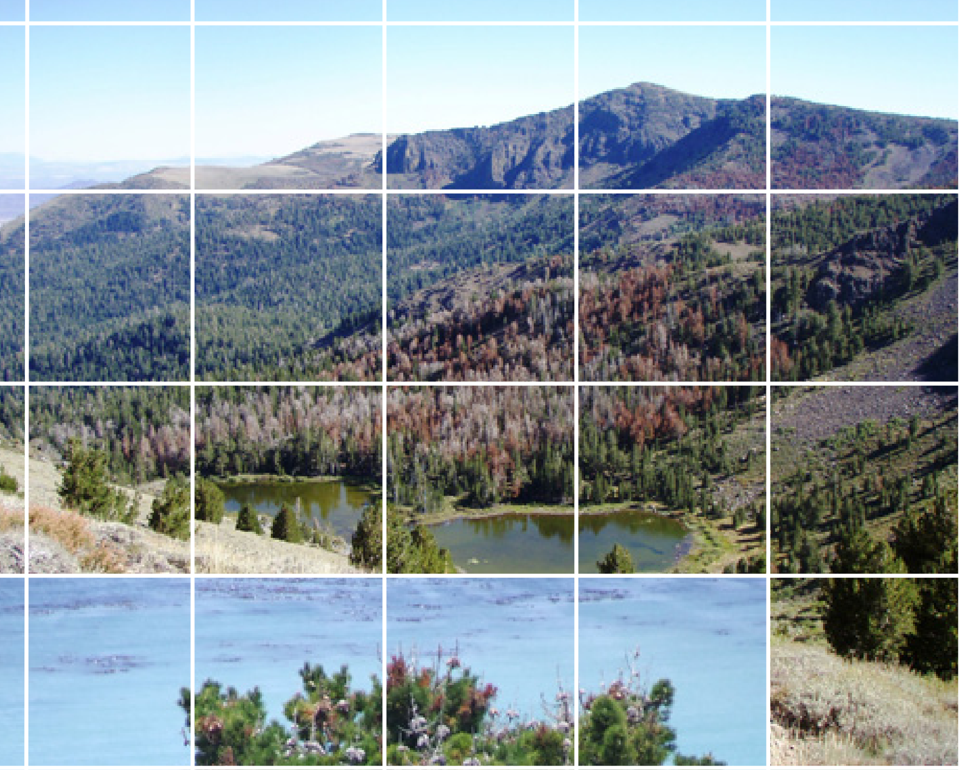
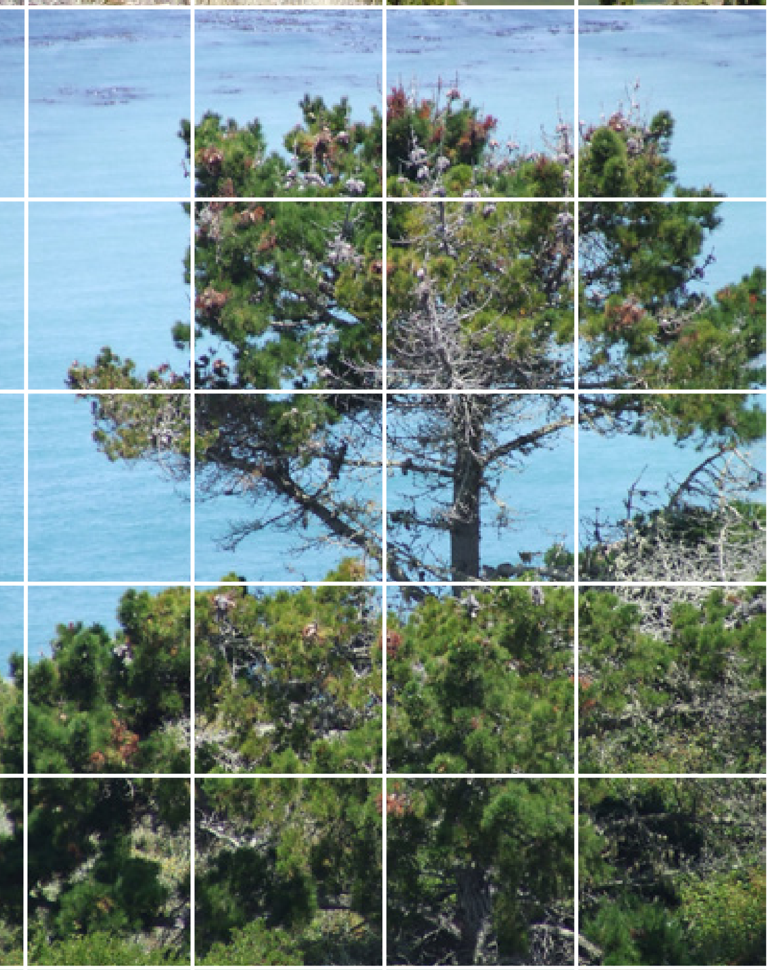
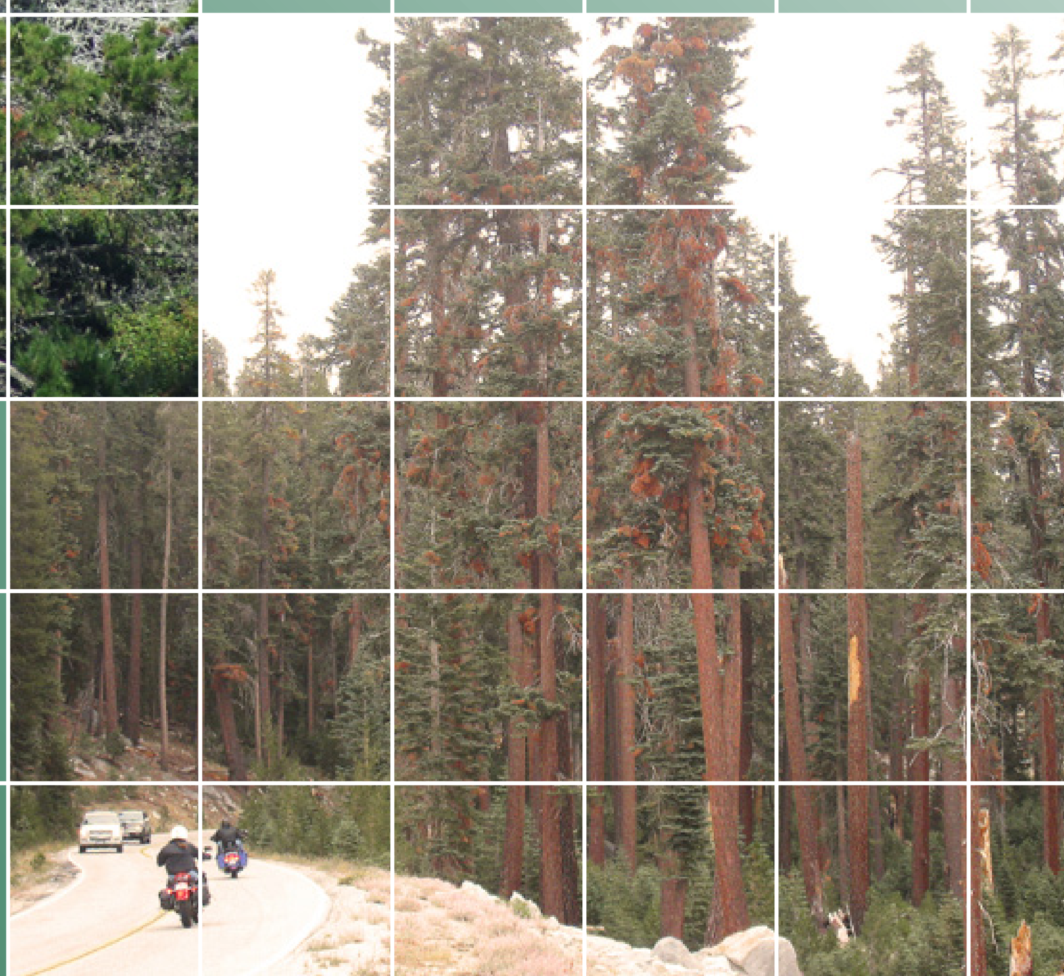




2010 Forest Pest Conditions California



A publication of the
California Forest
Pest Council

CALIFORNIA FOREST PEST CONDITIONS 2010

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Cover Photos

Top: Mountain pine beetle-caused mortality in whitebark and lodgepole pine, North Emerson Lake, Warner Mountains, Modoc National Forest, by Rachel Simons

Center: Pitch canker in Bishop pine, Monterey Ranger District, Los Padres National Forest, by Brent Oblinger

Bottom: Cytospora canker and dwarf mistletoe in red fir, Highway 120, Yosemite National Park, by Leif Mortenson

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/index.shtml

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Introduction

By Lisa Fischer

The 2010 edition of the *California Forest Pest Conditions* report highlights forest health activities and conditions covering native and non-native insects and diseases, forest conditions, abiotic factors, and invasive plants contributing to overall forest health, and serves as a historical record. This report was compiled by and for resource professionals, public and private land managers, and other interested parties for the purpose of reporting on conditions and the status of forest health across all forested lands in California.

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. New this year is the addition of a section on invasive plants; information for this section is provided by California Department of Food and Agriculture (CDFA), California Invasive Plant Council (CalIPC), Weed Management Areas, Forest Service, National Park Service (NPS), county and Tribal governments, and other organizations and non-profits. Integrating invasive plants into this report provides a more comprehensive look at the myriad complexities affecting our ecosystems and the health of our forests, oak woodlands, and shrublands across the State.

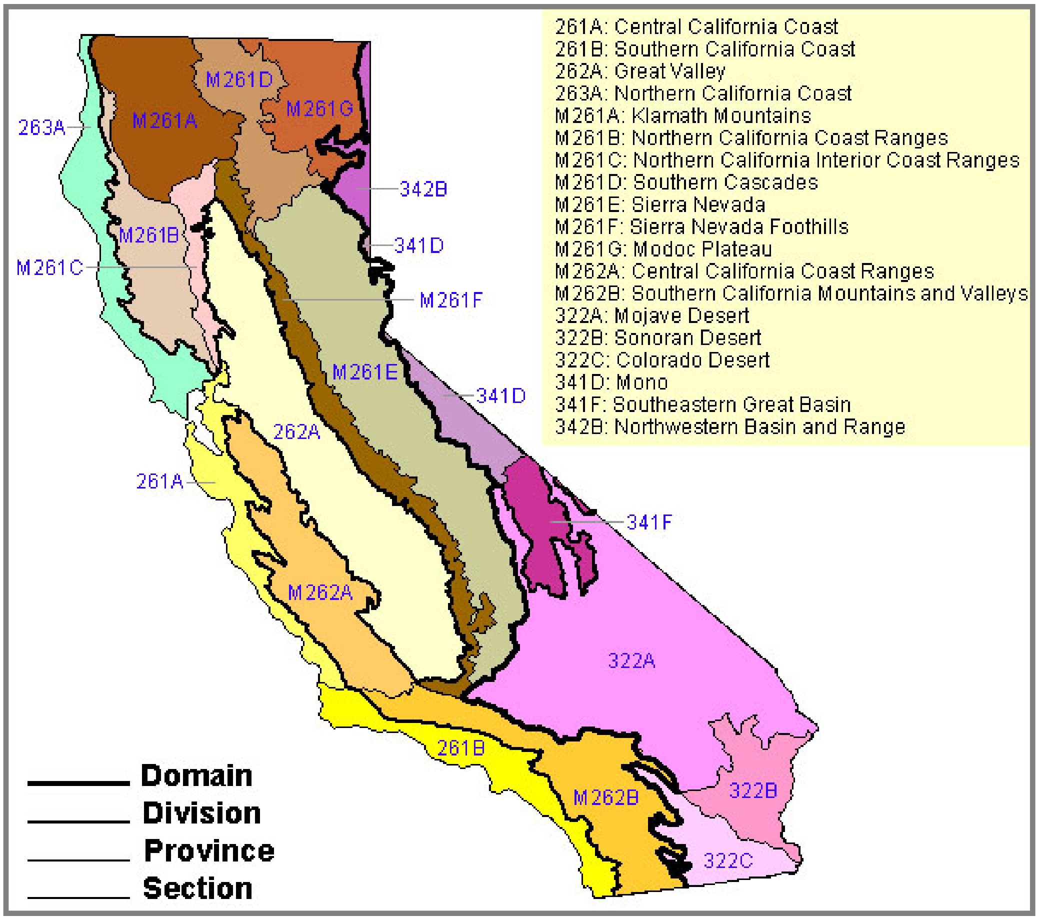
An analysis of the California Forest Pest Conditions reports from their inception in 1949 through 2009 has revealed certain historic trends where various insects and diseases have gone through regular or sporadic outbreak periods. The most significant trend has been the impact of invasive pests to the state. Originally, the only invasive forest pest mentioned was white pine blister rust. In recent years, invasive insect and disease pests have represented approximately one third of all the major forest pests listed in the reports.

California's recent weather patterns, most notably the previous three-year drought followed by two-wet springs, impact the overall health of our forests and range lands. For the water year beginning October 1, 2009, precipitation for California averaged close to normal, ending a 3-year drought in most parts of the state. Late storms in April and May of 2010 resulted in two consecutive years with wet springs. The cumulative total precipitation for the months of March, April, and May averaged for 8 northern Sierra weather stations was 18.4 inches. In 2009, the total was 15.5. The historical average is 12.9 inches (California Department of Water Resources). The late spring precipitation was responsible for a resurgence of several diseases including pitch canker. Insect activity is still responding to the previous three years of drought with mountain pine beetle, western pine beetle, and fir engraver causing the most conifer mortality.

This year also wraps up the completion of the California Insect and Disease Atlas (CAIDA) webGIS portal. There are over 8,000 pest detection reports included in CAIDA contributed by various agencies and organizations.

This report is organized by biotic damage agents, insects, diseases and declines, animal damage, abiotic activity, invasive plants and monitoring, 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 (see page 2) depicts regional and subregional extents of ecosystems, 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.

Map 1: Ecoregions of California, Bailey



California Forest Health Pest Conditions and Activity 2010 At-a-glance

Native bark beetles are a major cause of tree mortality in California. When, where, and the extent to which mortality occurs, is influenced by forest stand conditions and weather patterns. A dramatic rise in the number of dead trees typically follows several years of inadequate moisture. The more severe and prolonged the drought, coupled with dense stands of trees, equates to more host material available for beetle colonization and the potential for greater numbers of dead trees. Many areas of the state have been precipitation-deficit since 2007, resulting in increases in bark beetle-caused tree mortality over the past three years; for this most recent water year beginning October 1, 2009, precipitation for California averaged close to normal, ending a 3 year drought in some areas of the state. However, as is typical with bark beetle life cycles and tree fading patterns, most of the tree mortality attributed to native bark and engraver beetles this year was due to beetle attacks that occurred in 2009, a year when California's average seasonal precipitation through April 2009 was just 80% of normal.

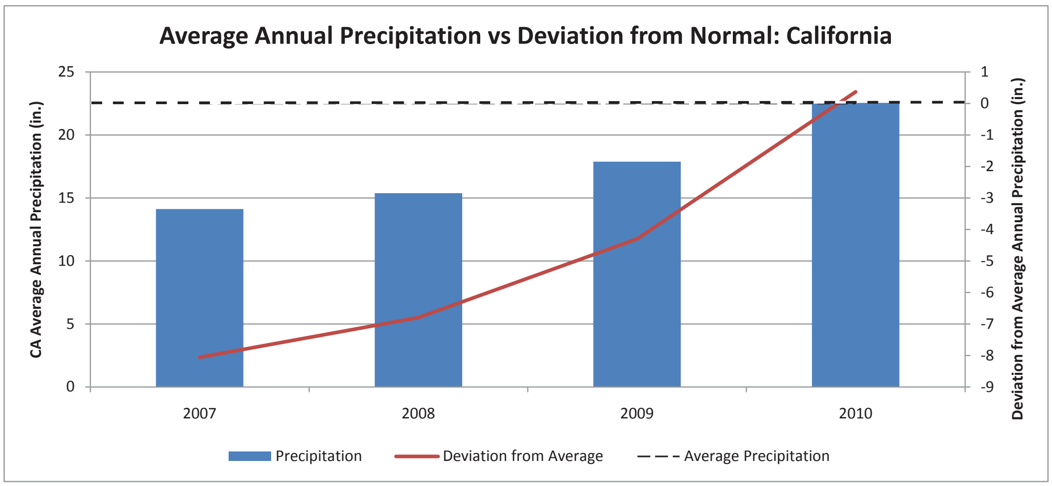


Table 1: California Precipitation 2007 through 2010

The number of trees killed by mountain pine beetle, western pine beetle, and fir engraver beetle was much higher in 2010, than in 2009, in many areas of the southern Cascades, Sierra Nevada and Southern California mountains, and on the Modoc Plateau. Aerial surveys mapped over 750,000 acres attributed to bark beetles, over double the acreage mapped in 2009 and triple the acreage mapped in 2008. Approximately 550,000 of the acres mapped in 2010 were true fir mortality attributed to fir engraver activity, and western pine beetle activity was attributed to 113,000 acres of ponderosa pine mortality. Pine mortality from mountain pine beetle remained close to 2009 figures at 94,000 acres, and Jeffrey pine beetle-caused mortality decreased from 2009.

Insect Activity Highlights

- Mountain pine beetle caused the highest level of mortality of pines during 2010. Continued activity in whitebark pines has increased the level of concern for this species.
- Western pine beetle activity in ponderosa pines, increased this year throughout Northern California. Coulter pine mortality attributed to western pine beetle increased in Southern California.
- Fir engraver attacks resulted in a substantial increase in top kill and whole tree mortality across hundreds of thousands of acres in northern California and the Sierra Nevada range. Affected areas were most often associated with drought conditions, overstocked stands, and other biotic agents.
- Douglas-fir tussock moth defoliation continued for the second year in Southern California; however, significant tree mortality has not been observed.
- An estimated 1,532 oaks succumbed to attacks by goldspotted oak borer in San Diego County.

