shasta-McCloud Management Unit, Shasta-Trinity National Forest. The stand was adjacent to FS Road 25, 11 miles west of Castella, approximately 300 yards east of the entrance to the Pinegri-La Resort (Shasta County, M261A). Dwarf Mistletoe Ratings (DMR) of infected trees were moderate, ranging from 2 to 4.

M261A

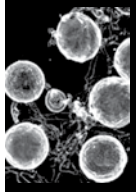
Limber Pine Dwarf Mistletoe
Arceuthobium cyanocarpum
Contributed by: Pete Angwin and Patricia Maloney

Figure 50: Dwarf mistletoe on whitebark pine.

Photo: P. Maloney

Dwarf mistletoe, *Arceuthobium cyanocarpum*, infection levels are high on whitebark pine (*Pinus albicaulis*) near Jakes Peak, southwest of Emerald Bay at Lake Tahoe (Eldorado County, M261E). There is 30% incidence of dwarf mistletoe in these trees and the average Dwarf Mistletoe Rating (DMR) is 4.3.

Extensive ongoing mortality of whitebark pine due to limber pine dwarf mistletoe (*Arceuthobium cyanocarpum*) and mountain pine beetle (*Dendroctonus ponderosae*) was observed in an approximately 80 acre area on the Bolam Bench on the north flank of Mt. Shasta (Siskiyou County, M261D). Dwarf Mistletoe Ratings (DMRs) of infected pines were high, ranging from 4 to 6. This infestation was previously reported as a “ghost forest” by Cooke in 1955 and was later surveyed by Mathiasen and Hawksworth in 1988. Two additional 80 acre disease centers were reported nearby.



Abiotic Conditions

Sun and Heat Injury
Contributed by: Don Owen


M261C

Several young Araucaria trees at the Turtle Bay Arboretum in Redding, Shasta County (M261C), were afflicted with spindle-shaped cankers on the southwest side of their stems. One tree was severely damaged and dying. Two fungi were isolated from the cankers by the CDFA Diagnostic Lab: a decay fungus, *Schizophyllum commune*, and a canker fungus, *Botryosphaeria dothidea*. Both are weak pathogens that often colonize wounded and/or stressed tissues. The southwest-facing orientation of the cankers suggests heat/sun damage. Arboretum personnel believe this may have happened when the young trees were transplanted from a shaded nursery to their current location where they were exposed to full summer sun.


M261A

A heat wave in mid-July caused some blue oaks in and around the Sacramento Valley to change color and lose a portion of their leaves prematurely. Some residents erroneously reported that their trees were dying.

A number of ornamental deodar cedar on a residential property in Round Mountain, Shasta County (M261A), developed scorched needles on the south sides of their crowns. The probable cause was heat damage that occurred in May when cool, wet weather was quickly followed by sunny days and near 100 degree temperatures.

Salt Injury
Contributions by: Danny Cluck


M261E

Ponderosa and Jeffrey pines exhibited symptoms of salt damage along roads in the Lake Davis Highlands subdivision of Plumas County (M261E). The damage apparently originated from the application of magnesium chloride during the previous summer to control dust from the subdivision's gravel roads. Isolated occurrences of salt damage were also reported along highways through the communities of Clio, Graeagle, and Portola.

Drought Stress
Contributions by: Jack Marshall, Tom Smith and Paul Zambino


M261B

In the northern area of the inland side of the California coast range (M261B) there was an excessive heat wave in July of 2006. This was followed by a very early heat wave in May 2008 and then two years of significantly lower than average precipitation. In response, many vegetation species expressed drought symptoms. There have also been high levels of insect attacks from insect species typically associated with drought (e.g. flatheaded fir borer in Douglas-fir) and a speedier than usual collapse of tanoaks and madrones that had *Phytophthora* infections in their stems or roots.


263A

Dozens of true oaks of various species in Las Posadas State Demonstration Forest died in 2009 (Napa County, 263A, M261B). The death and decline was visible from aerial surveys of the area. Ground checking the site showed that most of the affected trees were along a stream that recently altered its course. Trees were washed out, undercut, or had their water tables substantially lowered as a result of this alteration.

White firs at the Northstar ski resort complex at Tahoe in Placer County (M261E) were dying from a change in the water table of the site. A water retention pond had been built just above the dozen plus affected trees. Water was being held in the site that had normally run off to a nearby stream course. An overflow from the pond was sending water directly into the stand of trees. Root systems of the dying trees were under anaerobic