Awareness and concern regarding invasive forest pests continues to increase as more exotic species are being found in transported firewood and other wood products. Ash firewood infested with various life stages of emerald ash borer was denied entry into the state at the Topaz Border Protection Station in July, when a truck pulling a recreational trailer from Michigan was inspected for potential gypsy moth life stages. Goldspotted oak borer, an invasive insect that likely came into California in firewood from Arizona several years ago, killed an estimated 1,500 oaks in 2010. Aerial survey data indicates that this wood borer has been active in San Diego County since 2002, causing the death of roughly 1,500 to 2,000 trees per year. In 2010, an estimated 1,532 oaks succumbed to attacks by this wood boring beetle.

Severity of many diseases, similar to bark beetle activity, is influenced by the amount, timing, and duration of precipitation in current and previous years as well as stand conditions. Mortality associated with *Phytophthora ramorum*, the causal agent of sudden oak death (SOD), for example, often decreases following dry years. The observation of fewer oak and tanoak trees killed by SOD in established disease areas near the central coast compared with previous wetter years fits this pattern. However, there were several areas along the north coast where *Phytophthora ramorum* was newly detected, and expanded the range of the pathogen. Higher spring precipitation this past year also promoted the spread of infection and caused mortality levels to increase in other pathogens such as *Phytophthora lateralis* (cause of Port-Orford-cedar (POC) root disease). Port-Orford-cedar root disease killed trees in new areas along the north coast this year expanding it's range into the Trinity watershed, the last major uninfested watershed within the range of POC. Mortality and decreased growth of ponderosa pine due to black stain root disease, and bark beetle complexes, has continued to increase around root disease centers in portions of northeastern California.

Existing foci of *Heterobasidion occidentale* continue to affect true firs throughout forests of the Sierra Nevada, especially in management areas in the Eldorado National Forest, and expand by about a meter each year. New foci are becoming established, especially in areas where borax is not being applied to stumps of conifers which have been felled. Currently, 20% of all red fir mortality is ascribed to root disease caused by this fungus.

While no new diseases were reported in California in 2010, monitoring detected increased occurrences of two diseases: sweetgum scorch, caused by *Xylella fastidiosa*, and myrtle rust, caused by *Puccinia psidii*. While the myrtle rust is not necessarily a threat to California species, susceptible foliage of myrtle and some eucalyptus species can be shipped to wetter global locations as green filler for floral bouquets. The export of this fungus in this manner could have negative consequences for many other Myrtaceous species.

Disease Activity Highlights

- *Phytophthora ramorum*, the pathogen responsible for sudden oak death (SOD), was confirmed for the first time causing dieback and mortality in tanoak in Redwood Creek in Humboldt County. This find greatly increases the northernmost occurrence of SOD in California.
- Port-Orford-cedar root disease was found in the Trinity River watershed. This was the last major uninfested watershed in the native range of Port-Orford-cedar.
- Pitch canker damage continued to be observed in Monterey and Bishop pine stands of the central and north coast.
- Severe branch flagging on red fir associated with Cytospora canker increased and was widespread throughout the Sierras.
- The exotic rust fungus, *Puccinia psidii*, was found on myrtle in southern California.
- Severe leaf damage on sycamore was observed throughout the state in forest and ornamental settings due to anthracnose and powdery mildew directly following spring rains.
- Heavy precipitation caused problems in some established root disease centers, including branch and bole breakage from snow and ice storms.

During 2010, several state-wide initiatives have been working towards a more coordinated and comprehensive inventory, mapping, and management effort against a wide range of invasive plants affecting California's forests. The infusion of a large amount of Federal stimulus funding for invasive plant management has allowed for several wide-ranging mapping and management efforts to move substantially forward in 2010. Most invasive plants in California's forests are still considered to be eradicable, which increases the importance of early detection (inventory) and a rapid response to known occurrences. Management to support the goal of localized eradication has responded to the presence of many different invasive plant species throughout the state.

A notable exception to the stated goal of eradication for most forest invasive plants is the strategy to contain yellow star thistle, a ubiquitous invasive plant found in most parts of California. Yellow star thistle is not common in the mid to high elevations of the Sierra Nevada Mountains, so a containment strategy has been established; considerable work involving numerous partners has occurred within this strategy in 2010.

Invasive Plant Activity Highlights

- Yellow star thistle, the most common and well known noxious weed in CA infests approximately 20 million acres across the State; localized eradication efforts supplement the containment strategy.
- Saltcedar, an aggressive invader of riparian areas in drier areas, replaces native species, extracts salts from the soil, and excretes salt from its leaves increasing surface soil salinity, inhibiting native plant establishment and regrowth; eradication projects are ongoing.
- Thistles including musk, Canada, Scotch, and Italian thistle are expanding in their ranges; a large eradication project involving musk thistle and multiple ownerships is occurring in the Truckee River watershed.
- Leafy spurge, a perennial plant that can be toxic to humans and livestock if ingested, has limited distribution in California, with the largest infestation in north central CA; a watershed based eradication effort is underway within the Scott and Klamath River watersheds.
- Cheatgrass, an annual grass established throughout CA, is a threat to native vegetation types and can change the fire frequency in an area; eradication efforts continue in several areas.
- Several knapweeds are found throughout CA; management activities focus on eradication.
- A citizen-scientist program using smartphone technology is being implemented in the Santa Monica Mountain National Recreation Area and the San Francisco Bay Area to identify the locations of invasive weeds and map the spread throughout time.

Insect Conditions

Invasive Insects

Goldspotted oak borer
Agrilus auroguttatus
Contributions by: Tom Coleman

Goldspotted oak borer-caused tree mortality continued for an eighth year on the Descanso Ranger District, Cleveland National Forest, tribal land, Cuyamaca Rancho State Park, and private land (San Diego County, M262B). An estimated 1,532 dead oaks were detected via aerial survey in 2010. Coast live oak was the primary tree species mapped across 930 acres. Additional and current information about this new pest can be found at the goldspotted oak borer website (http://www.gsob.org).

Fig 1: Coast live oak killed by goldspotted oak borer on Exiiaapaayp Reservation.

Photo: T. Coleman

M262B

Emerald Ash Borer
Agrilus planipennis
Contributions by: Sheri Smith and California Department of Food and Agriculture

On July 13, 2010, a truck pulling a recreational trailer from Michigan entered the Topaz Border Protection Station. Inspector Susan Greenhouse informed the travelers that she needed to inspect the truck and trailer for gypsy moth. Inspector Greenhouse immediately noticed borer holes, galleries, and boring dust on firewood located in the truck bed. She informed the driver that the firewood would be prohibited entry because of insect activity and damage. The driver reluctantly relinquished 25 pieces of wood. D-shaped borer exit holes were found by both Inspector Greenhouse and station manager Chris Friedman, along with three suspect dead adult beetles, six suspect dead larvae, and one suspect pupa. All collected insects were sent to the CDFA lab in Sacramento and confirmed as emerald ash borer (*Agrilus planipennis*) by entomologist Chuck Bellamy.

Fig 2: Ash firewood from Michigan infested with emerald ash borer, Topaz Border Protection station, July 2010.

Photo: C. Friedman and S. Greenhouse, CDFA

Fig 3: Adult emerald ash borer in ash firewood, Topaz Border Protection Station, July 2010.

Photo: C. Friedman and S. Greenhouse, CDFA

European Gypsy Moth
Lymantria dispar
Contributions by: Sheri Smith and California Department of Food and Agriculture

In 2010, one European gypsy moth was trapped in Palo Alto (Santa Clara County, 261A). No additional gypsy moths were found during delimitation trapping around the Palo Alto detection site.

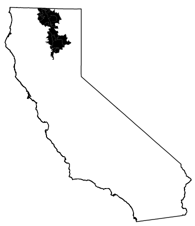
261A

Native Insects

Bark Beetles

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

Overview: Jeffrey pine mortality caused by Jeffrey pine beetle continued to decrease this year compared to the previous two years across the northeastern part of the state, in the Lake Tahoe Basin, and further south in the southern Sierra Nevada. The highest level of activity this year was reported on the Angeles National Forest in southern California. More specific information on location, host species, and number of trees or acres affected is provided below.



M261D

Specifics: Jeffrey pine beetle activity was relatively limited throughout northeastern California this year. Jeffery pine beetles killed 24 Jeffrey pines (spanning 10-18″ and >40″ DBH) in three groups near the north entrance of Lassen Volcanic National Park (Shasta County, M261D), and two large diameter (>30″ DBH) and five smaller diameter Jeffrey pines in Mill Creek Campground, Warner Mountains, Modoc National Forest (Modoc County, M261G).

Jeffrey pine beetle activity also decreased in the southern Sierras, particularly in the southern areas of the Lake Tahoe Basin Management Unit (El Dorado County, M261E). Suppression treatments last year at Fern Lake were successful in preventing significant tree mortality, only two new trees were attacked in 2010; beetle activity around Luther Pass has also subsided. Jeffrey pine beetles killed small diameter Jeffrey pine (<11” DBH) where previous tree mortality pockets had occurred on the Kernville Ranger District, Sequoia National Forest (Kern County, M261E). Trees were also attacked by pine engraver and red turpentine beetles.

M262B

Jeffrey pine beetle killed Jeffrey pines spanning several areas on the San Gabriel and Santa Clara Ranger Districts, Angeles National Forest (San Bernardino County, M262B). High tree densities around Wrightwood and in the San Gabriel Wilderness contributed to increasing bark beetle activity. Significant tree mortality occurred across 741 acres, impacting 299 trees.

Mountain Pine Beetle
Dendroctonus ponderosae
Contributions by: Beverly Bulaon, Danny Cluck, Tom Coleman, Amanda Grady, and Cynthia Snyder

M261A

Overview: As in recent years, mountain pine beetle caused the highest level of mortality of pines during 2010 compared to other tree killing agents. High levels of tree mortality continued in several areas that were also reported in 2009 and in previous years. Mt. Shasta (Siskiyou County, M261A), the Warner Mountain range (Modoc County, M261G), and June Mountain (Inyo County, 341D) continued as hotspots for activity in lodgepole and whitebark pines. The continued activity over multiple years, particularly in whitebark pines, which have fairly limited distribution in California compared to some other northwestern states, has increased the level of concern for this species. More specific information on location, host species, and number of trees or acres affected is provided below.

Specifics: Approximately 200 whitebark pines across 50 acres were attacked and killed near Bolam Bench on the north face of Mt. Shasta, Shasta-Trinity National Forest (Siskiyou County, M261A), in addition to an estimated 2,800 lodgepole pines over 700 acres on the northeast face from Military Pass to Pilgrim Creek near Four Corners Snowmobile Park (Siskiyou County M261A) were killed by mountain pine beetle.

Mountain pine beetle continued to cause high levels of tree mortality throughout northeastern

Fig 4: Mountain pine beetle-caused mortality in whitebark, lodgepole, and western white pine, Yellow Mountain, Modoc NF.

Photo: D. Cluck

California in 2010. Most of the mortality generally occurred in denser and larger average diameter stands of lodgepole and whitebark pine, but more open stands are starting to be impacted. This year marked the fifth year of an ongoing outbreak in the Warner Mountains that has resulted in killing nearly all suitable host material (lodgepole, western white, and whitebark pines >6” DBH) on Mt. Bidwell, Modoc National Forest (Modoc County, M261G). The outbreak continued to expand this year into adjacent areas such as Yellow Mountain, Mt. Vida, and Dismal Swamp, covering 2,000 acres; mortality averaged 12 trees/acre. Mortality of lodgepole and whitebark pine has also continued to increase throughout the southern Warner Mountains, impacting a large area (~3,000 acres) on Buck Mountain, Hat Mountain, and Horse Mountain; mortality averaged approximately 15-20 trees/acre.

Fig 5: Mountain pine beetle-caused mortality in whitebark pine, Mt Bidwell, Modoc NF.

Photo: D. Cluck

M261G

On the Lassen National Forest, mountain pine beetle continued to kill lodgepole pine on several hundred acres near Ashpan Butte and Bunchgrass Valley (Shasta County, M261D). As of this year, most of the larger diameter lodgepole pines were either green-infested or dead. Lodgepole pine growing along Little Truckee River between Truckee and Sierraville also experienced elevated levels (individuals and small groups) of mortality after a couple of years of limited activity (Sierra and Nevada Counties, M261E).

M261E

High levels of tree mortality continued this year throughout the upper montane forests dominated by whitebark and lodgepole pines on the Inyo National Forest. There are areas with high levels of mortality around June Mountain, Wheeler Range, Hilton Lake, Coyote Creek, Gibbs Lake, and San Joaquin Mountain (Mono County, 341D), where groups (3-10 trees/group) of variable diameter whitebark pines were killed. Group kills were observed in close proximity to trees attacked in previous years, resulting in expanded areas of dead trees in the same location, as well as newly established mortality centers that will likely expand in subsequent years. Increases in hazard trees and fuels continue to be a cause for concern where tree mortality occurs in recreation areas. In the Golden Trout Wilderness (Inyo County, 341D), limber pines on the east side by Cottonwood Creek (16S02 Road) were attacked this year.

341D

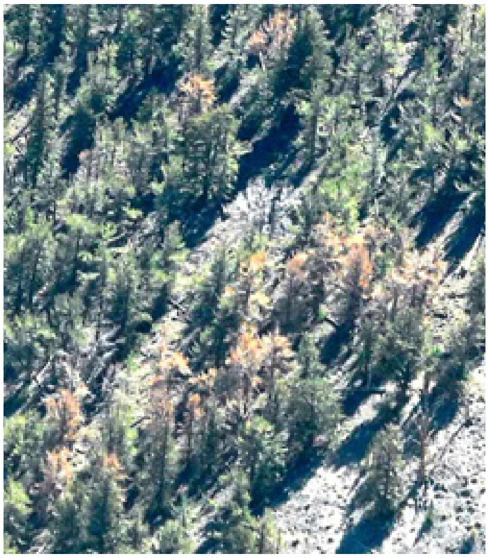


Fig 6: Limber Pine mortality from the air.

Photo: Z. Heath

Levels of tree mortality decreased in stands of lodgepole pine in the Lake Tahoe Basin and in the southern Sierra Nevada range this year, a downward trend continuing from 2009. Observed mortality occurred in small groups (2-5 trees) in close proximity to trees attacked in previous years. Groups of 5-6 trees (9-23" DBH, primarily >12" DBH) were killed in the Ward Creek drainage, at High Meadow (Eldorado County, M261E), and in the forests surrounding Huntington Basin (Fresno County, M261E). A decrease in host presence, as a result of previous mountain pine beetle attributed mortality along the Western Divide Highway between Ponderosa and Quaking Aspen campgrounds, led to a decline in activity this year (Tulare County, M261E), as the overstory species composition at this site is now ~90% white fir-dominated. A decrease of susceptible hosts near Caples Lake may also have explained the lower tree mortality detected by aerial survey there this year (Alpine County, M261E).

M261E

There were few reports of sugar pine mortality caused by mountain pine beetle this year. Two large diameter trees (46" and 54"DBH) were killed in Yosemite National Park (Mariposa County, M261E), and single trees and small groups (2-3 trees) of large diameter trees were observed fading in Mountain Home State Forest (1 tree per 5 acres) (Tulare County, M261E). At Peppermill Guard Station along the Western Divide Highway (Tulare County, M261E), three large diameter sugar pines (averaging 55" DBH) were attacked by mountain pine beetle, most likely incited by drought conditions as several white firs, incense cedars, and Jeffrey pines across the five acre site also died.

Mechanical and salt injury incited mountain pine beetle attacks in a few isolated areas this year. An increase in mountain pine beetle activity in a few individual trees and small groups of lodgepole pines in close proximity to the road, near Donner Pass along Interstate 80 and along Highway 89 to Sierraville on the Tahoe National Forest (Sierra and Nevada Counties, M261E), likely resulted from trees being impacted by high levels of salt-concentrated runoff. Several large diameter, old fire-scarred sugar pines were attacked and killed by mountain pine beetle in Elam Creek, Lassen National Forest (Tehama County, M261D) after "cookies," partial cross-sections of the bole, were removed from old fire scars for a fire history research project.

M262B

In southern California, an estimated 4,266 acres within the 2007 Slide and Butler fires experienced mortality from mountain pine beetle, Jeffrey pine beetle, and western pine beetle. Sugar pine, Coulter pine, Jeffrey pine, and ponderosa pine are succumbing to attacks by these bark beetles on the Mountaintop Ranger District, San Bernardino National Forest (San Bernardino County, M262B). Fire injury likely predisposed these trees to beetle attack.

Western Pine Beetle

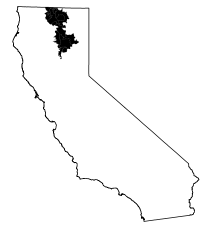
Dendroctonus brevicomis

Contributions by: Beverly Bulaon, Danny Cluck, Tom Coleman, Amanda Grady, Don Owen, and Cynthia Snyder

Overview: Ponderosa pine mortality caused by western pine beetle increased this year in multiple locations compared to 2009. Counties where large diameter trees were killed include Lassen, Modoc, and Shasta. On private lands in the central Sierra Nevada range, tree mortality was significantly lower compared to 2009 levels; however, there was an increase in a few specific sites in Amador and Eldorado Counties. In plantations and natural stands on National Forest lands in the southern Sierra Nevada range, this beetle remained active

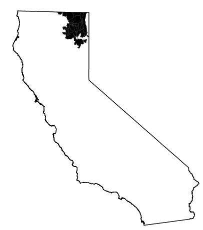
and mortality levels were similar to that reported in 2009. In southern California, there was an increase in Coulter pine mortality attributed to western pine beetle killed on the Cleveland and San Bernardino National Forests and on the Pauma Reservation.

Specifics: Western pine beetle remained active in the Shingletown area (Shasta County, M261D). At the CALFIRE Station (40 acres of mixed conifer forest), a group of three ponderosa pines faded in August. A fourth tree showed evidence of western pine beetle and red turpentine beetle attack, but the crown remained green. Parcels surrounding the station property also had scattered ponderosa pine mortality, but at a lower level than occurred in 2009. On a property approximately 4 miles southeast of Shingletown, western pine beetle killed several hundred ponderosa pine in groups ranging in size from ¼ to three acres, totaling approximately seven acres. These groups were a mixture of trees killed this year and in 2009. Pitch tubes were abundant on trees killed this year, suggesting that tree defenses had improved but were insufficient to resist high beetle populations.



M261D

Overstocking in combination with drought conditions predisposed stands of primarily ponderosa pine to western pine beetle attack again this year at McCloud Flats (Siskiyou County, M261D). The Flats are also known to harbor black stain root disease and increased precipitation this spring activated latent root disease in the area, resulting in a large increase in tree mortality. Due to this combination of bark beetle and root disease activity, approximately 20 trees/acre were killed across ~3,500 acres; the total estimate of trees affected is 38,000. Further to the east, mortality, particularly of large diameter ponderosa pines (>30” DBH), was noted in a few locations. Approximately 20 individual trees and 10 groups (5-20 trees/group) of smaller diameter trees were killed along Highway 36, just west of Susanville (Lassen County, M261D), and ~15 old growth ponderosa pines along Highway 44, between County Road A21 and Old Station, were killed (Lassen and Shasta Counties, M261D). Additional mortality of large diameter ponderosa pines (~1 tree/20 acres) was detected via aerial survey on the Modoc National Forest, around Lava Beds National Monument (Modoc County, M261G).



M261G

Western pine beetle activity on private lands in the central Sierra Nevada range decreased significantly compared to 2009; however, some group kills, primarily in overstocked stands, did increase to 30 trees in Amador and El Dorado Counties (M261E). A few individual trees on private lands were also attacked throughout the range. Removal of infested and dead trees continues to present issues as there are no mills available in the area. Most of the trees were harvested for firewood.

Fig 7: Western pine beetle-caused mortality in mature ponderosa pine plantations, Nutmeg plantations, High Sierra RD, Sierra NF.

Photo: B. Bulaon

Fig 8: A mature ponderosa pine plantation attacked by WPB, RTB, and pine engravers after a marijuana clean up effort of the area, Hume Lake RD, Sequoia NF.

Photo: B. Bulaon

Fig 9: Bark beetle (WPB and RTB) attacks concentrated on winter storm damaged trees, MiWok RD, Stanislaus NF.

Photo: B. Bulaon

M261E

Tree mortality continued in pine plantations and natural stands in the southern Sierra Nevada Range. Tree mortality occurred in Nutmeg Saddle pine plantations (Fresno County, M261E), where more than 400 acres were detected via aerial surveys; 20-30 trees were attacked per group. Western pine beetle associated mortality was aggravated by restoration and clean up activities at a recent marijuana site along Highway 180, resulting in western pine beetle attacks on 30 ponderosa pines (12-32” DBH) over a 5 acre area (Tulare County, M261E), and mechanical injuries from skid trail ripping after a plantation thin predisposed 5 residual ponderosa pines to bark beetle attacks on the Stanislaus National Forest (Tuolumne County, M261E).

Natural stands on the Sierra and Sequoia National Forests were especially susceptible to western pine beetle attacks after winter storms in January and late March caused severe stem and limb breakage. Western pine beetle attacked groups of mature ponderosa pines near the residential areas of Pinehurst and at Cedar Brook Campground (Fresno County, M261E). Scattered individual pines (>36” DBH) were also attacked (1 tree/acre), killing most of the overstory. Stands on the Eldorado (Amador County, M261E) and Stanislaus National Forests (Tuolumne County, M261E) were also damaged by windstorms (2 trees/acre). Western pine beetle, red turpentine beetle, and pine engraver beetles attacked the standing snapped-off trees and broken limbs.

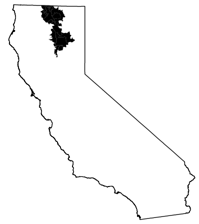
M262B

Ponderosa and Coulter pines were attacked and killed by western pine beetle in southern California this year. Low numbers of large diameter ponderosa pine (1 tree/acre) with poor crowns and dwarf mistletoe infections were killed in the Crystal Lake Campground, San Gabriel Ranger District, Angeles National Forest (Los Angeles County, M262B). This is the third year of activity at this high-value site where Heterobasidion root disease is suspected of predisposing these trees to bark beetle attack. Dense Coulter pine plantations on Thomas Mountain, San Jacinto Ranger District, San Bernardino National Forest have experienced low levels of tree mortality from western pine beetle from 2007-2009 (Riverside County, M262B). The level of tree mortality significantly increased this year as 198 trees covering an estimated 83 acres were killed. These forest stands are isolated from other areas of Thomas Mountain, which could limit the extent of tree mortality. In addition, scattered Coulter pine mortality was detected across the Pauma Reservation and on the Palomar Ranger District, Cleveland National Forest, where 94 trees were killed across 68 acres (San Diego County, M262B). Injuries incurred during the 2007 Poomacha wildfire may have contributed to the tree mortality.

Red Turpentine Beetle
Dendroctonus valens
Contributions by: Beverly Bulaon, Danny Cluck, Don Owen, and Cynthia Snyder

Overview: Unlike the attacks of more aggressive bark beetles, such as western pine beetle

or mountain pine beetle, attacks by red turpentine beetle rarely lead to tree mortality; rather, they are indicative that a tree is under severe stress due to drought, injury, and/or disease. This beetle also readily attacks freshly-cut stumps and trees under attack by other bark beetles. Reports of red turpentine beetle activity were fewer in 2010 compared to 2009, when the beetle was active in many of the 2008 wildfire areas. Reported activity this year was primarily in trees in recreation areas impacted by soil compaction or other stressors caused by camping. Western pine beetle was commonly found in red turpentine beetle attacked pines.



M261D

Specifics: Red turpentine beetle continued to attack ponderosa and Jeffrey pine in the Eagle Campground at Eagle Lake, Lassen National Forest (Lassen County, M261D). Most of the attacked trees were growing in overstocked stands with high levels of soil compaction, suppressed crowns, and/or were previously injured by campers. Two hundred acres within the recreation area were thinned at Eagle Lake in September 2010 with Forest Health Protection funding. Approximately 50 heavily attacked trees were removed during this treatment, which combined with the thinning, resulted in an overall improvement in growing conditions for the residual pines. In the Shingletown area (Shasta County, M261A), red turpentine beetle colonized ponderosa pines killed by western pine beetle (see section on western pine beetle, page 10).

M261A

The 2009 Tennant Fire, southeast of Macdoel in Siskiyou County (M261D), was an uncharacteristically high intensity wildland fire that burned approximately 3,225 acres resulting in severe tree mortality throughout 79% of the area. Red turpentine beetle activity was less than expected in June this year within the fire area.

Fig 10: Red Turpentine Beetle attacks on tree snapped by winter storm, MiWok RD, Stanislaus NF.

Photo: B. Bulaon

Red turpentine beetle attacks were common in association with western or mountain pine beetle activity in pines in the southern Sierra Nevada range. Attacks were consistently found at the base of western pine beetle-attacked ponderosa pines in plantations and natural stands on the Sierra and Stanislaus National Forests (M261E). Trees along roadsides in high use recreation areas (ex: Pinecrest Lake, Tuolumne County; Bass Lake, Madera county, M261E) were also attacked as evidenced by large pitch tubes. On many of the declining large diameter sugar pines in Mariposa, Madera, Fresno, and Tulare Counties (M261E), red turpentine beetle pitch tubes were present in large numbers.

Douglas-fir Beetle
Dendroctonus pseudotsugae
Contributions by: Jack Marshall

263A

In Humboldt Redwoods State Park near Miranda, Douglas-fir beetle attacked large diameter Douglas-fir infected with *Phaeolus schweinitzii*. Trees also had bark scorching from prescribed fire (Humboldt County, 263A).

Spruce Beetle
Dendroctonus rufipennis
Contributions by: Jack Marshall

A few large Sitka spruce trees near Big Lagoon County Park in Humboldt County (263A) were dying from attacks by spruce beetle. The trees may have suffered effects from strong winds adjacent to the Pacific Ocean, and may have been infected with *Phaeolus schweinitzii*, as conks were found at the bases of other Sitka spruce in the vicinity.

Fir Engraver

Scolytus ventralis

Contributions by: Beverly Bulaon, Danny Cluck, Amanda Grady, Don Owen, and Cynthia Snyder

M261E

Overview: Fir engraver attacks in 2009 resulted in a substantial increase in topkill and whole tree mortality in 2010 across hundreds of thousands of acres in northern California and the Sierra Nevada range. Affected areas were most often associated with drought conditions, overstocked stands, and other biotic agents, such as Heterobasidion root disease, dwarf mistletoe, and Cytospora canker. At the Forest Service Placerville nursery (Eldorado County, M261E), mortality of five pole-size white fir was linked to annual pruning treatments. In red fir, mortality was reported from Plumas and Fresno Counties.

M261A

Specifics: White fir mortality was common throughout mid-elevation forests in interior northern California. An area of notable tree mortality extends along the west side of Hat Creek Valley from Old Station north to the community of Hat Creek (Shasta County, M261A). Tree mortality is widely scattered, but covers thousands of acres. Tree mortality is also common in the area from Shingletown to Viola (M261E), and significant levels of white fir mortality led to the closure of McBride Springs Campground, Shasta-Trinity National Forest (Siskiyou County, M261A). Heterobasidion root disease was found in conjunction with fir engraver attacks in this campground.

M261D

Fir engraver activity also increased dramatically throughout northeastern California in response to continued drought conditions. Most of the affected areas are closely associated with lower average annual precipitation zones (< 30″ rainfall/year). In addition to lower precipitation levels, one or more of the following contributing factors were present in nearly every affected stand across northeastern California: overstocking, dwarf mistletoe, Cytospora canker, and Heterobasidion root disease. Significant white fir mortality (2-10 trees/acre) occurred on approximately 8,000 acres of the Big Valley Ranger District near Round Mountain and Snell Butte, Modoc National Forest (Modoc County, M261G), and high levels of white fir mortality were also observed on the Lassen National Forest in low density stands that experienced low levels of precipitation (Lassen County, M261D). These units (comprising ~200 acres), were heavily thinned approximately 20-25 years ago, and planted to ponderosa and Jeffrey pine, leaving a residual white fir density less than 50 ft^2/acre. These residual white fir (12-24” DBH) are now being attacked and killed by fir engraver beetles. There is some degree of competition from plantation pines and brush, but it is unknown how much this and/or other factors, such as Heterobasidion root disease, are playing a role in the observed mortality. Further south on the Tahoe National Forest, elevated white fir mortality, associated with Heterobasidion root disease and white fir dwarf mistletoe, was observed in a 30 acre stand along Highway 89 at Cal Pines Summit (Nevada County, M261E).

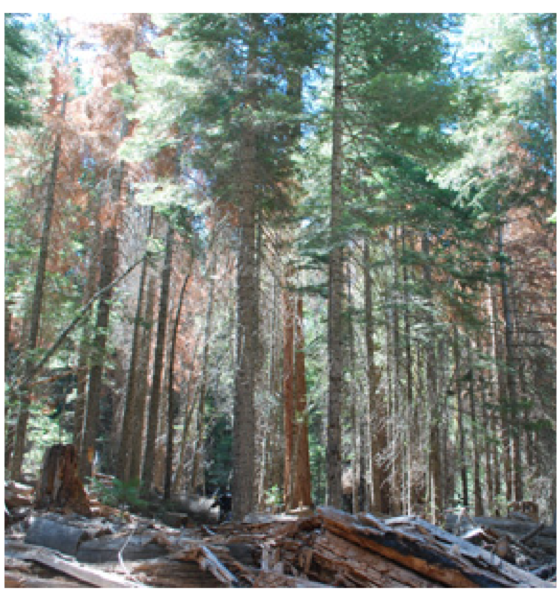


Fig 11: Scattered white fir mortality due to fir engraver, Heterobasidion root disease, and overstocking, Yosemite NP.

Photo: B. Bulaon

Fir engraver beetles also remained active further south in the Sierra Nevada range. Both red and white fir mortality was ubiquitous, occurring in small groups (2-3 trees/acre) or scattered individuals of various sizes. Root disease, dwarf mistletoe, Cytospora canker, woodborers,

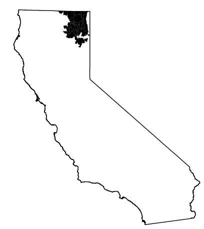
and/or mechanical injury were often found in combination with fir engraver attacks. Along west-facing hillsides near Fallen Leaf lake (El Dorado County, M261E), scattered mortality of small diameter white fir (~2 trees/acre) was detected across more than 50 acres. Also in El Dorado County, white fir trees along Mormon Emigrant Trail, with evidence of Heterobasidion root disease in adjacent cut stumps, were attacked by fir engraver beetle (M261E). Along Highway 108 (15 mile stretch towards Pinecrest), individual white fir of variable sizes were attacked by fir engraver beetle. These trees were most likely weakened by frequent highway maintenance activities (Tuolumne County, M261E).

Fir engraver activity also increased in several red fir stands throughout northeastern California. Red fir mortality (~1-2 trees/acre) was observed on several hundred acres near Gibsonville Ridge, Plumas National Forest (Plumas County, M261E). Most of the red fir in this area had high levels of true fir dwarf mistletoe and *Cytospora abietis* infections. Scattered pockets of red fir mortality were also reported in high elevation forests in Tamarack Meadow in both dense and open stands (Fresno County, M261E).

Pine Engraver
Ips pini
Contributions by: Danny Cluck

341D

Pine engraver beetles caused topkill and whole tree mortality of approximately 30 Jeffrey pine near Said Valley Reservoir, Modoc National Forest (Lassen County, 341D). These trees were growing at the forest and desert interface in overstocked stands. Lower boles of larger diameter trees were also infested with *Ips emarginatus*. *Ips pini* attacked and killed several pockets of Jeffrey pine in this same location during the extremely dry years of 2001 and 2002. *Ips pini* also killed a group of Jeffrey pines in the nearby area of Spring Hill above Highway 139 (M261G).



M261G

California Fivespined Ips
Ips paraconfusus
Contributions by: Beverly Bulaon and Tom Coleman

California fivespined ips attacked ponderosa pines in conjunction with western pine beetle around Bass Lake (Madera County, M261E). A few trees in the vicinity of western pine beetle group attacks had topkill. In addition, a half acre patch in Wrights Creek plantation (10-15” DBH) were topkilled (Tuolumne County, M261E).

M262B

In the southern part of the state, California fivespined ips killed Coulter pine along the Main Divide on the Trabuco Ranger District, Cleveland National Forest (Riverside County, M262B). An estimated 196 trees succumbed to beetle attacks in these dense stands (~125 trees/acre). Tree mortality is concentrated in two areas covering an estimated 12

Fig 12: Group of ponderosa pine killed by *Ips Pini* on the Modoc NF.

Photo: B. Oblinger

Fig 13: Ips top killing of Jeffrey pine, Big Valley RD, Modoc NF.

Photo: B. Oblinger

acres. Although bark beetle activity has occurred in this area for several years, there was a significant increase in the level of mortality this year. California fivespined ips and California flatheaded borer caused scattered mortality of Jeffrey pine in the vicinity of Pine Mountain, Mt. Pinos Ranger District, Los Padres National Forest (Kern County, M262B). Tree mortality and topkill occurred across an estimated 1,534 acres and impacted 4,720 trees. Heterobasidion root disease and high stand densities likely contributed to the increase in insect activity. Tree mortality has persisted in these areas for three years.

322A

Pinyon Ips
Ips confusus
Contributions by: Beverly Bulaon

341F

Pinyon ips attacked single-leaf pinyon infected with *Leptographium* sp. or those with mechanical injury (Inyo County, 341F). Tree mortality (1 tree/acre/year) continued below Grandview Overlook (Inyo County, 341F) due to widespread disease infection and subsequent attack by pinyon ips. Beetle attacks were concentrated on tree sections infected with *Leptographium* sp.; uninfected portions of the bole were not attacked by the beetle. Fuel reduction treatments around Historic Hunter Mountain Cabin in Death Valley National Park (Inyo County, 322A) incited both ips and red turpentine beetle attacks on a few recently pruned trees along the entrance road.

Wood Boring Beetles

261A

Flatheaded Fir Borer
Melanophila drummondi
Contributions by: Danny Cluck, Jack Marshall, and Don Owen

M261B

Inland Douglas-fir with black stain root disease were attacked by flatheaded fir borer in the following locations in Humboldt County (261A): Seely Creek and Old Briceland Road near Garberville; Wildcat Road between Ferndale and Petrolia; Sulphur Creek near Dinsmore; Redwood Valley north of Highway 299 along Redwood Creek (the greatest number of affected trees were observed here); and along Highway 299 and Snow Camp Road leading south from Lord Ellis Summit. Along the north coast of Mendocino County, near Rockport, flatheaded fir borer continued to attack Douglas-fir with scorched bark sustained in the 2008 June lightning fires (M261B), and for the second year in a row, a high concentration of flatheaded fir borer killed Douglas-fir in Sonoma County off Trinity Road, northeast of Glen Oaks (263A).

Douglas-fir mortality, from 2010 and previous years, is widely scattered on both sides of the Klamath River from Interstate 5 to Horse Creek (Siskiyou County, M261A). Single trees and small groups of up to six trees were attacked and killed. In the northeastern part of the state, flatheaded fir borer activity continued in drier Douglas-fir stands. Two notable locations with Douglas-fir mortality were Happy Camp Road near Blairsden, on the Plumas National Forest (Plumas County, M261E), and Little Giant Mill Road, near Chapman Gulch, on private timberland (Tehama County, M261D). Douglas-fir mortality in the Happy Camp Road area was concentrated on south facing slopes and dry, shallow soils where California black and canyon live oaks were present. The Chapman Gulch area consists of a pole-sized mixed conifer plantation. Douglas-fir mortality was scattered throughout 600 acres of plantation and averaged 2 trees/acre, but was most closely associated with dry south facing slopes where California black oak was present.