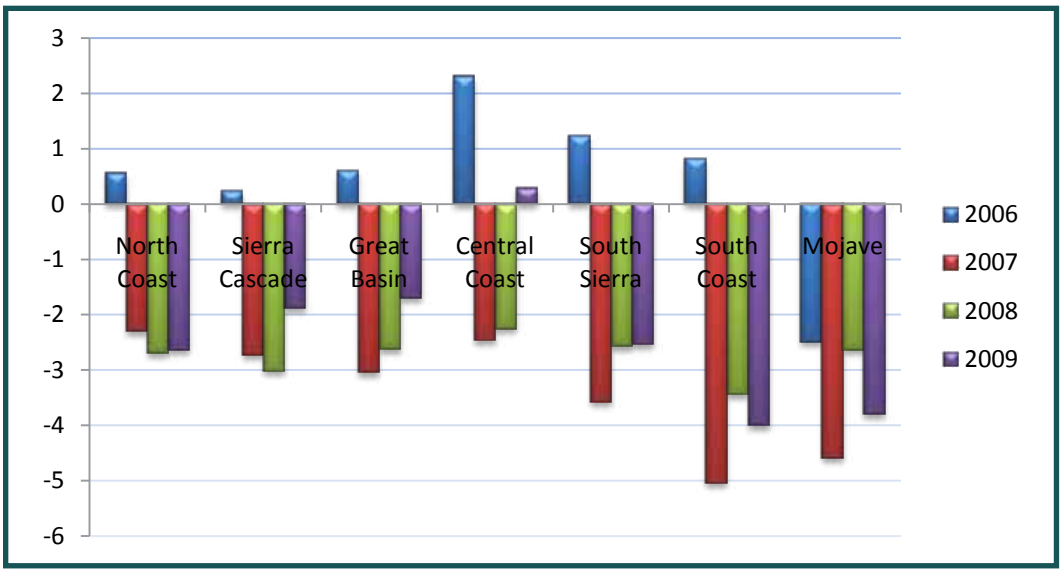


Table 4. Palmer drought indices for the seven hydrologic zones in California, 2004-2009. The Palmer Drought Index is an indicator of drought or moisture excess and ranges from -6 to +6, with the negative values denoting degree of drought.

conditions but did not have signs or symptoms of any root disease. The boles of the dying trees were being attacked by bark beetles.

Drought-related defoliation, dieback, and mortality occurred in a mixture of willow species (presumed *Salix exigua*, *S. goddingi*, *S. lasiolepis*) in willow clumps along 0.7 miles of Sand Creek in Sand Creek Canyon, Front Range Ranger District, San Bernardino National Forest, (San Bernardino County, M262B). Tree mortality of up to 100% occurred in three small willow clumps. All symptoms were restricted to short stretches of streambed where the soil surface became powder dry by the end of August. Dry-adapted perennials were well established near the affected clumps, indicating that affected areas were subject to recurring periods of low soil moisture. No disease organisms or insects were observed as contributing to the willow defoliation, dieback, and mortality.

Figure 51: Branch breakage from heavy snowfall.

Photo: T. Coleman

M262B

Figure 52: Jeffrey pines injured during winter storms.

Photo: P. Zambino

Snow and Wind Injury
Contributed by: Tom Coleman and Paul Zambino

California black oak and coast live oak experienced branch and stem failure following approximately two feet of heavy snowfall around the communities of Julian and Wynola near the Descanso Ranger District, Cleveland National Forest (M262B, San Diego County). Branch flagging from broken limbs and stems was common throughout the area.

Several dozen (6-20" DBH) Jeffrey pine snapped from winter storm damage at the Mount McGill Campground, Mt. Pinos Ranger District, Los

M262B

Padres National Forest (M262B, Ventura County). Other trees less than 6" DBH were permanently bent to the ground, indicating that the conditions that snapped the larger trees likely included heavy snow, as well as wind. Storm damage also caused windthrow of heterobasidion root disease-affected legacy Jeffrey pines. The site is near the top of a ridge and is subject to recurrent winter storms.

Invasive Plants

Contributed by: Tom Smith

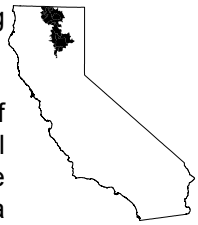
M261E

Yellow star thistle (*Centaurea solstitialis*) and scotch broom (*Cytisus scoparius*) have been reported moving eastward in El Dorado County (M261E). The invasive weeds appear to be following the transportation routes to the east particularly along Highway 88 and the Mormon Emigrant Trail. Chinese tree of heaven (*Ailanthus altissimo*) has been found at higher elevations in El Dorado County. It is now becoming common in the 2,000 to 4,000 foot elevation zone.

Animal-caused Damage

Contributor: University of California Cooperative Extension: Greg Giuisti

Animal-caused damage focuses on vertebrate species; in this report, only mammals are reported. Animal damage can occur seasonally and be highly localized, or wide spread and occur throughout the year. Different types of damage can occur at different times of a tree's life cycle. Most vertebrates causing damage are wild, but in some instances young trees can be significantly damaged by domestic stock.



M261D

Damage is usually classified as any animal behavior that inhibits the expected growth of a tree in its particular site and can include direct feeding by an animal to a tree's terminal leader or bark; rubbing by deer or elk to dislodge the "velvet" from their antlers; stripping the bark for nesting material; trampling on young seedlings; or excavating or digging beneath a seedling, dislodging it from the soil.

Porcupine
Erethizon dorsatum

Figure 53: Porcupine damage on ponderosa pine, Goosenest RD, Klamath NF.

Photo: P. Angwin

The reported occurrence of damage caused by porcupines has dramatically decreased during the past decade. USDA Wildlife Services, California, reports that they have not received any requests for service regarding this species for many years. Beginning in 2008, a resurgence of porcupine feeding damage was reported from the Lassen National Forest (M261D) in both mixed conifer and eastside pine stands. Of note, the 100 year old trees on the eastside had evidence of past feeding damage. The damage was reported as localized and limited in extent.

261A

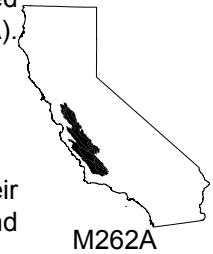
Wild Hogs
Sus scrofa

263A

Another species that seems to be resurging are wild hogs (*Sus scrofa*) after nearly a decade of relative scarceness. During the late 1980's and through the first half of the 1990's hogs created both a challenge for forest managers and a boom for hunting guides. For unknown reasons, populations declined dramatically throughout the state by the beginning of the new century. The gestation period for hogs is four months and the sow can have 6-12 young per litter. Their ability to re-populate an area relatively quickly has been observed many times over the years in California. Those counties where an increase of hog presence has been observed include Lake, Mendocino, Napa, Monterey, and Santa Cruz (261A, 263A, M261B, M262A).

M261B

Pocket gophers
Thomomys bottae



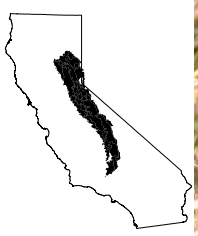
M262A

Pocket gophers can be a chronic pest to most conifers in the "whitewood" group. Their feeding behavior has been documented on Douglas-fir seedlings, saplings, pole logs, and

Figure 54: Pocket gopher.

Photo: G. Giusti

mature trees up to 36" DBH. Their behaviors are driven both by hunger and an insatiable need to gnaw on wood to manage the length of their incisors which grow continuously throughout their lives.



M261E

A total of 2,891 acres were reported as being affected by pocket gophers in 2009. Damage was reported from Hume Lake Ranger District, Sequoia National Forest (M261E), in ponderosa pine, mixed-conifer, and red fir stands; Hat Creek, Almanor and Eagle Lake Ranger Districts, Lassen National Forest (M261D), in mixed-conifer, ponderosa pine, and eastside pine stands; and from the Salmon/Scott Ranger Districts, Klamath National Forest (M261A), in mixed-conifer stands. Affected trees were generally less than 10 years of age with the level of damage being reported as static or slightly decreasing. The one exception is a 200 acre stand of red fir where damage to less than 10 year old trees may be increasing.

M261D

Black bear
Ursus americanus

A chronic challenge for north coast foresters on private and tribal redwood and Douglas-fir landscapes are black bears. Black bears continue to damage susceptible stands, pre-commercially thinned stands that are 11-20" DBH are most vulnerable. Bear feeding is generally initiated one or two years post-thinning.

263A

For the first time this past year, CALFIRE and private consulting foresters report black bear damage to coastal redwoods in Mendocino County (263A). To date, the damage had been limited to Del Norte, Humboldt, and Trinity counties (263A, M261A, M261B). This expansion of black bear damage to redwoods in Mendocino County is something relatively new and not reported in previous reports or research documents.

M261A

Deer and Elk
Odocoileus sp. and *Cervus* sp.

Deer and elk are large animals that require a relatively large amount of forage to sustain them daily. In addition, the males of both groups produce new antlers every year requiring the individuals to "rub" the velvet growing cover in order to remove the covering prior to the fall breeding season, known as the "rut". Both their feeding and rubbing behavior can have serious consequences for the growth pattern of conifers, particularly seedlings and saplings.

M261B

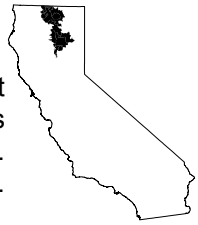
Damage by deer and elk was reported from Mendocino, Siskiyou, Plumas, Butte, Tehama and Lassen Counties. In all cases, those reporting suggested that the damage is remaining static and is affecting most trees less than 10 years of age.

Domestic Stock

Livestock are generally larger than most wild species. Consequently, their impacts to regeneration efforts can be from both foraging activity and trampling. Over the past two years a total of 880 acres of ponderosa pine regeneration plots were reported impacted

from the presence of livestock. In all cases, seedlings less than 10 years of age were reported as being damaged. In one case, young aspens were reported impacted on a 100 acre plot that has subsequently been fenced to minimize future damage. The damage is generally reported as static.

Crows
Corvus sp.