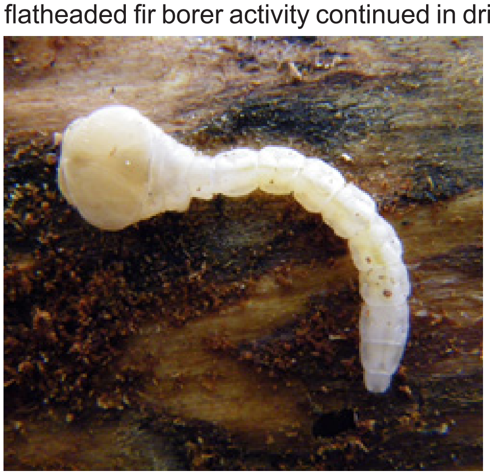


Fig 14: Borer found in dying Douglas-fir near Blairsden, Plumas NF.

Photo: D. Cluck

263A

California Flatheaded Borer
Melanophila californica
Contributions by: Tom Coleman

California flatheaded borer caused several pockets of Jeffrey pine mortality east of Big Bear City in the Mountaintop Ranger District, San Bernardino National Forest, in 2010 (San Bernardino County, M262B). Fifty-five trees encompassing 27 acres died. High pine densities likely contributed to the increased activity by this wood borer.

M261A

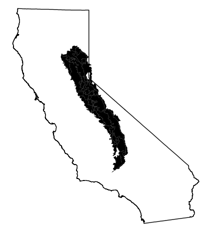
Defoliators

Black Oak Leaf Miner
Eriocraniella aurosparsella
Contributions by: Danny Cluck

M262B

Blotch mining of California black oak leaves by the black oak leaf miner in the Blue Canyon area, Tahoe National Forest, decreased in 2010 (Placer County, M261E). During the cool and wet spring, snow remained on the previous outbreak site during the emergence period of this moth (which pupates in the soil), possibly reducing the adult population. Light defoliation was observed only in a small area (~500 acres), east of Emigrant Gap off of Interstate 80. Activity decreased from approximately 7,000 acres in 2009.

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



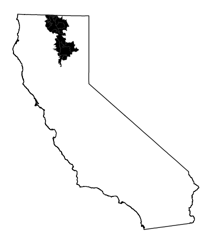
M261E

Douglas-fir tussock moth trap catches remained extremely low throughout all areas of northeastern California in the fall of 2009, and no white fir defoliation was observed during the 2010 aerial detection survey flights (M261D).

Douglas-fir tussock moth defoliation continued for the second year across 192 acres south of Big Bear Lake, Mountaintop Ranger District, San Bernardino National Forest (San Bernardino County, M262B). Average defoliation levels are approaching 30-50% on white fir. Trees experiencing two years of defoliation showed high levels of defoliation (70-90%). Significant tree mortality was not observed in the outbreak area, but could increase if populations

Fig 15: Douglas-fir tussock moth defoliation of white fir, San Bernardino NF.

Photo: T. Coleman



M261D

Table 2: Number of Douglas-fir Tussock Moth pheromone detection survey plots by trap catch for 2000-2010 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%												
2010	142	134	6	2	0	0	0	0	0	0	0	0	0	0	0
	*90%	94%	4%	1%											

*Some Plots were not collected due to weather

persist. Douglas-fir tussock moth larvae were observed in Big Bear City defoliating Colorado Blue Spruce and scattered pines. Populations will continue to be monitored via adult trapping and egg mass counts to predict population levels next year.

Western Tussock Moth
Orgyia vetusta
Contributions by: Tom Coleman

M261B

Western tussock moth populations reached significant levels in Marian Bear Memorial Park in San Diego County (M261B). Defoliation (20-30%) of coast live oak occurred over 5 acres. This is the second year of defoliation in the area, but no tree mortality has occurred from this injury.

Fall Webworm
Hyphantria cunea
Contributions by: Steve Jones

Fig 16: Webworm on madrone.

Photo: S. Jones

M261F

Fall webworm defoliated madrone around Sugar Pine Lake (Placer County, M261F). Webbing was quite extensive on trees of all age classes; however, defoliation was confined to the ends of branches.

Pinyon Sawfly
Neodiprion edulicolus
Contributions by: Beverly Bulaon

322A

Pinyon sawfly was detected on over 10,000 acres of single-leaf pinyon pine forest in Death Valley National Park in 2009 (322A). This may be the first recorded large outbreak in California. Defoliation covering smaller acreages was previously noted in past California Forest Pest Condition Reports (2009 and 1964). Defoliation this year was moderate to severe around Hunter Mountain. On the most severely defoliated trees, only current year needles remained. From a distance, these trees appeared dead. About half of all trees in the affected areas were nearly 100% defoliated, while few remained completely uninjured. Other agents such as pinyon pitch mass borer, red turpentine beetle, and *Ips* species were also found on sawfly affected trees. No tree mortality has been observed to date.

Fruittree Leaf Roller
Archips argyrospila
Contributions by: Tom Coleman

M262B

Fruittree leaf roller continued to cause moderate levels of defoliation on California black oak near the communities of Crestline, Mountaintop Ranger District, San Bernardino National Forest (San Bernardino County, M262B). The defoliation covered an estimated 60 acres. Defoliation has continued in this area for several years, but tree mortality was not evident.

Other Insects

Ips
Ips plastographus
Contributions by: Jack Marshall

263A

Ips plastographus maritimus adults and larvae were observed in mature dead bishop pines along Highway 101 south of Eureka, as well as in firewood and slash material at Loleta, near the same location (263A).

Fig 17: Ponderosa pine damaged by *Rhyacionia zozana* near Goose Valley, Shasta County.

Photo: D. Owen

Ponderosa Pine Tip Moth
Rhyacionia zozana
Contributions by: Don Owen

Ponderosa pine tip moth continued to damage ponderosa pine in plantations near Goose Valley, (Shasta County, M261D). The infestation is highly variable with pockets of damage scattered across several Sections. Heavily damaged trees are stunted and significantly different in height from undamaged trees of the same age. Variable site conditions may have contributed to the damage. The pine tip moth has also remained a problem on young ponderosa pine plantations throughout Amador and El Dorado Counties (M261E).

Fig 18: Branch flagging on ponderosa pine caused by an infestation of Matsucoccus scale near Dana, Shasta County.

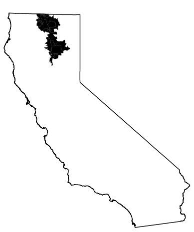
Photo: D. Owen

Black Pineleaf Scale
Nuculaspis californica
Contributions by: Don Owen

Ponderosa pines along Black Ranch Road and in the general vicinity of Black Ranch, north of Burney, exhibited poor crown characteristics (Shasta County, M261D); a few of these trees died. A number of factors contributed to the situation: low site, dwarf mistletoe, western pine beetle activity, and a heavy infestation by black pineleaf scale. The scale was the dominant stressor, resulting in poor needle retention and shortened, chlorotic needles.

Remnant ponderosa pines situated between agricultural fields and Dee Knoch Road, east of Fall River Mills, also experienced a heavy infestation of black pineleaf scale (Shasta County, M261D). Frequent dust and agricultural chemical spraying were reported in this area and may have led to an increase in scale populations.

M261E



M261D

Ponderosa Pine Twig Scale
Matsucoccus bisetosus
Contributions by: Don Owen

A rare outbreak of the ponderosa pine twig scale caused branch mortality on ponderosa pine across an 80 acre parcel on the northeast side of Soldier Mountain, near Dana (Shasta County, M261D). Affected trees were mostly pole-size, although an occasional larger tree had branch flagging. Damage was concentrated in areas with young trees, but widely scattered in surrounding older stands. The outbreak was not severe enough to cause any significant impact on affected trees. Ponderosa pine twig scale was also found infesting ponderosa pine near Dee Knoch Road, east of Fall River Mills (Shasta County, M261D), but did not appear to be causing damage. Birds feeding on the scale removed the outer bark on the upper bole of some trees. A previous outbreak of this insect in Graeagle, Plumas County, lasted 2 years.

Incense Cedar Scale
Xylococculus macrocarpae
Contributions by: Jack Marshall

Scores of seedling- and small sapling-sized incense cedars near Salmina (Lake County, M261B) were infested with incense cedar scale. Heavy infestations led either to direct mortality or to attacks by a *Phloeosinus* sp. This was the second successive year for this infestation, which has grown in size. Last year, data from random 1-square-inch counts along the stem of a representative 1" DBH sapling yielded an average of 22.8 crawlers/in^2. As observed in other research on this pest, the lower bole had fewer crawlers (8.6/in^2) than the upper half of the bole (37.0/in^2). Many larger saplings remain infested with the scale. Infested stems and branches had an unidentified black, spongy sooty mold build-up.

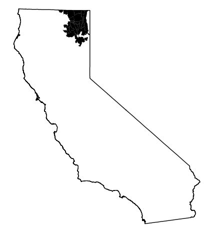
M261B

Needle Fascicle Scale
likely *Matsucoccus fasciculensis*
Contributions by: Don Owen

In addition to black pine leaf, ponderosa pine twig, and incense cedar scale, a fourth species of scale was found infesting ponderosa pine near Dee Knoch Road, east of Fall River Mills (Shasta County, M261D). The scale, likely *M. fasciculensis*, was found within sheaths at the base of needle bundles.

Gouty Pitch Midge
Cecidomyia piniinopis
Contributions by: Amanda Grady and Don Owen

Gouty pitch midge activity on 70 acres of the Scarface Burn Plantation, a 20 year old offsite Jeffrey pine plantation, caused branch tip swelling and twisting, Big Valley Ranger District, Modoc National Forest (Modoc County, M261G).



M261G

Branch tip flagging caused by the gouty pitch midge was visible for the fourth consecutive year across Hatchet Mountain (Shasta County, M261A). The impact of the midge was greatest in areas with the poorest growing conditions. There has been a general trend toward less damage during the past two years. Dissection of green shoots from infested trees indicates that the outbreak is declining. The full extent of damage from this year's infestation will not be known until the spring of 2011, when currently infested shoots die.

M261A

Cooley Spruce Gall Aphid
Adelges cooleyi
Contributions by: Jack Marshall

In Humboldt County, infestations of the Cooley spruce gall aphid were noted on several large Sitka spruce just west of Ferndale (263A).

263A

Sawflies
Contributions by: Don Owen

Pale green sawfly larvae of the genus *Strongylogaster* were found boring in the outer bark of a ponderosa pine killed by western pine beetle near Fender Ferry's Road (Shasta County, M261A).

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

A *Contarinia* species made several choose-and-cut Douglas-fir Christmas trees grown in Sonoma County, near the Napa County line, unsellable (263A).

Horntails
Sirex spp.
Contributions by: Jack Marshall

261A

Horntail larvae were recovered from damaged redwood lumber in decks near Davenport (Santa Cruz County, 261A). The redwood logs were brought in from fire killed or scorched redwood. The species is likely *S. areolatus*, but trapping cages will be used to attempt to capture adults for identification.

Oak Leaf Galls
Andricus kingi
Contributions by: Tom Smith

M261A

Blue Oaks in the Loma Rica area of Yuba County showed extensive discoloration and loss of foliage. Upon closer examination, the trees were found to be infested with extremely high levels of cynipid wasps causing leaf galls on the under surfaces and yellowing of the upper surfaces of the leaves. Many leaves were shed prematurely. A further survey of the area found that blue oaks as well as other oak species were highly infested in an area that ran throughout the foothills of the Sierras from Sacramento to Butte Counties (M261A). No tree mortality occurred, but many trees were under severe stress from the loss of foliage.

Pine Reproduction Weevil
Cylindrocopturus eatoni
Contributions by: Beverly Bulaon

Pine reproduction weevil feeding declined in young ponderosa pine plantations on Bass Lake Ranger District, Sierra National Forest (Madera County, M261E) compared to previous years. Light to moderate feeding was evident on half of the planted saplings in monitoring plots. Tree mortality most likely occurred during the fall or winter of last year.

Twig Beetles
Pityopthorus boycei
Contributions by: Beverly Bulaon

341D

Until recently, *Pityopthorus boycei*-caused tip dieback was not typically noticed. However, continual tip dieback on lodgepole pines along major highways (Highway 88, Amador County; Highway 120, Tuolumne County; Highway 50, Eldorado County, M261E) was widespread and conspicuous in 2010. Tip dieback was most severe on whitebark pines along Wheeler Range (Mono County, 341D; reported by FIA crews). Ground surveys found nearly 50-90% of all branch tips infested with current broods across approximately 100 acres.

Fig 19: Alder flea beetle injusry on the San Bernardino NF.

Photo: T. Coleman

M262B

Alder flea beetle
Altica ambiens
Contributions by: Tom Coleman

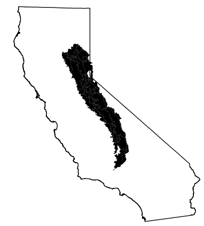
White alder defoliation occurred on the Angeles and San Bernardino National Forests (San Bernardino County, M262B). Defoliation was isolated to low elevation riparian areas near Mt. Baldy and Lytle Creek. An estimated 53 acres of defoliation were aerially detected. Alder flea beetle caused extensive defoliation of all size classes, but no tree mortality occurred and trees re-foliated following the event.

Redwood Bud/Gall Mite
Likely *Trisetacus sequoia*
Contributions by: Jack Marshall


263A

A row of redwoods north of Sears Point in Sonoma County had large twig galls and curled needles, indicative of the redwood bud or gall mite (263A).

Grasshoppers
Acrididae spp.
Contributions by: Danny Cluck and Tom Smith


M261E

High numbers of grasshoppers (Acrididae, short-horned grasshoppers) were observed throughout a young sugar pine orchard within the Foresthill Genetics Center, Tahoe NF, Placer County (M261E). Grasshoppers appeared in mid August and began feeding on sugar pine seedlings, completely defoliating a few individuals. A registered insecticide was subsequently applied that reduced grasshopper numbers and prevented further damage.


262A

Beale Air Force base reported an outbreak of grasshoppers in 2010 (Sutter County, 262A). The infestation defoliated about fifty fruitless mulberries on the base. Oleanders were also severely attacked. The insects also fed on yellow starthistles, eating the flowers and buds, and may have reduced the infestation of that invasive weed to a small degree. Aside from defoliating trees and shrubs, the grasshoppers clogged car radiators and were especially dense near the base runways, attracting large numbers of birds to feed on them and causing flight safety concerns.

Urban tree pests

Aphids and Mites
Contributions by: Tom Smith

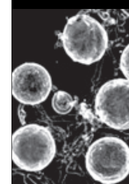
The City of West Sacramento (Sacramento County, 262A) reported outbreaks of various aphids and mites on Chinese elm, little leaf linden, valley oak, and crape myrtle. Trees in Redwood City (San Mateo County, 261A) also had abnormally high levels of aphids during 2010. The main tree species impacted was the ash, *Fraxinus velutina*. Older trees had the highest infestation level. Cars parked under infested trees were covered in insect honeydew.


M262A

Tulip tree scale, *Toumeyella liriodendra*, has become a serious pest of tulip trees in the community of Sunnyvale (Santa Clara County, M262A). The pest has been slowly spreading to the east and north from the South Bay area for several years.

Bark and Engraver Beetles
Dendroctonus and *Ips* species
Contributions by: Tom Smith

The City of Pasadena reported an increase in the amount of miscellaneous bark beetle attacks and tree mortality on various pine species within the city limits (Los Angeles County, M262B).

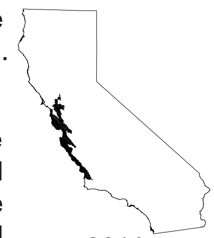


Disease Conditions

Phytophthora Diseases

Sudden Oak Death
Phytophthora ramorum
Contributions by: Janice Alexander, Kamyar Aram, Phil Cannon, Matteo Garbelotto, Zack Heath, Alan Kanaskie, Jim Kasper, Chris Lee, Don Owen, Dave Rizzo, Yana Valachovic, and Seth Zuckerman

Overview: *Phytopthora ramorum*, the pathogen that causes sudden oak death (SOD), continues to kill tanoak and coast live oak in areas where it is already established. *P. ramorum* requires wet, moist conditions to proliferate and spread. Dry conditions over the past several years had limited the spread of the disease within already established locations. However, a new foci was found in 2010 at Redwood Creek in northern Humboldt County, a section of California's north coast that had previously been thought to be free of this disease. Monitoring both aerially and on the ground was conducted in 2010 across the infested counties in California and included Del Norte County which is currently uninfested.



261A

Status: Aerial Surveys
Aerial surveys mapped about 2,700 dead live oak and tanoak on 1,500 acres throughout the range of *P. ramorum* in 2010 (261A, 263A). This is the lowest level of mortality observed since SOD aerial surveys began in 2001. Also, the number of recently killed trees per acre has dramatically decreased overall in previously infested areas. During the last several years, an extended dry period has not been suitable for the proliferation of *P. ramorum* and mortality has decreased each year.

Status: Stream Surveys
Approximately 180 streams throughout the coastal ranges of California between Cambria and the Oregon Border were baited early in the spring of 2010 with uninfested rhododendron leaves (261A, 263A).

Stream-based detection surveys were also conducted in Monterey and San Luis Obispo counties in southern California and in Butte, Yuba, Nevada, Placer, and El Dorado counties in northern California. Baits were cultured at the University of California, Davis, for the presence of *P. ramorum*. The pathogen was not detected in any of the samples, although other *Phytophthora* species were recovered.

263A

Two significant new areas of *P. ramorum* infestation were discovered through streambaiting on the North Coast (263A). These areas are in the Mattole Watershed (20 miles NW of Garberville) and along Redwood Creek (a very long and large creek that feeds into the Pacific Ocean near Orick). Because these discoveries were in very large watersheds, a great deal of additional streambaiting was conducted to pinpoint where *P. ramorum* spores were entering streams. In the Mattole watershed, the streambaiting enabled local experts to find the source of inoculum. Some bay trees were located on the ground; their leaves were confirmed to be infected by *P. ramorum*. However, no dead tanoaks have been found to-date at this site.