M261D

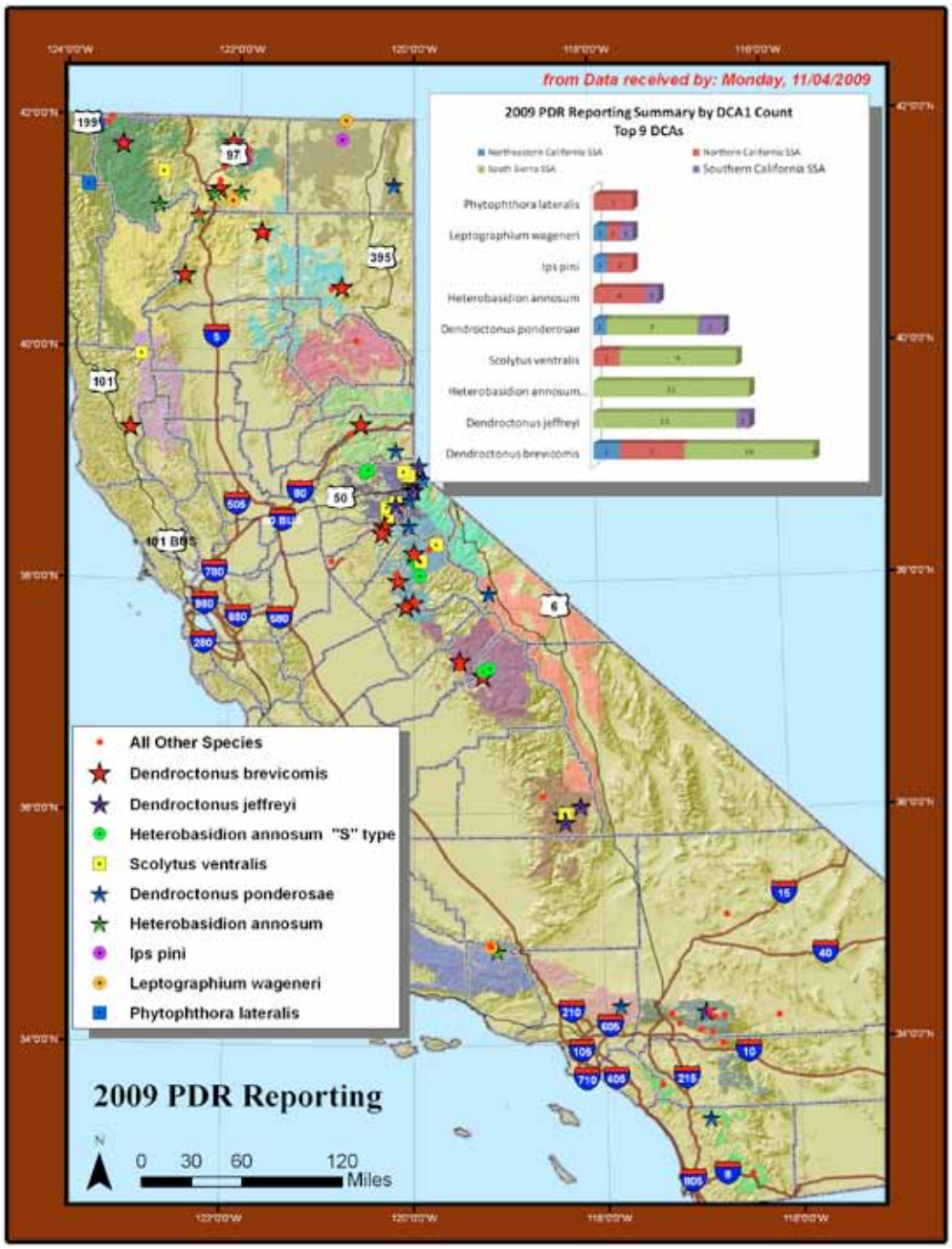
Common crows have been feeding on the seed and newly germinating seedlings at the Magalia State Forest Nursery in Magalia, Butte County (M261D). The nursery has traditionally had a problem with crows attacking the sugar, gray, and Coulter pine crops. This has been the first year that crows fed on the Jeffrey pine crop, causing significant loss.

California Insect and Disease Atlas (CAIDA)
A Historical Database

The CAIDA was developed in 2007 to compile pest surveys, detections, and reports to more readily track trends in forest health over time. To date, this database contains over 7,000 historic records of forest pests. In 2009, an electronic version of the paper Pest Detection Report (PDR) form was piloted. The map below depicts the 2009 insect and disease detections. In the future this report will be web accessible with the ability to create and display spatially explicit data and information.

Map 6: 2009 Pest detection reporting summary.

Map: Z. Liu



Insect and Disease Risk Modeling and Mapping (IDRM)

Insect and Disease Risk Modeling in California was initiated in 1995. A national multi-criterion framework was established to facilitate a standardized modeling approach across all forest health regions to create a seamless set of risk models for forest insects and diseases. Model criteria and parameters vary across the landscape for each host type. Scientific literature, professional knowledge, and statistical data form the basis for the development of the host-specific models. Input criteria for the models include: stand density index (SDI), basal area (BA), quadratic mean diameter (QMD), precipitation, relative humidity, elevation, percent canopy cover, and temperature regime, among others. The results were published in 2005. A new iteration of the national model is underway and scheduled to be completed in 2012.

Surfaces representing the input criteria for each host/pest model are currently being modeled by the Forest Health Technology Enterprise Team (FHTET). The most difficult input criteria to model is the presence/absence and density of individual tree species. The accuracy of these surfaces is critical to ensuring the correct host/pest models are generated in the correct locations. FHTET has modeled host surfaces for two USGS ecological zones in Region 5. The Forest Health Protection staff is working to qualitatively validate the accuracy of these surfaces.

This validation process begins with the creation of maps which overlay the California Existing Vegetation data over the host surfaces. These maps are reviewed and locations that may be modeled incorrectly are identified. These questionable areas are then visited by Forest Health Protection staff to determine which hosts and densities are actually present in these locations. Basal area (BA) and diameter at breast height (DBH) measurements are recorded and sent back to FHTET to calibrate the model for surface creation.

Forest Health Protection staff are also taking BA and DBH measurements in the normal course of their field visits. Providing FHTET with this additional plot data for inclusion in the modeled surface is critical to increasing the accuracy of the host surfaces. More accurate host species surfaces will generate a more accurate prediction of risk across the landscape.

2005 Risk maps are available on the USDA Forest Service, Forest Health Monitoring website at: http://www.fs.fed.us/r5/spf/fhp/fhm/risk/.

LIST OF COMMON AND SCIENTIFIC NAMES

INSECTS

Common Name	Scientific Name
Recent Introductions	
Asian citrus psyllid	*Diaphorina citri*
Asian longhorned beetle	*Anoplophora glabripennis*
Banded elm bark beetle	*Scolytus schevyrewi*
European gypsy moth	*Lymantria dispar Linnaeus*
Goldspotted oak borer	*Agrilus coxalis*
Light brown apple moth	*Epiphyas postvittana*
Mediterranean pine engraver	*Orthotomicus erosus*
Red-haired pine bark beetle	*Hylurgus ligniperda*
Walnut twig beetle	*Pityophthorus juglandis*
Bark Beetles and Wood Borers	
Ambrosia beetles	*Monarthrum spp.*
Bronze birch borer	*Agrilus anxius*
California fivespined ips	*Ips paraconfusus*
California flatheaded borer	*Melanophila californica*
Cedar bark beetle	*Phloeosinus sp*.
Douglas-fir beetle	*Dendroctonus pseudotsugae*
Fir engraver	*Scolytus ventralis*
Fir roundheaded borer	*Tetropium abietis*
Flatheaded fir borer	*Melanophila drummondi*
Jeffrey pine beetle	*Dendroctonus jeffreyi*
Monterey pine ips	*Ips mexicanus*
Mountain pine beetle	*Dendroctonus ponderosae*
Oak bark beetles	*Pseudopityophthorus spp.*
Pine engraver	*Ips pini*
Pine engravers	*Ips spp.*
Pinyon ips	*Ips confusus*
Red turpentine beetle	*Dendroctonus valens*
Western oak bark beetle	*Pseudopityophthorus pubipennis*
Western pine beetle	*Dendroctonus brevicomis*
Wood borers	*Semanotus sp.*
Yellow Phoracantha	*Phoracantha recurva*
Defoliators	
California oakworm	*Phryganidia californica*
Douglas-fir tussock moth	*Orgyia pseudotsugata*
Fall webworm	*Hyphantria cunea*
Fruittree leafroller	*Archyps argyrosphila*
Gypsy moth	*Lymantria dispar*
Lodgepole pine needleminer	*Coleotechnites milleri*
Pandora moth	*Coloradia pandora*
Pine catkin sawflies	*Xyela* spp.
White fir sawfly	*Neodiprion abietis*
Other Insects	
Aspen gall wasp	unknown
Black Pineleaf Scale	*Nuculaspis californica*
Cooley spruce gall aphid	*Adelges cooleyi*
Douglas-fir twig weevil	*Cylindrocopturus furniss*

Gouty pitch midge	*Cecidomyia piniinopis*
Jeffrey pine needleminer	*Coleotechnites sp. near milleri*
Needleminers	*Coleotechnites spp*.
Pine needle sheathminer	*Zelleria haimbachi*
Pine reproduction weevil	*Cylindrocopturus eatoni*
Ponderosa pine tip moth	*Rhyacionia zozana*
Ponderosa pine twig scale	*Matsucoccus bisetosus*
Red gum lerp psyllid	*Glycaspis brimblecombei*
Scales	*Physokermes sp.*
Sequoia pitch moth	*Synanthedon sequoiae*
Spruce aphid	*Elatobium abietinum*
The obtuse sawyer	*Monochamus obtusus*
Western pineshoot borer	*Eucosma sonomana*

DISEASES AND THEIR CAUSAL PATHOGENS

Common Name	Scientific Name
Cankers	
Alder canker	*Phytophthora siskiyouensis*
Chinquapin canker	*Phytophthora cambivora*
Chinkapin canker	Unknown
Cytospora canker of true fir	*Cytospora abietis*
Diplodia blight of pines	*Sphaeropsis sapinea (Diplodia pinea)*
Douglas-fir canker	Unknown
Madrone canker	*Nattrassia mangiferae* and *Botryosphaeria dothidea*
Phomopsis canker	*Phomopsis lokoyae*
Pitch canker	*Fusarium circinatum*
Sooty Bark Canker	*Encoelia pruinosa (=Cenangium singulare)*
Thousand Cankers Disease of Black Walnut	*Geosmithia sp. and Fusarium solani*
Declines	
Oak Decline	Unknown
Chaparral Death and Decline	Unknown
Incense-cedar decline	Unknown
Sudden oak death	*Phytophthora ramorum*
Mistletoes	
Douglas-fir dwarf mistletoe	*Arceuthobium douglasii*
Gray pine dwarf mistletoe	*Arceuthobium occidentale*
Lodgepole Pine Dwarf Mistletoe	*Arceuthobium americanum*
Mountain hemlock dwarf mistletoe	*Arceuthobium tsugense* subsp. *mertensianae*
Pinyon pine dwarf mistletoe	*Arceuthobium divaricatum*
Red fir dwarf mistletoe	*Arceuthobium abietinum* f. sp. *magnificae*
Sugar pine dwarf mistletoe	*Arceuthobium californicum*
Western dwarf mistletoe	*Arceuthobium campylopodum*
White fir dwarf mistletoe	*Arceuthobium abietinum* f. sp. *concoloris*
Foliage Diseases	
Elytroderma Needle Cast	*Elytroderma deformans*