Status: Ground Surveys
At the Redwood Creek infestation, aerial surveys identified dead tanoaks which helped focus ground surveys to the most probable location where inoculum could enter the creek. Early visits to this site (and foliar analyses) indicated tanoaks on both the western and eastern banks of the creek had been killed by *P. ramorum*. A comprehensive ground survey and analysis of foliage, collected from both symptomatic tanoak and bay laurel, identified the area of infestation.

261A

In June 2010, surveys to sample vegetation in the Tamalpais Valley section of Mill Valley (Marin County, 261A) for sudden oak death (funded by the USDA Forest Service through the Tamalpais Community Services District) began. Specific activities included a street-by-street survey of susceptible vegetation, sampling possibly infected trees, education and outreach sessions, and development of a localized management plan. Twenty-one of twenty-three sampled trees in the Tamalpais Valley tested positive for *P. ramorum* by the CDFA lab.

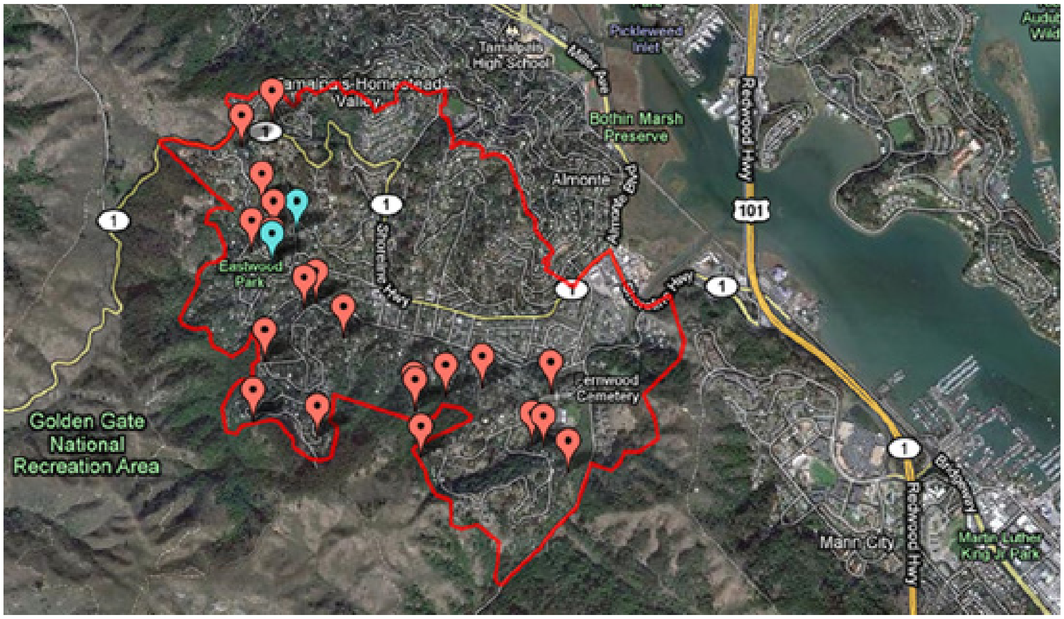
Sudden oak death (SOD) community outreach sessions, intended to engage the public in issues relevant to the disease in the local area, and to assist communities in identifying locations where the pathogen is present were conducted in nine communities in 2010. Meetings were held for 250 participants in Sonoma, the East Bay, Marin County, Atherton, Los Altos, Portola Valley, Woodside, and South San Francisco. From this group, 148 trained citizen scientists surveyed their local areas and sent in leaf samples for analysis. Close to 1,000 unique trees were sampled (see Map 4), which is the highest number of trees surveyed during any SOD ground sampling effort over the past three years. Highlights from this

Distribution of Sudden Oak Death as of October 12, 2010

Map 2: Distribution of Sudden Oak Death in California and Oregon

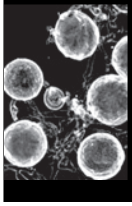
Map: Courtesy of Kelly Lab, UC Berkeley

Map produced on 10/12/10 by UCB GIF: http://oakmapper.org, http://gif.berkeley.edu
For more information about Sudden Oak Death,
please visit the California Oak Mortality Task Force website at
http://www.suddenoakdeath.org/



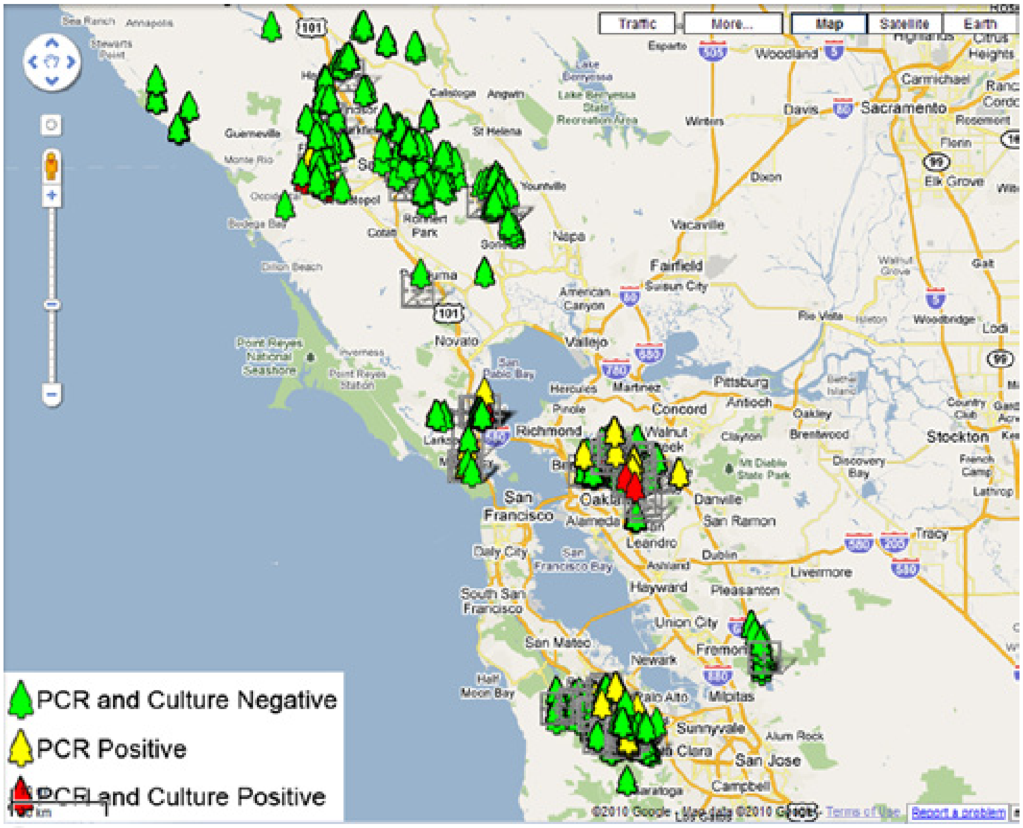
Map 3: Positive *P. ramorum* locations in Tamalpais Valley, shown in red.

Map: J. Alexander



year's sampling effort include: positive samples from Atherton, a return of SOD to the fire trail above Memorial Stadium at UC Berkeley, southward confirmations in the Orinda area, more positive confirmations east of Highway 280 in the Woodside/Portola Valley area, several "hotspots" west of Healdsburg and Windsor, and confirmations east of Cotati.

There were nine detections of *P. ramorum* in nurseries and landscapes in California as of October, 2010. In response to increasing international interest in "clean stock" nursery programs, CDFA and the California Association of Nurseries and Garden Centers (CANGC) provided a series of workshops that focus on minimizing the risk of *P. ramorum* introduction into nurseries as well as movement out of nurseries via infested plants.



Map 4: Citizen scientist sampling from nine communities in the Bay Area.

Map: J. Alexander

Port-Orford-cedar Root Disease
Phytophthora lateralis
Contributions by: Pete Angwin

Overview: *Phytophthora lateralis*, the causal agent of Port-Orford-cedar root disease was identified for the first time in the Trinity River watershed which was the last major uninfested watershed in the range of Port-Orford-cedar (POC). The first occurrence of Port-Orford-cedar root disease in California is thought to have been in the lower Smith River Drainage in and around Crescent City in the early 1960's and has been spreading ever since. The first occurrence of the pathogen in the Kalmath and Sacramento River watersheds was in the mid-1990's.

Status: Port-Orford-cedars in a residential neighborhood in McKinleyville were observed dying from Port-Orford-cedar root disease. The disease was confirmed by ELISA test for *Phytophthora*, and killed a cedar along a residential road and two mature (45-year-old) trees in a long hedge surrounding a private property. Several Port-Orford-cedars previously died upslope from this group of trees. This observation follows the pattern for tree mortality in ornamental Port-Orford-cedars in McKinleyville, Blue Lake, and Arcata over the past several years.

M261A

Phytophthora lateralis first affected Port-Orford-cedar in the mid-1990s at the intersection of Bluff Creek Road (FS Road 13N01) and Fish Lake Creek (Humboldt County, M261A, N41o 41.569', W123o 28.231'). Port-Orford-cedar root disease rapidly spread in Port-Orford-cedar along Fish Lake Creek to the south side of Fish Lake. In 2010, Port-Orford-cedar began to die in a 5 acre area on the north side of Fish Lake, adjacent to the west side of Fish Lake Campground, indicating that the pathogen had been introduced (most likely by humans) to the opposite side of the lake. Management options are currently being considered.

In 2010, an infestation of POC root disease along Slide Creek, immediately above and below the crossing with Bluff Creek Road (FS Road 13N01), approximately 1.5 miles from the infestation at Fish Lake, continued to expand and intensify (Humboldt County, M261A, N41o 14.709', W123o 41.087'). Symptomatic POC were first noticed in 2007, and the presence of *P. lateralis* was confirmed in 2008.

In 2007, a ¼-acre POC eradication project was implemented in the northernmost root disease infestation along Clear Creek in the Siskiyou Wilderness Area, Klamath National Forest, Happy Camp Ranger District (Siskiyou County, M261A). The eradication project is located along the Clear Creek Trail, 6.3 miles south of Young's Valley. Although many infestations are present downstream from the eradication site, a visit to the area in July of 2010 confirmed that the pathogen has not spread upstream from this location.

Fig 20: Port-Orford-cedar management sign at new root disease infestation at Fish Lake Campground, Six Rivers NF.

Photo: P. Angwin

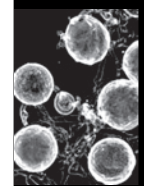
In 2010, genetic detection (PCR) tests did not detect the presence of *P. lateralis* at the 3-acre Port-Orford-cedar eradication treatment at Scott Camp Creek in the upper Sacramento River drainage (Siskiyou County, M261A). This was the second consecutive year in which the pathogen was not detected. Symptomatic or diseased POC have not been found outside the treatment area since the original infection was identified in 2001.

Fig 21: Port-Orford-cedar seedling bait to detect *Phytophthora lateralis* at Scott Camp Creek eradication treatment area, Shasta-Trinity NF.

Photo: P. Angwin

Fig 22: Cinnamon-brown stain in phloem from Port-Orford-cedar root disease at new infestation area along US Highway 299 near Willow Creek.

Photo: P. Angwin



Last year, approximately five Port-Orford-cedar along the US Highway 299 turnout by Willow Creek at Milepost 30.1 faded and died (Humboldt County, 263A, N40o 54.267’, W123o 45.521’). Stain patterns under the bark matched that of Port-Orford-cedar root disease and subsequent lab tests conducted by Oregon State University confirmed the presence of *P. lateralis*. This was the first time that *P. lateralis* was identified in the Trinity River watershed. In 2010, the pathogen was confirmed in two additional symptomatic POC at Milepost 30.36, indicating that the pathogen had spread at least a ¼ mile downstream from the location at the turnout. Until now, this was the last major watershed considered to be uninfested throughout the range of Port-Orford-cedar. Three additional sites along US Hwy 299 have been identified during aerial detection surveys and, from a distance, on the ground, but because of steep terrain and difficulty acquiring access to private land, the cause of the mortality has not been confirmed.

263A

Phytophthora Root Disease
Phytophthora cinnamomi
Contributions by: Jack Marshall

Overview: *Phytophthora cinnamomi*, a root disease that responds to moist, wet conditions like the other two Phytophtora’s mentioned, has had an impact in some forest locations in 2010. The late spring rains especially impacted areas where the water table was already close to the soil surface and where *P. cinnamomi* currently exists.

Status: Two large Pacific madrone mortality centers were located in the Palmer Creek drainage, a tributary of Mill Creek west of Healdsburg (Sonoma County, M261C). The centers were approximately 1 to 3 acres in size and were inspected and sampled in 2008 and 2009. Isolations of *Phytophthora cinnamomi* were made from both surface-sterilized roots and from soil samples at these sites.

M261C

Canker Diseases

Pitch Canker
Fusarium circinatum
Contributions by: Phil Cannon and Tom Gordon

Overview: *Fusarium circinatum*, the cause of pitch canker, produces markedly more spores during moist, wet weather than in dry, droughty conditions. Species of pines that are susceptible to this fungus, including Monterey and Bishop pines, are more prone to infection during years with wet springs because shoot tissue are more succulent, and the

Fig 23: Pitch canker in Bishop pine, Monterey RD, Los Padres NF.

Photo: B. Oblinger

pathogen colonizes young, succulent shoots more easily that hardened tissue. The advance of this disease in 2010 was less than would have occurred in a similarly wet year one or two decades ago. A reason for this lower level of infection, especially in Monterey pine, is that many of these pines have a level of acquired resistance from previous exposure to and infection by this pathogen (Gordon et al, in press).

Status: Although this disease remains a problem for both planted and native Monterey pines in coastal California from San Diego County through Sonoma County (261A, 263A), in many parts of San Luis Obispo County, pitch canker is a much less conspicuous problem than it has been in the past. In Morro Bay, relatively few diseased trees were observed during a windshield survey. In native stands on the Monterey Peninsula, new infections were detected on some trees but the overall intensity of the disease did not change from last year. In the San Francisco Bay Area, symptomatic branch tips remain evident on planted Monterey pines, but the visual impact is substantially less than it was ten years ago. Branch dieback in western Marin County on both Bishop pine and non-native Monterey pine still occurred in 2010.

Pitch canker is causing extensive shoot damage and tree mortality in Bishop pine stands on Point Reyes National Seashore that naturally regenerated after the Mount Vision fire of 1995. A cursory survey of the approximately 5,000 acre Bishop pine forest at Point Reyes National Seashore indicates that approximately 40% of all Bishop pines have at least a small amount of dieback caused by pitch canker, while 5% of all pines in the area have died from this disease. These stands are approaching 16 years of age and competition is also causing substantial mortality of suppressed trees.

Pitch canker remains active at a Christmas tree farm in Solano County, which is perhaps the most inland location where the disease occurs.

Fig 24: Cytospora canker and dwarf mistletoe in Red Fir, Yosemite NP.

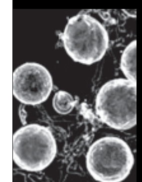
Photo: L. Mortenson

Cytospora Canker of Red Fir

Cytospora abietis

Contributions by: Leif Mortensen

Status: Cytospora canker is an aggressive and commonly observed disease in red fir trees across the Sierras, but its greatest impact occurs in conjunction with other diseases such as red fir dwarf mistletoe and root rot, bark beetle infestations, dense stand conditions, and stress induced by drought. In 2010, Cytospora canker of red fir showed an increase in incidence and as an agent of mortality. A careful examination of the Forest Inventory Analysis (FIA) plots in the Sierras indicates that Cytospora canker is more likely to become established in limbs of red fir trees that have already been colonized by dwarf mistletoe. Further analyses of the FIA plot data indicate that the Cytospora/dwarf mistletoe combination has had a greater effect on red fir than *Heterobasidion occidentale*.



Cytospora Canker of Tecate Cypress
Cytospora sp.
Contributions by: Akif Escalen and Paul Zambino

M262B

Status: Young tecate cypress (*Cupressus forbesii*) on Otay Mountain, Otay Mountain Wilderness (San Diego County, M262B) had extensive yellowing and dieback of lower branches with some resin release in the Spring of 2010. Natural stands of tecate cypress are only found in a few locations in the United States, all in southern San Diego County. These trees are critical to the survival of Thorne's hairstreak butterfly (*Callophrys gryneus thornei*), that feeds exclusively on foliage of tecate cypress and only occurs in the cypress population on Otay Mountain. A fungus cultured from an infected branch sample was identified by a genetic test using PCR analysis as a *Cytospora* species (Akif Eskalen, UC Riverside). Additional monitoring of disease at this site will be needed to determine if the symptoms represent natural thinning of lower branches or disease encroachment into a critical cypress population.

Thousand Cankers Disease
Contributions by: Phil Cannon and Steve Seybold

M262A

262A

M261B

Overview: A combination of the insect *Pityophthorus juglandis* and the fungus *Geosmithia* sp., tentatively called *G. morbida*, can lead to the development of thousand cankers disease of walnut. A tree that loses many limbs and has severe canker damage on its main stem can be killed. This disease was first documented in California within Yolo County in 2008. Thousand cankers disease is a great concern in many states after causing mortality of ornamental eastern black walnuts in various western states. Due to the risk of it spreading to the natural range of eastern black walnut and other walnut species, concern has risen throughout the U.S. Many different walnut species and hybrids are susceptible, as can be observed in clonal archives at the USDA National Clonal Germplasm Repository in Winters. This disease has been confirmed in California on *Juglans microcarpa*, *J. nigra*, *J. hindsii*, *J. nigra* x *J. hindsii*, *J. regia*, *J. hindsii* x *J. regia*. However, English (Persian) walnut (*Juglans regia*) appears only moderately susceptible to the pathogen and is a less favorable host for the beetle than black walnuts, although rootstocks of native or hybrid species in walnut production areas may still be colonized. These findings have partially alleviated concerns about the threat to English walnut in the interior valleys of California, which represent 99% of the nation's commercial walnut production. Margins of some plantations along roadways have been reported to be affected, and interactions between native stands and production plantations will remain an issue for concern and monitoring.