Ink Spot of Aspen	*Ciborinia whetzelii*
Stigmina Leaf Spot Of Port-Orford-Cedar	*Stigmina thujina*
Sugar pine needle cast	*Lophodermella arcuata*

Nursery Diseases

No Common Name	*Cylindrocarpon destructans*
No Common Name	*Phytophthora ramorum*

Leaf Scorch

Sweetgum Leaf Scorch	*Xylella fastidiosa*
Maple Leaf Scorch	*Xylella fastidiosa*

Root Diseases

Annosus root disease	*Heterobasidion annosum*
Armillaria root disease	*Armillaria mellea*, *Armillaria* sp.
Black stain root disease	*Leptographium wageneri*
Port-Orford-cedar root disease	*Phytophthora lateralis*
Phytophthora root rot	*Phytophthora cinnamomi*
Schweinitzii root disease	*Phaeolus schweinitzii*

Rots

Butt Rot	*Phellinus tremulae*

Rusts

Eucalyptus/guava/myrtle rust	*Puccinia psidii*
Incense-cedar Rust	*Gymnosporangium libocedri*
Stalactiform Rust	*Cronartium coleosporioides (= C. stalactiformae)*
Western gall rust	*Endocronartium harknessii*
White pine blister rust	*Cronartium ribicola*

True Mistletoes

True mistletoe	*Phoradendron* spp.
Oak Mistletoe	*Phoradendron serotinum ssp. tomentosum (Phoradendron villosum)*

TREES

Common Name	Scientific Name
Conifers	
Pines	
Aleppo pine	*Pinus halepensis*
Bishop pine	*Pinus muricata*
Coulter pine	*Pinus coulteri*
Foxtail pine	*Pinus balfouriana*
Gray pine	*Pinus sabiniana*
Italian stone pine	*Pinus pinea*
Jeffrey pine	*Pinus jeffreyi*
Knobcone pine	*Pinus attenuata*
Lodgepole pine	*Pinus contorta* var. m*urrayana*
Monterey pine	*Pinus radiata*
Ponderosa pine	*Pinus ponderosa*
Singleleaf pinyon	*Pinus monophylla*
Sugar pine	*Pinus lambertiana*

Torrey pine	*Pinus torreyana*
Western white pine	*Pinus monticola*
Whitebark pine	*Pinus albicaulis*

True firs

Red fir	*Abies magnifica*
White fir	*Abies concolor*

Others

Brewer spruce	*Picea breweriana*
Douglas-fir	*Pseudotsuga menziesii*
Engelmann spruce	*Picea engelmannii*
Giant sequoia	*Sequoia giganteum*
Incense-cedar	*Calocedrus decurrens*
Mountain hemlock	*Tsuga mertensiana*
Port-Orford-cedar	*Chamaecyparis lawsoniana*
Coast redwood	*Sequoia sempervirens*
Sitka spruce	*Picea sitchensis*

Hardwoods

Oaks

Oaks	*Quercus* spp.
California black oak	*Quercus kelloggii*
Coast live oak	*Quercus agrifolia*
Shreve Oak	*Quercus parvula* var. *shrevei*

Other

Aspen	*Populus tremuloides*
Big-leaf maple	*Acer macrophyllum*
California bay laurel	*Umbellularia californica*
California sycamore	*Platanus racemosa*
Camphor	*Cinnamomum camphora*
Chinkapin	*Castanopsis chrysophylla*
Eucalyptus	*Eucalyptus* spp.
Mountain mahogany	*Cercocarpus* sp.
Pacific madrone	*Arbutus menziesii*
Poison oak	*Toxicodendron diversilobum*
Poplar	*Populus* spp.
Tanoak	*Lithocarpus densiflorus*
Willow	*Salix* spp.

Publications and Information Distribution

2009 Forest Health Monitoring Posters for Evalutaion Monitoring projects
http://fhm.fs.fed.us/posters/index.shtml

Angwin, Peter A. 2008. Evaluation of Port-Orford-cedar root disease situation at Sanger Lake. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. N09-01. 4 p.

Angwin, Peter A. 2009. Biological evaluation of insect and disease conditions in the Hi-Grouse Project Area, Goosenest Ranger District. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. N09-02. 7 p.

Angwin, Peter A. 2009. Annosus root disease at McBride Springs Campground, Shasta-McCloud Management Unit. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. N09-03. 4 p.

Bulaon, Beverly M., Egan, J., MacKenzie, M. 2009. Evaluation of Insect and Disease Incidence on the Big Grizzly Project, Georgetown Ranger District, Eldorado National Forest. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. SS09-02. 13 p.

Bulaon, Beverly M., Egan, J., MacKenzie, M. 2009. Current Situation of Mountain Pine Beetle at High Meadows, Lake Tahoe Basin Management Unit. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. SS09-03. 8 p.

Bulaon, Beverly M., Egan, J., MacKenzie, M. 2009. Forest Health survey of Huntington Lake Basin Recreation Area, Sierra National Forest. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. SS09-15. 14 p.

Cluck, Daniel R. 2009. Douglas-fir Tussock Moth Pheromone Detection Survey 2008 Report. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. NE09-01. 2 p.

Cluck, Daniel R. 2009. Evaluation of grasshopper injury to sugar pine seedlings in the Foresthill Forest Genetics Center. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. NE09-02. 4 p.

Cluck, Daniel R. 2009. Evaluation of hazard tree marking within the Moonlight Fire. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. NE09-03. 7 p.

Coleman, T.W. 2009. Forest Health Conditions for 2008, Angeles National Forest, FHP Report SC09-01. 5 p.

Coleman, T.W. 2009. Forest Health Conditions for 2008 and update on goldspotted oak borer activities, Cleveland National Forest, FHP Report SC09-02. 5 p.

Coleman, T.W. 2009. Forest Health Conditions for 2008, Los Padres National Forest, FHP Report SC09-03. 5 p.

Coleman, T.W. 2009. Forest Health Conditions for 2008, San Bernardino National Forest, FHP Report SC09-04. 5 p.

Coleman, T.W. 2009. Oak Mortality on the Viejas Reservation from the from the goldspotted

oak borer, FHP Report SC09-06. 6 p.

Egan J. M. 2008. A retrospective study of forest thinning and subsequent bark beetle-caused mortality in the Warner Mountains of Northeastern California. M.S. Thesis Colorado State University, 152 p.

Egan, Joel M. 2009. Evaluation of Fire-Injured Trees in the Lily Project Thinning and Prescribed Underburn, Summit Ranger District, Stanislaus National Forest. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. SS09-01. 9 p.

Egan, Joel M., Bulaon, B., MacKenzie, M. 2009. Evaluation of Two Red Fir Units Proposed for Management in Bear Valley Ski Area, Calaveras Ranger District, Stanislaus National Forest. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. SS09-07. 12 p.

Egan, Joel M., MacKenzie, M. 2009. Evaluation of Jeffrey pine mortality near Fallen Leaf Lake Campground. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. SS09-12. 7 p.

Gillette, N.E., Erbilgin, N., Webster, J.N., Pederson, L., Mori, S.R., Stein, J.D., Owen, D.R., Bischel, K.M., Wood, D.L. 2009. Aerially applied verbenone-releasing laminated flakes protect Pinus contorta stands from attack by Dendroctonus ponderosae in California and Idaho. Forest Ecology and Management (257):1405-12.

Graves, A.D., Coleman, T.W., Flint, M.L., and Seybold, S.J. 2009. Walnut twig beetle and thousand cankers disease: Field identification guide, UC-IPM Website Publication, 2 pp., Nov. 21, 2009, http://www.ipm.ucdavis.edu/PDF/MISC/thousand_cankers_field_guide.pdf

Graves, A.D., Flint, M.L., Coleman, T.W., and Seybold, S.J. 2010. Thousand cankers disease of walnuts: A new disease in California, UC-IPM Website Publication, 4 pp., http://www.ipm.ucdavis.edu/EXOTIC/thousandcankers.html

Smith, Sheri L. 2009. Goldspotted oak borer strategic plan. USDA Forest Service, Pacific Southwest Region, Vallejo, CA. http://www.fs.fed.us/r5/spf/fhp/socal/Goldspotted%20Oak%20Borer%20Strategic%20Plan%20September%202009.pdf

Snyder, Cynthia L. 2009. Biological evaluation of proposed Six Mile LSR thinning project-Salmon/Scott Ranger District. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. N09-04. 3 p.

Snyder, Cynthia L. 2009. Biological evaluation of Scott Bar Mountain thinning project-Salmon/Scott River Ranger District. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. N09-05. 3 p.

Snyder, Cynthia L. 2009. Biological evaluation of Middle Creek thinning project. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. N09-06. 3 p.

Snyder, Cynthia L. 2009. Biological evaluation thinning projects- Goosenest Ranger District. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. N09-07. 9 p.

Snyder, Cynthia L. 2009. Insect and disease evaluation of silvicultural certification stands 160 and 161 in Elk LSR for Craig Sewell. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. N09-09. 4 p.

Snyder, Cynthia L. 2009. Port-Orford-cedar root disease update for Clear Creek drainage, Siskiyou Wilderness. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. N09-10. 7 p.

Snyder, Cynthia L. 2009. Insect and disease evaluation of plantations in the Buttermilk LSR for Joe Miranda. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. N09-11. 3 p.

Snyder, Cynthia L. 2009. Insect and disease evaluation of rust resistant sugar pines for Chad Atwood. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. N09-13. 3 p.

Snyder, Cynthia L. 2009. Insect and disease evaluation of plantations in the Willow Creek PCT for Chad Atwood. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. N09-14. 3 p.

Woodruff, William C., Cluck, Daniel R. 2009. Insect and disease evaluation of silvicultural certification stand 'Gold 14' and an off-site Jeffrey pine plantation. USDA Forest Service, Pacific Southwest Region, Forest Health Protection Report No. NE09-04. 9 p.