Status: Thousand cankers disease is currently a problem only in certain riparian areas where native black walnut species naturally occur and on planted black walnuts. The disease has been found in native walnuts in the area around Ojai (Ventura County, M262A) and is very common along the Putah Creek area near Winters. Thousand cankers has been confirmed in Los Angeles County in the south and as far north as Sutter and Lake Counties (M262B, 262A, and M261B).

Hypoxylon / Bot cankers of oaks
Biscogniauxia mediterranea / Botryosphaeria spp.
Contributed by: Paul Zambino

Status: Coast live oaks (*Quercus agrifolia*) at the Santa Ysabel Preserve in San Diego County (M262B) were significantly affected by canker fungi. In some trees, horizontal portions of every limb throughout the crown were cankered on the lower 20-60% of their circumference. In others, all small branches had died back and caused epicormic sprouting with major branches having profuse thin twigs but no middle-sized branches. *Diplodia* / *Botryosphaeria* spp. (the causes of bot canker on oak) and *Biscogniauxia mediterranea* (the cause of Hypoxylon canker on oak) were present (Figure 25); the casting of a dead outer layer of bark from large living branches and boles of coast live oak (Figure 26) was typical of infection by *Biscogniauxia*. This assortment of canker fungi also caused branch

Fig 25: Bot canker and dieback in coast live oak caused by Botryosphaeria spp. Cankers start on the underside of branches and produce wedges of stain.

Photo: P. Zambino

Fig 26: In early stages, Hypoxylon (Biscogniauxia) canker of coast live oak causes outer layers of bark to die and be shed. It later kills branches and produces a black fungus layer that give the disease the common name "charcoal canker".

Photo: P. Zambino

dieback in most coast live oaks at three sites on Camp Pendleton (M262B). Trees with cankers at all these locations lacked goldspotted oak borer presence and there was minimal mortality. Lower levels of fruiting by these fungi and less severe cankering were seen on coast live oak at many other sites in Southern California in 2010.

M262B

Rust Diseases

White Pine Blister Rust
Cronartium ribicola
Contributions by: Joan Dunlap

Overview: Several different species of five-needle pines grow in California, all of which are susceptible to white pine blister rust. The disease first moved into sugar pine in northern California near the Oregon border about 60 years ago and continues to move southward through the Sierras. White pine blister rust can now be found as far south as Sequoia National Park, although it appears to be less prevalent there. White pine blister rust is generally absent in whitebark pine and foxtail pine in the southern Sierra Nevada; although the rust has been found this far south infecting sugar pine. Foxtail and whitebark pine grow in dry, high elevation locations, and these conditions are generally not favorable for *C. ribicola* infection. The furthest south *C. ribicola* has been found infecting whitebark pine is at Trail Lake on the Sierra National Forest at an elevation of 11,000 feet above sea level (Inyo County, M261E).

Fig 27: White pine blister rust on whitebark pine in the Warner Mountains west of Soup Spring CG, Modoc NF.

Photo: D. Cluck

M261G

Status: White pine blister rust (WPBR) was detected on several whitebark pines in the Warner Mountains, Modoc National Forest, in 2010 (Modoc County, M261G). Ground surveys by Forest Health Protection staff to assess whitebark pine conditions showed WPBR has infected approximately 1% of the trees from the Oregon border to the southern extent of whitebark pine near Buck Mountain. White Pine Blister rust has also been observed on whitebark pine (*Pinus albicaulis*) in many stands where it has been studied in the central Sierras. In 2010 high levels of WPBR-infection were observed on western white pine west of Lake Tahoe in the Ellis Peak area. Many of the western white pine trees in these stands show some degree of infection and many are already dead (M261E).

Rust Resistance Program

The Region 5 Genetic Resources staff screens both sugar pine (*Pinus lambertiana*) and western white pine (*P. monticola*) for natural genetic resistance to WPBR. Screening for major gene resistance (MGR) occurs at the Placerville Nursery, Eldorado National Forest (Eldorado County, M261E), and screening for slow rust resistance (SRR) takes place at two field sites on the Happy Camp Ranger District, Klamath National Forest (Siskiyou County, M261C). In the winter of 2010, 422 sugar pine families were screened for MGR; 26 of these were promising. Most of the families represented in these trials were from the Lassen National Forest and the Lake Tahoe Basin Management Unit; the remainder came from six other national forests and private industry lands. This year's screening yielded 6 new trees with MGR out of 169 tested for the Lassen, and 14 out of 103 tested for the Lake Tahoe Basin. In general, these results reflect the lower frequency of trees with MGR in northern CA forests than in central Sierra forests. The upcoming rust resistance screening will again focus on collections from the northern California forests. To date, a total of 1,788 sugar pines with MGR have been identified on federal, state, and private lands.

On the Klamath National Forest, activities related to SRR evaluations continued with the planting of 1,019 MGR seedlings from 170 families at the Happy Camp Outplant Site (HCOPS), and 2,522 non-MGR seedlings from 101 North Zone families at the Classic field site. All seedlings had been grown at the Placerville Nursery. This year, evaluations at the HCOPS led to an initial selection of 30 sugar pines with SRR traits from 678 surviving trees (out of 4,272 planted in 1992). The first rust reading of 7,650 sugar pines planted in the 2006 SRR heritability study was completed in spring 2010. These data will provide insight into the heritability of SRR mechanisms in sugar pine.

M261E

The 2010 sugar pine cone crop was light in most areas. The exception was southern California where 320 bushels were collected from 42 proven trees with MGR. As part of two cooperative agreements with non-Federal organizations, twenty additional bushels were collected from 4 trees with MGR near Lake Tahoe and 190 bushels from 39 trees with MGR on the Stanislaus National Forest. Southern California forests were also revisited to collect cones from 171 new sugar pines that will be tested for MGR using their seedlings. Since staff would like to use rust-resistant seedlings in future reforestation projects on the Stanislaus National Forest's Summit Ranger District, collections were made from 16 western white pine trees for MGR testing. This year marked the continuation of other high-elevation pine cone collections in foxtail, limber and Great Basin bristlecone pines. Collections were made from 74 trees and are planned for about 50 more on the Angeles, Los Padres, San Bernardino, Inyo, Mendocino, Shasta-Trinity, and Klamath National Forests. Future collections are expected from these species and whitebark pine as part of a three-year contract to gather seed from new areas for seed banking for genetic conservation purposes.

Broom Rust of Incense Cedar

Gymnosporangium libocedri

Contributions by: Martin MacKenzie and Tom Smith

An area of about 70 acres in the Lake Tahoe Basin has been seriously impacted by incense cedar broom rust (Placer County, M261E). All the incense cedar trees of all ages were infected by the disease. Larger trees were covered by brooms. Smaller trees and seedlings exhibited dieback and death. Severe brooming on incense cedar of all ages was also observed on the Eldorado National Forest in Twin Bridges throughout the Pyramid Creek drainage north of US Highway 50. The alternate host in the area is serviceberry. The foliage of serviceberry was heavily infested during the growing season and appeared bright yellow-orange from a distance. Due to available moisture and high inoculum loads this year, additional damage is expected in the coming years.

Fig 28: Incense cedar rust on serviceberry.

Photo: C. Daugherty

M262B

Fig 29: Myrtle rust in San Diego County has affected plants grown in nursery settings for foliage or for sale as ornamentals, such as this common myrtle.

Photo: P. Zambino

Eucalyptus / Guava / Myrtle Rust
Puccinia psidii / Uredo rangelii species complex
Contributions by: Pat Nolan and Paul Zambino

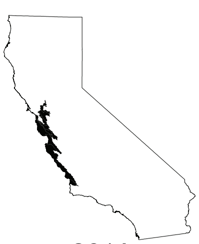
In September of 2010, the Plant Disease Diagnostic Laboratory of the San Diego County Department of Agriculture, detected myrtle rust, *Uredo rangelii*, on a sample of common myrtle, *Myrtus communis*, submitted by a commercial grower in the Fallbrook area (San Diego County, M262B). Myrtle is commonly grown in this area and sold as green filler for floral bouquets and arrangements.

Pustules in the Fallbrook sample had abundant asexual urediniospores but completely lacked dark teliospores. This, and the presence of a smooth, non-ornamented "tonsure" on urediniospores, appear to indicate the asexual strain (*Uredo rangelii*) typically found on myrtle instead of the sexual strain (*Puccinia psidii*), which is generally found on eucalyptus. To date, rust has not been detected on eucalyptus in California. Myrtle rust is still highly localized and no detections have occurred in some years.

The Fallbrook rust sample was sent under USDA-APHIS permit to researchers at the Rocky Mountain Research Station for DNA studies of the species complex, which is causing widespread damage to Eucalyptus plantations in South America and rose apple in Hawaii. This disease also was detected in April of 2010 on myrtle in Australia. Plants in the myrtle family include common myrtle, eucalyptus, gum, guava, bottlebrush plant, tea tree, and others.

Shoot and Foliar Diseases

M261A



261A

Anthracnose on Oak and Sycamore
Contributions by: Pete Angwin, Phil Cannon, Jack Marshall, Don Owen, and Paul Zambino

Anthracnose and other foliar diseases were significant on several hardwood species throughout California. Many of these diseases were related to elevated spring and early summer rains that occurred in 2010.

Anthracnose was common, but not severe, on black oak in the foothills of the upper Sacramento Valley in the vicinity of Redding (Shasta County, M261A, M261C). Black oaks at Howard Forest, south of Willits in Mendocino County, also had moderate leaf blight from anthracnose this summer (261A).

Sycamore trees in San Luis Obispo and Monterey Counties were severely affected by an anthracnose caused by *Apiognomonia veneta* (261A). The rainy, moist conditions that prevailed during the late spring and early summer of 2010 enabled this fungus to form successive generations of spores and therefore copious numbers of spores were available to attack newly formed leaves upon emergence. Most impacted trees appeared healthy and are expected to recover from this disease, but the carbohydrate reserves of most affected trees have been reduced. If defoliation or leaf damage occurs in successive years to come, these trees could be severely impacted.

Fig 30: Midsummer symptoms of sycamore anthracnose on California sycamore include irregular patches of leaf necrosis, dieback of small twigs, and small cankers on larger twigs.

Photo: P. Zambino

Fig 31: Repeated years of sycamore anthracnose in canyons in southern California cause thin crowns, twisted branches, dieback, and decline. Sprouting at the bases of the severely affected tree pictured will aid its survival.

Photo: P. Zambino

Sycamore anthracnose was also prevalent in natural stands of California sycamore (*Platanus racemosa*) throughout southern California in 2010 (M262B). Spring dieback of young leaves and growing shoots caused up to 90% crown defoliation in some side canyons along City Creek and Mill Creek, Little Sand Canyon, and Borea Canyon, Front Country Ranger District, San Bernardino National Forest (San Bernardino County, M262B). At these sites, scattered sycamores are often the only hardwoods on canyon slopes. Anthracnose was also severe in sycamores in the bottom of the much flatter Talega Canyon on Camp Pendleton (San Diego County, M262B). New foliage regrew on trees following damage at these sites by midsummer. However, angular patches of necrosis were prevalent in many summer leaves, and some leaves were deformed. Thrip damage may have contributed to this deformation at some sites. Microscopic examination of sporulation structures in bark of branch cankers at the site of twig dieback confirmed *Discula platani*, which is the anamorphic state of *Apiognomina venata*, as the major fungus causing anthracnose. Anthracnose did not appear to be causing outright mortality, although multiple years of cankering have given crowns a contorted appearance at many locations and may have been a factor in inducing basal sprouts seen at some locations.

263A

Sycamore trees in the vicinity of San Pablo Bay, north of San Francisco (263A), were also heavily impacted by this pathogen in 2010. However, in this case, the powdery mildew *Erysiphe plantini* was also contributing to much of the damage. A wet spring and much heavier than usual fog during much of the summer probably exacerbated this disease complex.

Diplodia Shoot Blight
Diplodia sp.
Contributions by: Pete Angwin and Don Owen

Recent research suggests there are two *Diplodia* species that can commonly cause shoot blight and cankers of pines. *Diplodia pinea* and *D. scrobiculata* can co-occur in some places such as the Great Lakes Region of the U.S. and Europe. Along the central coast of California, only *D. scrobiculata* has been detected and further genetic testing could be completed to determine which species occur in other portions of the state.

M261C

Shoot dieback caused by *Diplodia* sp. increased this year on ponderosa pines in the upper Sacramento River Canyon, Shasta, and Siskiyou Counties, and in the vicinity of McCloud in Siskiyou County (M261A, M261C). This caused an increase in landowner inquiries about the disease.

Along the Interstate 5 corridor, diseased trees were visible from Shasta Lake to just north of Dunsmuir. The disease was also common on the west side of Redding, in the Trinity River drainage west of Weaverville, and in the upper Klamath River drainage west of I-5. Two consecutive years of wet spring weather have most likely contributed to this increase.


M261E

Necrotic branch tips of current year's growth on mature ponderosa pine were observed along Deer Creek Hwy between Forest Ranch and Lomo (Butte County, M261E). Shoots killed in previous years were still attached to some branches. Severity of shoot blight varied between trees. This disease was confirmed by viewing characteristic fruiting structures and spores of *Diplodia* species present in dead, stunted needles and shoots.

Tip Dieback and Canker of Coast Redwood
Cause unknown
Contributions by: Tom Smith


262A

Several planted coast redwoods in the Granite Bay area (Sacramento County, 262A), suffered from tip dieback and branch cankers. The causal agent was thought to be *Botryosphaeria*, but the causal agent was not isolated. The trees were planted in an urban setting far off site from the natural range of the species which may also have been a contributing factor to the dieback of the branches.

Tip Blight of Incense Cedar
Pestalotiopsis funereal
Contributions by: Tom Smith


M261F

Incense cedars in a stand near Kyburz in El Dorado County had Pestalotiopsis tip blight (M261F). Approximately one dozen trees had severe tip blight and ranged in age from small understory saplings to large, old growth specimens. The fungus caused yellowing of the foliage and some minor tip dieback, but otherwise did not appear to be seriously harming the trees.

Red Band Needle Blight
Mycosphaerella pini (Dothistroma septospora)
Contributions by: Jack Marshall

A few planted Monterey or Monterey x knobcone hybrid pines along Highway 299 west of Berry Summit in Humboldt County were symptomatic of this disease (M261B).

Foliar Blight of California Bay Laurel
Cylindrocladium sp.
Contributions by: Jack Marshall


M262A

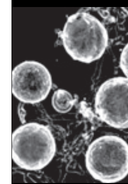
Many acres of California bay laurel were blighted in Armstrong Redwoods State Park (Sonoma County, M262A). Trees were more severely affected when growing in the understory beneath redwood trees, and had less damage when growing in the open. Symptoms first appeared in the lower crowns and spread upward from there.

Foliar Blight of Madrone
Mycosphaerella sp.
Contributions by: Jack Marshall

Madrones along Highway 299 east of Lord Ellis Summit were heavily infected with a leaf pathogen(s) that caused extensive foliar dieback. In many cases, only the topmost leaves remained uninfected. *Mycosphaerella* sp. was isolated from a typically symptomatic madrone (Humboldt County, M261B).

Root Diseases

Overview: Although many fungi cause root rots in forest trees in California, the four most important root diseases in California are Heterobasidion root disease, black stain root disease, Armillaria root disease, and Port-Orford-cedar root disease (discussed above, page 28). Root diseases can influence forest stand structure, composition, and overall



health. Root disease organisms kill host cambium, decay root wood, plug water conducting tissue, or cause some combination of these effects. Tree death results directly from root disease impacts, occurs when trees with decayed roots are windthrown, or is caused by bark beetles that attack root disease-weakened trees.

Heterobasidion Root Disease

Research conducted by William Otrosina and Matteo Garbelotto indicates that root rotting fungi in North America once collectively known as *Fomes annosus* and later as *Heterobasidion annosum* comprise two distinct species: *Heterobasidion irregulare* and *Heterobasidion occidentale* (Otrosina and Garbelotto, 2010).

Heterobasidion irregulare
Contributions by: Pete Angwin

M261A

Button conks of *Heterobasidion irregulare* were found on roots of ponderosa pine seedlings adjacent to a 1 acre group of dead and dying ponderosa pine near the toilets at the eastern edge of Hirz Bay Group Camp #1 (Shasta County, M261A).

Heterobasidion occidentale
Contributions by: Pete Angwin, Martin MacKenzie, Beverly Bulaon, and Phil Cannon

Heterobasidion occidentale continued to cause scattered pockets of mortality in white fir of all sizes throughout the 15 acre McBride Springs Campground on the Shasta-McCloud Management Unit of the Shasta-Trinity National Forest (Siskiyou County, M261D). In 2009, fruiting bodies were found in four white fir stumps. Fir engraver beetles (*Scolytus ventralis*) continued to attack and kill larger fir infected with this root disease. Because of the hazard at this site, the campground remained closed during the 2010 season, and removal of all white fir commenced in August.

Fig 32: White fir killed by Heterobasidion root disease and fir engraver beetle at McBride Springs Campground, Shasta-Trinity NF.

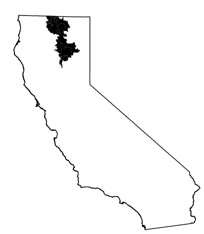
Photo: P. Angwin

M261B

Scattered pockets of dead, dying, wind-thrown and broken white fir are widespread in an approximately 20 acre mixed conifer stand along the top of Tatham Ridge on the Grindstone Ranger District of the Mendocino National Forest (Tehama County, M261B). The pathogen was confirmed by the presence of fruiting bodies in white fir stumps. Similar mortality due to *H. occidentale* was also noted and confirmed by the presence of fruiting bodies in conks in a large stand along FS Road 19, two miles north of the Pilgrim Creek Snowmobile Park on Shasta-McCloud Management Unit of the Shasta-Trinity National Forest (Siskiyou County, M261D).