FOREST PEST DETECTION REPORT

I. FIELD INFORMATION (See instructions on reverse)

1. County:

2. Forest (FS only):

3. District (FS only):

4. Legal Description:
T. R.
Section (s)

5. Date:

6. Location:

UTM:

7. Landownership:
- National Forest ☐
- Other Federal ☐
- State ☐
- Private ☐

8. Suspected Cause of Injury:
- 1. Insect ☐
- 2. Disease ☐
- 3. Animal ☐
- 4. Weather ☐
- 5. Chemical ☐
- 6. Mechanical ☐
- 7. Weed ☐
- 8. Unknown ☐

9. Size of Trees Affected:
- 1. Seedling ☐
- 2. Sapling ☐
- 3. Pole ☐
- 4. Sawtimber ☐
- 5. Overmature ☐

10. Part(s) of Tree Affected:
- 1. Root ☐
- 2. Branch ☐
- 3. Leader ☐
- 4. Bole ☐
- 5. Twig ☐
- 6. Foliage ☐
- 7. Bud ☐
- 8. Cone ☐

11. Species Affected:

12. Number Affected:

13. Acres Affected:

14. Injury Distribution:
1. Scattered ◯ 2. Grouped ◯

15. Status of Injury:
1. Decreasing ◯ 2. Static ◯ 3. Increasing ◯

16. Elevation:

17. Plantation?
1. Yes ◯ 2. No ◯

18. Stand Composition (species):

19. Stand Age and Site Class:
Age: Class:

20. Stand Density:

21. Site Quality:

22. Pest Names (if known) and Remarks (symptoms and contributing factors):

23. Sample Forwarded:
1. Yes ◯ 2. No ◯

24. Action Requested:
- 1. Information only ☐
- 2. Lab Identification ☐
- 3. Field Evaluation ☐

25. Reporter's Name:

26. Reporter's Agency:

27. Reporter's Address, email and Phone Number:
email: _____ phone: _____
Address 1: _____
Address 2: _____
City: _____ State: _____ Zip: _____

II. Reply (Pest Management Use)

28. Response:

29. Report Number:

30. Date:

31. Examiner's Signature:

R5-3400-1 (Rev. 3/02)

Completing the Detection Report Form

Heading (Blocks 1-7): Enter all information requested. In Block 6, **LOCATION**, provide sufficient information for the injury center to be relocated. If possible, attach a location map to this form.
Injury Description (Blocks 8-15): Check as many boxes as are applicable, and fill in the requested information as completely as possible.
Stand Description (Blocks 16-21): This information will aid the examiner in determining how the stand conditions contributed to the pest situation. In Block 18 indicate the major tree species in the overstory and understory. In Block 19, indicate the stand age in years and/or the size class (seedling-sapling; pole; young sawtimber; mature sawtimber; overmature or decadent).
Pest Names (Block 22): Write a detailed description of the pest or pests, the injury symptoms, and any contributing factors.
Action Requested (Block 24): Mark “Field Evaluation” only if you consider the injury serious enough to warrant a professional site evaluation. Mark “Information Only” if you a reporting a condition that does not require further attention. All reports will be acknowledged and questions answered on the lower part of this form.
Reply (Section II): Make no entries in this block; for examining personnel only. A copy of this report will be returned to you with the information requested.
Handling Samples: Please submit injury samples with each detection report. If possible, send several specimens illustrating the stages of injury and decline. Keep samples cool and ship them immediately after collection. Send them in a sturdy container, and enclose a completed copy of the detection report.

Your participation in the Cooperative Forest Pest Detection Survey is greatly appreciated. Additional copies of this form are available from the Forest Service - Forest Health Protection, and from the California Department of Forestry and Fire Protection.

The Cooperative Forest Pest Detection Survey is sponsored by the California Forest Pest Council. The Council encourages federal, state, and private land managers and individuals to contribute to the Survey by submitting pest injury reports and samples in the following manner:

Federal Personnel: Send all detection reports through appropriate channels. Mail injury samples with a copy of this report to one of the following offices:

USDA Forest Service
State and Private Forestry
Forest Health Protection
1323 Club Drive
Vallejo, CA 94592

Forest Health Protection
Shasta-Trinity
National Forest
3644 Avtech Parkway
Redding, CA 96002

Forest Health Protection
Stanislaus National Forest
19777 Greenley Road
Sonora, CA 95370

Forest Health Protection
Lassen National Forest
2550 Riverside Drive
Susanville, CA 96130

Forest Health Protection
San Bernardino National Forest
602 Tippecanoe Avenue
San Bernardino, CA 92408-2677

State Personnel: Send all detection reports through channels. Mail injury samples with a copy of this report to one of the following appropriate offices:

Forest Pest Management
CA Dept. of Forestry & Fire Protection
P.O. Box 944246
Sacramento, CA 94244-2460

Forest Pest Management
CA Dept. of Forestry & Fire Protection
6105 Airport Road
Redding, CA 96002

Forest Pest Management
CA Dept. of Forestry & Fire Protection
17501 N. Highway 101
Willits, CA 95490

Forest Pest Management
CA Dept. of Forestry & Fire Protection
SLU Meridian Station
4050 Branch Road
Paso Robles, CA 93446

Private Land Managers and Individuals: Send all detection reports and samples to the closest California Department of Forestry and Fire Protection office listed above.

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