Fig 33: *Heterobasidion occidentale* fruiting bodies in white fir stump near the Pilgrim Creek Snowmobile Park, Shasta-Trinity NF.

Photo: P. Angwin



M261D

Heterobasidion occidentale continues to kill true firs in many root disease centers scattered throughout forests of the Sierra Nevada as well. As a consequence of past management practices, including intermittent removal of engraver beetle-killed fir without concomitant application of Sporax,

M261E

some of the most heavily affected fir stands are in the Eldorado National Forest (M261E).

A new U.S. Forest Service Handbook supplement on this disease in California can be accessed on the web at https://fs.usda.gov/FSI_Directives/R5-3409.11-2010-1.doc. This document and other information on the website www.fs.fed.us/r5/spf/fhp/heterobasidion.shtml will be useful for recognizing and controlling the spread of this disease in the state.

Armillaria Root Disease
Armillaria spp.
Contributions by: Phil Cannon, Martin MacKenzie, Jack Marshall, Don Owen, and Paul Zambino

Overview: Unlike in other regions, Armillaria root disease in California is believed to be caused by primarily one species, *Armillaria mellea*, which affects both hardwoods and conifers. In 2010 as in the past, this disease was especially apparent in trees near buried wood or roots where levels of inoculum could build up, and in trees that had been stressed by flooding, fire, or other environmental factors. Dead oak roots often serve as a source of inoculum.

Fig 34: Armillaria root and butt rot caused the failure of this large canyon live oak near a gated forest service road, six years after fire damage.

Photo: P. Zambino

On Hardwoods

A few tanoaks were killed by an *Armillaria* sp. above Redwood Creek in northern Humboldt County (M261B). The pathogen was confirmed in these trees after they were surveyed on the ground south of a new site where sudden oak death occurs along Redwood Creek.

One tanoak was killed by this root disease in MacKerricher State Park within an area infested with sudden oak death (Mendocino County, 263A). The killed tree was near a water leak, and saturated soil conditions likely led to mortality by an *Armillaria* sp.

Armillaria root disease contributed to recent tree failure of 6 canyon live oaks (*Quercus chrysolepis*) along Barrett Stoddard Truck Trail, 2N01.1, between Barrett and Cascade Canyons, San Gabriel River Ranger District, Angeles National Forest (San Bernardino County, M262B). Approximately 20 acres of canyon live oaks along moderately steep slopes of the canyon were affected by fires 6 and 8 years ago. Upslope scars and fire-hollowed decay columns were found in almost every tree. Tree failure occurred in trees when thin shells of remaining wood were colonized and weakened by an *Armillaria* sp. The Armillaria-affected trees had little to no basal sprouting while other fire-damaged trees with an equal amount of fire scars had abundant sprouts.

M262B

M261A

On Conifers

Ponderosa pine, sugar pine, and Douglas-fir are dying from Armillaria root disease (most likely *A. mellea*) throughout an 80 acre parcel in the Horse Creek drainage, which is a tributary of the Klamath River in Siskiyou County (M261A). Mortality is clustered around large diameter black oaks that were killed by herbicide treatment several years ago. Most of the dead and dying trees are 8 -12” DBH, although an *Armillaria* sp. was confirmed in a larger dying ponderosa pine that was 16” DBH. No disease was found in conifers growing away from the oaks.

Several large fir trees were killed by an *Armillaria* sp. in the Mount Ellis area just west of Lake Tahoe (M261E).


Figs 35 & 36: Armillaria root disease, which previously killed a giant sequoia, is beginning to cause dieback on another nearby.

Photo: S. Hanna

In the Sequoia National Forest, a case was documented where Armillaria root disease, which had already killed a giant sequoia, was beginning to cause dieback and kill a neighboring giant sequoia. The trees are separated by roughly 200 feet (M261E).

Black Stain Root Disease
Leptographium wageneri var. *pseudotsugae*
Contributions by: Pete Angwin, Chris Lee, Jack Marshall, Don Owen, and Bill Woodruff

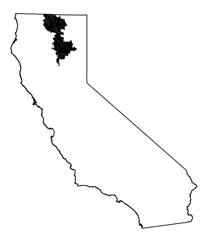
Overview: Black stain root disease is caused by several host-specialized varieties of *Leptographium wagerneri*. Douglas-fir and ponderosa pine are more likely to be affected by this disease if their roots have already suffered from limiting soil conditions, most commonly brought on by soil disturbance. When trees are affected by black stain their root systems are functioning at less than full capacity, and are substantially more susceptible to insects, such as bark-beetles, that attack living roots of stressed trees or stumps.

263A

<u>North Coast</u>
Dead or dying Douglas-firs with black stain root disease, caused by *Leptographium wageneri* var. *pseudotsugae*, were observed in several places in Humboldt County (263A). Affected Douglas-fir were of all sizes (1 - 30" DBH) and were generally associated with either roadside location, encroachment on thin prairie soils, or past harvesting that created numerous Douglas-fir stumps. Several dead trees also contained larval mines and larvae of the flatheaded fir borer (*Melanophila drummondi*), and at least one also contained larvae of an unidentified roundheaded borer. Diseased Douglas-firs were observed in the following locations: Seely Creek and Old Briceland Road near Garberville; Wildcat Road between Ferndale and Petrolia; Sulphur Creek near Dinsmore; Redwood Valley north of Hwy 299 along Redwood Creek (the greatest number of affected trees were observed at this site); and along Hwy 299 and Snow Camp Road leading south from Lord Ellis Summit (M261B).

M261B

<u>McCloud Flats</u>
Conspicuous concentrations of mortality around black stain root disease centers, caused by Leptographium wageneri var. ponderosae, have been evident in ponderosa pine stands at the Mud Flow Research Natural Area of the Shasta-McCloud Management Unit of the Shasta-Trinity National Forest for many years (Siskiyou County, M261D). While a windstorm during the winter of 2008-2009 blew down large numbers of the root-diseased pines, mortality continued in 2010.



M261D

Ponderosa pine mortality due to black stain was also identified in the Shasta-McCloud Management Unit in Small Sales Unit 321, approximately one mile north of the Pilgrim Creek Snowmobile Park along FS Road 19 (Siskiyou County, M261D).

Fig 37: Black stain root disease in ponderosa pine at Small Sales Unit 321near the Pilgrim Creek Snowmobile Park, Shasta-Trinity NF.

Photo: P. Angwin

Fig 38: Black stain root disease study at Poison Lake, Lassen NF.

Photo: W. Woodruff

M261D

Lassen National Forest

US Forest Service Southern Research Station (SRS), NE California USFS Forest Health Protection (FHP) staff, and Lassen National Forest staff have been studying black stain root disease, on ponderosa pine since 1997. Research has been conducted in an area just west and north of Poison Lake on the Eagle Lake Ranger District of the Lassen National Forest (Lassen County, M261D). To date, researchers have identified several insect vectors and the time of year when these vectors are active. They have also determined how many spores of the causal agent are needed for an infection to occur. Researchers have also been monitoring tree health and mortality in the study area since timber harvest activities concluded in the late 1990's. Previously, researchers only assessed the severity of *L. wageneri* infection by the appearance of foliage and the amount of staining present in the wood at the base of trees. But in September, 2010, researchers uprooted 13 ponderosa pines in the Poison Lake study area in order to quantify the amount of staining in the roots of ponderosa pine trees with differing crown conditions. The condition of the crowns prior to falling will be compared with the amount of black stain visible in the roots. Results will be reported at a later date.

Schweinitzii Root Disease

Phaeolus schweinitzii

Contributions by: Jack Marshall

261A

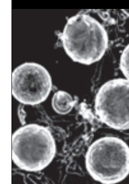
In Santa Cruz County, *Phaeolus schweinitzii* incidence is scattered in the Douglas-fir trees within the Soquel Demonstration State Forest (261A).

A few large sitka spruce trees near Big Lagoon County Park in Humboldt County appeared to be dying from insect attacks. However, conks of *Phaeolus schweinitzii* were found at the bases of several sitka spruce in the vicinity and this disease may be predisposing these trees to spruce beetle attack. Some of these trees could also be suffering from effects of strong winds coming out of the Pacific (263A).

263A

Conks of *P. schweinitzii* were found beneath several Bishop and shore pines within MacKerricher State Park north of Fort Bragg in Mendocino County. Conks were found on roots of pines growing adjacent to coastal sand dunes (263A).

Conks were also observed on several Douglas-fir stumps at the new sudden oak death site along Redwood Creek in Humboldt County (263A).



Red Ring Rot
Phellinus pini
Contributions by: Pete Angwin

M261A

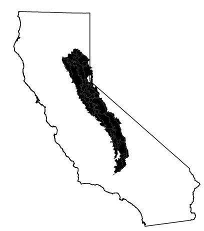
Phellinus pini fruiting bodies were found on Douglas-fir scattered throughout the 5 acre Steel Bridge Campground and the 5 acre Douglas-City Campground (both administered by the Bureau of Land Management) near Douglas City (Trinity County, M261A). This fungal pathogen has been known to cause extensive decay columns in Douglas-fir and because of the potential hazard at these recreation sites, most of the infected trees were removed.

Mistletoes

Western Dwarf Mistletoe
Arceuthobium campylopodum
Contributions by: Pete Angwin and Don Owen

A 2 acre parcel of ponderosa pine is heavily infested with dwarf mistletoe in the Horse Creek drainage, which is a tributary of the Klamath River in Siskiyou County (M261A). The trees are 8-12” DBH and relatively uniform in height. Virtually every tree has an infected lower bole, while infections in the crowns are light. This pattern indicates relatively even-aged stand development and that trees were infected at an early age.

Gray Pine Dwarf Mistletoe
Arceuthobium occidentale
Contributions by: Pete Angwin



M261E

A 2 acre patch of heavily infested gray pine was identified on Bureau of Land Management land adjacent to the eastern boundary of the Enterprise Rancheria of the Maidu Indians (Yuba County, M261E). Individual infected pines had dwarf mistletoe ratings ranging from 4 to 6 (extremely high according to the Hawksworth Rating System). Plans are underway to remove the infected pines.

Oak Mistletoe
Phoradendron villosum
Contributions by: Paul Zambino

M262B

There were relatively low levels of oak mistletoe observed in stands of coast live oak (*Quercus agrifolia*) on the Manzanita Reservation of the Kumeyaay Nation (San Diego County, M262B). Incidence ranged from 12-50% of trees infected; with the exception of a single tree with 60% mistletoe, intensity in most crowns was less than 1%. This reflects long-term effectiveness of mistletoe removal that occurred a decade earlier. Incidences and intensity appeared much higher on lands of adjacent ownerships.

Oak mistletoe appeared to be completely absent from coast live oak and Engelmann oak (*Quercus engelmannii*) on the Viejas Reservation of the Kumeyaay Nation (San Diego County, M262B).

Bigleaf Mistletoe
Phoradendron tomentosum ssp. *macrophyllum*
Contributed by: Paul Zambino

Bigleaf mistletoe (*Phoradendron macrophyllum*) was prominent in all Fremont cottonwoods (*Populus fremontii*) >24” DBH in the lower meadows of the Viejas Reservation of the Kumeyaay Nation (San Diego County, M262B), but was not seen in a younger cohort of regenerating cottonwoods <10” DBH or planted sycamores at various sites. Two of six honey locusts (*Gleditsia triacanthos*) were also affected in one area of gallery forest, where this species had apparently been planted to provide shade. Intensity in crowns of the cottonwoods averaged 12% with a maximum of 30% and averaged 25% in infected honey locust.

Declines

Red Fir Decline

Contributions by: Phil Cannon and Leif Mortensen

M261E

Studies conducted through Oregon State University by graduate student Leif Mortensen have focused on fir decline information provided by Forest Inventory Analysis (FIA) plots in California. Initial analysis indicates mortality rates in red fir are among the highest for all conifers in the Sierras and that they are increasing (M261E). White fir mortality rate is second behind red fir and is also increasing, but at a slower pace. Of standing trees tallied in FIA plots, a greater proportion of red fir are dead than for white fir, lodgepole pine and Jeffrey pine. The biggest difference between red fir and other forest types statewide is red fir's high proportion of trees that have multiple types of significant damage. A red fir tree is twice as likely as a white fir to have significant insect and disease problems. Drought stress, overstocking, and Heterobasidion root disease all occur in red fir stands. The average dwarf mistletoe rating for red fir is higher than for any other tree state-wide.

Links between climate change and the deteriorating health of many red fir trees in California are being investigated. Increasing temperatures may make red fir branches more vulnerable to bark desiccation, and affected branches could be less likely to fend off dwarf mistletoe infection. Greater incidence of dwarf mistletoe would increase prevalence of Cytospora canker. More information on this decline is anticipated in the near future.

Fig 39: Cytospora cankers on the exposed side of all of the white alder in this stand demonstrate the influence of environment in the disease's development. Flea beetles also thinned the foliage.

Photo: P. Zambino

Alder Decline by Multiple Agents

Contributed by: Paul Zambino

Decline in white alders (*Alnus rhombifolia*) continued in southern California in 2010, but was only detected in ground-based examinations (San Bernardino County, M262B). At sites with decline, many alders ≥10" DBH in exposed locations were affected, while young regeneration is unaffected. The previously reported decline along a stretch of Mill Creek from Thurman Flats Picnic Area to beyond the Vivian Creek Recreation Site is intensifying (Front Range Ranger District, San Bernardino National Forest). Decline was also observed this year along San Antonio Creek near the Lower San Antonio Fire Station on the San Gabriel River Ranger District of the Angeles National Forest (San Bernardino County, M262B). Here, patches of declining alders at this site all had Cytospora (Valsa) cankers that only occurred on the exposed southeastern side of their boles. Alder flea beetle was also present at this site, but mostly on younger trees not in decline. Rhizomorphs of *Armillaria* spp. were present on recently killed alders at Thurman Flats, but it could not be determined if this was a saprophytic or pathogenic relationship.

M262B

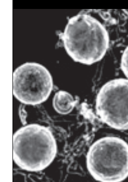
Incense Cedar Decline

Contributed by: Paul Zambino

Decline of incense cedar (*Calocedrus decurrens*) was severe for several years through 2009 in the Mill Creek drainage near Vivian Creek Recreation Site on the Front Range Ranger District of the San Bernardino National Forest (San Bernardino County, M262B). Besides causing mortality, a thin appearance had developed in the crowns of many trees due to abscission of small branches. Some of these trees also appeared deformed with twisted branch growth. The normal precipitation in 2010 likely reduced stress in incense cedar and foliage was visibly denser in many trees that had thin crowns in 2009. No trees died of incense cedar decline in 2010 at this location. Growth from sites where green branchlets had abscised in 2009 was usually perpendicular to the original axis of growth, giving branches an irregular, bushy appearance unlike the normally flat growth habit of unstressed cedars. This may explain the deformed appearance of some trees that survived recurrent cycles of stress.

Fig 40: Early stages of decline of this incense cedar are shown by branch thinning at the lower right, and bushy, irregular branches at top left.

Photo: P. Zambino

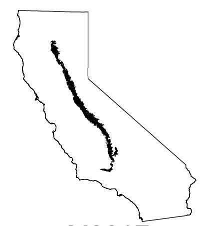


Pinyon Pine Dieback
Contributions by: Kim Camilli

Pinyon pines in the Tehachapi area were dying back individually and in small groups. The pines died from the top down. Multiple factors influenced damage observed. In areas where pines were dying back, recent dirt road construction impacted soil structure near affected trees. Dwarf mistletoe was present in the crowns and fairly abundant in some trees. Various foliage insects were found and the pinyon ips beetle aggressively attacked these stressed trees (Kern County, M261F).

Fig 41: Pinyon pine dying back from top.

Photo: K. Camilli



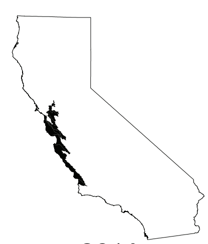
M261F

Urban Tree Disease Problems

Xylella Leaf Scorch
Xylella fastidiosa
Contributions by: Tom Smith

The City of San Dimas in the Los Angeles area reported the first incidence of leaf scorch on liquidambar in the city. This disease has been observed in the area but has never been reported at that location. The leaves of infected trees become discolored because large bacterial populations in the xylem prevent water from being translocated to the leaves (Los Angeles County, M262B).

Fire Blight on Pear
Brenneria amylovora
Contributions by: Brent Oblinger, Paul Zambino



261A

Moderate-to-severe branch flagging of this year’s growth was observed on ornamental pear trees in urban areas within portions of central California. Examples of ornamental pear trees with symptomatic branches were seen along I-680 near San Jose (Santa Clara County, 261A) where approximately 10 trees had branch flagging. Many ornamental pear trees throughout Davis had dieback of current year’s shoots. Examples were present north of the intersection

Fig 42: Severe branch dieback associated with fire blight on ornamental pear in Davis, CA.

Photo: B. Oblinger

M262B

of Drew Ave and Cowell Blvd along Drew Ave where four symptomatic trees were found, and along the southern side of West Covell Blvd, just west of State Rte 113, where approximately 20 trees were symptomatic. Individual trees, without other hosts in close proximity, as well as rows of pear trees were symptomatic. Blossom clusters are often the site of initial infection from which further dieback can occur. Disease development most likely corresponded with periods of spring precipitation when much higher than normal rainfall was recorded during April. Killed shoots gradually wilted and darkened throughout the spring and summer while remaining in the crowns of trees.

The City of Albany also had a huge problem with the bacterial disease fire blight. Over two hundred flowering pears were affected. Other species affected included apples, toyons, and elderberries.

All ornamental pears at the San Bernardino National Forest Supervisors Office in San Bernardino (San Bernardino County, M262B) had some branches affected by fire blight.

Fig 43: Native dodder on, Pasadena CA.

Photo: D. Barar

261B

Native Dodder
Cuscuta sp.
Contributions by: Tom Smith

The City of Pasadena (Los Angeles County, 261B) reported an outbreak of native dodder within the city limits. The parasitic seed plant was attacking various host species. Hosts suffered dieback and stress from the attacks. The amount of dodder was over the normal background levels for the pest (M262B).

Fig 44: Chemical burn of liquidambar, San Dimas, CA.

Photo: D. Day

261A

Chemical Injury
Contributions by: Tom Smith

A row of 27 liquidambar trees were accidentally sprayed with herbicides near a railroad right-of-way in San Dimas (Los Angeles County, 261A). All of the trees showed singed foliage and three trees died. Tissue samples analyzed from the leaves showed presence of the chemical Krovar. Oaks, eucalyptus trees, pines, and deodar cedars growing in the area were also impacted by this herbicide. After damage was observed, the railroad company attempted to trench between its right-of-way and the trees to prevent further herbicide movement through the soil.

Natural Gas Leaks
Contributions by: Tom Smith

The City of Burbank (Los Angeles County, 261A) reported at least ten trees killed by suspected or confirmed natural gas leaks. The number of affected trees increased compared to past years.

Fig 45: Camphor tree damaged by a natural gas leak, Burbank, CA.

Photo: G. Williams

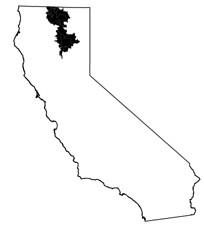
Monterey Pine Mortality
Unknown Cause
Contributions by: Tom Smith

There was a consistent loss of Monterey pine and other conifers at the Oakland Zoo over the past year. The cause is currently unknown.

Abiotic Conditions

Winter Injury / Foliage Desiccation
Contributions by: Don Owen

Winter injury occurred to ponderosa pines at the north end of a lava field east of Fall River Mills and south of Dee Knoch Road in Shasta County (M261D). The pines looked dead in the spring, but close inspection showed that needles had browned approx ¾ of their length from the tip down (bases were green) and buds were still alive. This year's foliage was uninjured and the tree crowns developed normally following bud break. The damage extended for approximately a mile along the edge of the lava field. Black pineleaf scales on these trees were adversely affected by the needle desiccation. Live scales could only be found on the green portions of needles. Scales were equally abundant on desiccated portions of needles, but all were dead.



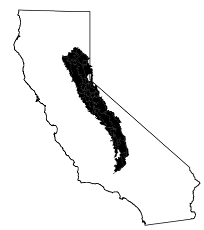
M261D

Snow Breakage
Contributions by: Martin MacKenzie and Cynthia Snyder

Severe winter storms hit northwestern California during the early months of this year, especially in Siskiyou County near Mt. Shasta and Weed. The Mt. Shasta-McCloud Management Area reported hundreds of acres of snow breakage in contiguous 30-40 year old ponderosa pine plantations surrounding Mt. Shasta (Siskiyou County, M261A). Pines (8-16" DBH) in overly dense stands with 200-250 trees per acre were affected.

M261A

During a spring survey for *Diplodia*, several foresters reported that the level of snow damage was higher than in previous years. In the southern and Central Sierras there were a series of late spring snowstorms that loaded many trees with wet heavy snow (M261E). While a limited survey of this snow damage did not reveal any significant insect problems, it did highlight what will be a developing problem in the rest of this decade. The National Forests of the Sierras contain many plantations that are in need of thinning and these un-thinned stands contain many trees that are over 60 ft tall and under 10 inches in diameter. These tall trees are susceptible to snow damage and as the number of stands in this condition increases in the future, snow breakage will become a more common event.



M261E

Frost
Contributions by: Danny Cluck and Tom Coleman

Black oaks throughout northeastern California were hit with a late frost that coincided with bud break. The cold temperatures of May 22 and 23 killed catkins and newly elongating foliage on thousands of trees in Modoc, Lassen, Plumas, and Tehama Counties. Injury was mostly found in the top half of tree crowns as buds in lower portions had not yet broken dormancy. Nearly all trees grew out a full complement of foliage by the end of June.

Fig 46: Foliage in the top half of the crown of this black oak was frost killed coinciding with bud break, Highway 70 east of Quincy, CA.

Photo: D. Cluck

Late frost caused premature leaf loss on California black oak on Mt. Laguna, Descanso Ranger District, Cleveland National Forest (San Diego County, M262B). Trees re-foliated following the leaf loss and no tree mortality was observed.

M262B

Drought

Contributions by: Martin MacKenzie

M261F

During the spring of 2010 there was a significant loss of black oaks in the foothill areas of Mariposa County (M261F). The oaks that had thin crowns in 2009 and failed to leaf out in 2010 were those growing relatively close to stream banks.

Continued decline and death of Douglas-fir in the north coast area was related to fire scorch from previous year's forest fires (263A). A number of trees also succumbed due to attack by black stain or schweinitzii root disease.

Climate-Disease Interactions

Contributions by: Martin MacKenzie

263A

While the spring of 2010 arrived late, cool, and wet, it was by any parameter well within the range of variation that has recently been seen in California. Some information was gathered specifically to see if the late arrival of spring had any impact upon forest health. Diplodia blight caused by *Diplodia* spp. is a diseases that can increase when environmental conditions are wet and humid. There are several locations along the foothill boundary of the Southern Sierra forest where gray pine gives way to low elevational *Pinus ponderosa* and along this boundary there are several locations where *Diplodia* infections have been historically recorded. A survey of these locations failed to detect any upswing in the number of *Diplodia* infected trees, although the infection levels on individual trees might have been heavier than in the previous year. Although the spring of 2010 may have been wet enough to stimulate *Diplodia* in the foothills of the Sierras it was also cool enough to restrict the development of infections in new trees (M261F).

While the insects and fungi made only slight changes to their behavior, some low-elevational black oaks (*Quercus kelloggii*) did respond to the increased soil moisture of the spring (M261F). In the last few years, these oaks had minimal shoot elongation and had shown some minor branch and twig dieback. As a consequence, in 2009, their branches had a "poodle tailed" appearance, with foliage clustered at the tips of the branches. With the increased moisture from spring 2010, they had significant shoot elongation. While not all low-elevational black oaks displayed this response, it was frequent enough to be worthy of note.

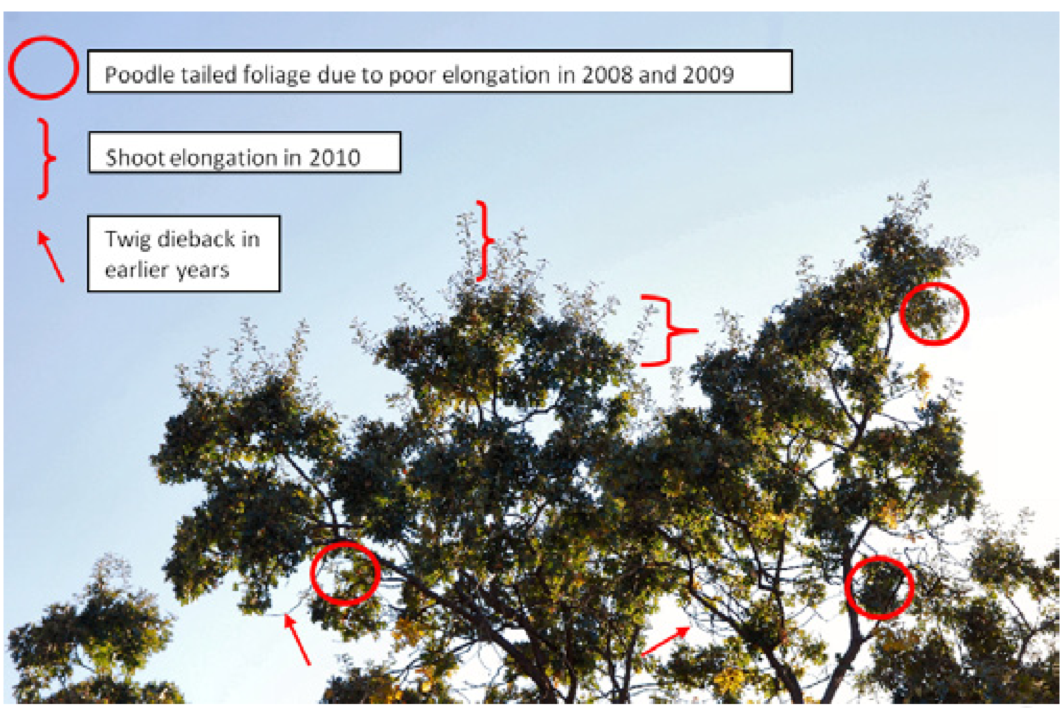


Fig 47: Black oak response to increased soil moisture.

Photo: M. MacKenzie

Miscellaneous

Pollen as a pathogen
Contributions by: Martin MacKenzie

Black oak leaves from the Stanislaus National Forest, on the Groveland Ranger District collected at 4,000 ft, were taken back to the lab for microscopic examination of leafspots. These leaves had multiple splotches on their upper surfaces (M261F).

Fig 48: Black oak leaf with suspected new fungus.

Photo: M. MacKenzie

Examination of the material on the upper surface of the leaves revealed that it was composed mainly of pine pollen. Washing the upper surfaces of the leaves revealed that the pollen had killed the chloroplasts in the palisade layer of the leaf lamina, although the cuticle and epidermal layer appeared not to have been breached. To fertilize the female flower the pollen germ tube has to grow through the stigma and down the style of the flower, and this growth is initially a gene regulated parasitism by the haploid pollen on the diploid female flower. The gene products of this parasitism are complex and have evolved to prevent the female flower from being parasitized by the pollen of other (non-compatible) species. In the observations reported here, the partial germination or at least germination gene products resulted in leafspots. However, the possibility exists that germinating fungal spores utilized the pollen-laden water spots conducive for germination, and took advantage of the altered leaf physiology to effect infection, causing a leafspot disease.

Production of pollen can also come with some cost or stress to the health of the tree that is producing the pollen, and pollen production can also be a response to stress – a mechanism for passing on genes before dying. In bristlecone pine, some male trees produced pollen exclusively at sites on branches that would normally be occupied by new needles. After the pollen was cast, these trees gave the impression that they had been severely defoliated (M261E).

Fig 49: Bristlecone pines, one producing female cones, and one producing male cones. The male cone producer appears defoliated.

Photo: M. MacKenzie

M261E

One apparently "defoliated" tree produced a large number of male cones over the past few years and some needles died. The export of nutrients in the form of pollen may have created a nutrient stress. In contrast, the apparently healthy tree produced mainly female cones. Photopoints (pictures taken from the same spot of the same subject over time) will provide an opportunity to determine if the "stressed" tree recovers and alternates to producing female cones. There is no record of the Great Basin bristlecone tree being strictly male or female in the past.

Animal Damage

Black Bear

Ursus americanus

Contributions by: Pete Angwin, Greg Guisti, and Jack Marshall

Bear damage continues in redwood stands in the North Fork of the Mad River. This year's damage may end up being worse than usual as berry production was very low and bears may have resorted to more bark stripping for food (261A).

Fig 50: Bear damage to coast redwoods.

Photo: G. Giusti

Bear damage was also noted in many large coast redwoods along the Bald Hills Road in Redwood National and State Parks from Highway 101 (at Orick) to the Lady Bird Johnson Grove (Humboldt County, 261A).

Scattered redwood mortality was also noted within Redwood Creek drainage north of Hwy 299 in Humboldt County.

Squirrel Damage to Big Leaf Maple

Contributions by: Danny Cluck, Jack Marshall, Tom Smith, and Yana Valachovic

Fig 51: Squirrel damage on big leaf maple.

Photo: K. Julin

Numerous big leaf maple trees in Marin County showed mechanical feeding damage in the upper parts of the canopy (261A). The cause of damage was unknown until one landowner in the community of Lagunitas saw a squirrel stripping bark from her tree.

This same kind of damage is also prevalent on big leaf maples all along Bair Road in northwestern California. This road branches off of Hwy 299 just east of the Lord Ellis summit and then runs north and parallel with Redwood Creek (263A).

Fig 52: Ponderosa pine girdled by squirrels, Eagle Lake, Lassen NF.

Photo: D. Cluck

Rodent girdling of branches and stems caused branch, top and whole tree mortality of big leaf maple in many areas of the north coast. Reports of similar damage to maples came from the Hwy 101 corridor of southern Humboldt County, the Lagunitas/Woodacre area of Marin County, and in the following areas of Sonoma County: along Ft. Ross road between Bohan Dillon and Niestrath roads, along the Russian River, and in Ragle Park in Sebastopol (261A).

Tree squirrel feeding resulted in the girdling of boles and branches on several Jeffrey and ponderosa pines next to Eagle Lake, Lassen National Forest, Lassen County. (M261D) This damage was first reported in 2008 as porcupine injury but subsequent investigation of feeding pattern has changed this conclusion. The affected area has also increased by close to one hundred acres and now includes hundreds of trees. The feeding results in a barber pole pattern where bark is only removed from the bole in between the branch whorls. The feeding resulted in the top killing of many pines in and around the recreation area. Some of these were removed as hazard trees because of their proximity to a bike trail.

Squirrels were also observed harvesting a large proportion of Jeffrey pine seed in many locations of the Sierra, including Fallen Leaf Lake (M261E).

M261F

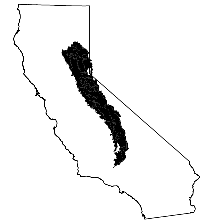
Porcupine
Erethizon dorsatum
Contributions by: Greg Guisti and Tom Smith

A single large incense cedar in the Alta Community, Placer County, was found damaged by a porcupine. The animal was feeding on bark near the top of the tree and girdled the tree in the process (M261F).

Damage Due to Unknown Causes

Seedling Dieback and Mortality

Contributions by: Don Owen



Dieback and mortality occurred to 2-year old grafted ponderosa pine at the Sierra Pacific Industries seed orchard near Gazelle, Siskiyou County (M261E). A variety of symptoms appeared during the summer, including curved tops and branch tips, stunted needles, needle and shoot mortality, resin-soaked tissues, and whole tree mortality. No insect damage was present. No pathogen could be recovered from samples sent to the California Department of Food and Agriculture Diagnostics lab.

Gray Pine Dieback

Contributions by: Kim Camilli

Fig 53: Gray pine dying back from top.

Photo: K. Camilli

Extensive numbers of gray pine (*Pinus sabinana*) have been dying back in northern San Luis Obispo County (M262A). Trees began to die back from the top down. Complete death occurs in about one year. The ages of affected trees were approximately 50-60 years. Approximately 10-20% of trees in a 300-400 acre area died back from an unknown cause. One possible cause of dieback may have been competition with dense-crowned associates of blue oak and live oak, which caused the vigor of gray pines to rapidly decline. Dominant trees in the areas were coast live oak, sycamore, cottonwood, willow, Coulter pine and gray pine. Only the gray pines were affected.

Blue Oak Mortality

Contributions by: Tom Smith

Blue oaks died in areas of Sacramento, Placer, and Yuba Counties (M261F). A stand of about ten older trees died at a fire station in the Loma Rica area of Yuba County. The trees had been affected by construction and the introduction of a lawn to the area. The trees were being overwatered and likely suffering from *Phytophthora* root disease. A similar problem was found at a property in a rural section of Sacramento County.

Blue oaks throughout a 22 acre ranch property near the town of Penryn in Placer County also died. The trees suffered from very thin crowns, severe dieback, and eventually death. When examined, it was found that the trees were being watered as part of the irrigation of grass for cattle feed. The source of the water was known to have been infested with a *Phytophthora* spp. involved in root disease in the past.

Galls and Leaf Curls on Redwood

Contributions by: Tom Smith

In February, as home gardeners were getting back into their gardens, there was a request for assistance relating to a coast redwood (*Sequoia sempervirens*) planted in Sonora, CA. The suspect trees were displaying galls and had curled foliage. These trees were unquestionably off-site, for they were growing at least 80 miles away from the nearest natural stand of coast redwoods. No insect or fungus could be found within or on the galls or curled needles. Although curled needles are often symptomatic of herbicide damage, consultation by county extension with the homeowner's landscaper eliminated the possibility of this being herbicide damage. Further consultation with the CDFA diagnostic lab, revealed that the lab

Fig 54: Giant Sequoia dieback.

Photo: K. Camilli

M261F

M261E

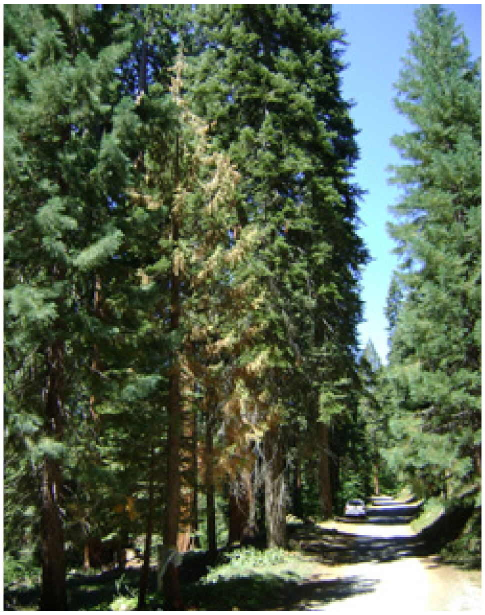


Fig 55: Larva found in giant sequoia.

Photo: K. Camilli

has encountered this kind of symptom several times over the last 20 years and has never been able to determine a causal agent. It is suspected that this damage is induced by a mite, probably one of the eriphoid mites. However, by the time the homeowner finds the damage, the mites have completed their life cycle and moved to a new part of the host (M261F).

Giant Sequoia Mortality
Unknown Cause
Contributions by: Kim Camilli

Two giant sequoia trees (30-40 years of age) died within one month of each other on Mountain Home State Demonstration Forest, (Kings County, M261E). Symptoms included sudden terminal death and rapid foliage discoloration. Wood samples were collected to rear out insects. The samples were also tested for Armillaria and Heterobasidion root diseases; no root disease was detected.

Invasive Plants

By David Bakke

Invasive plants damage ecosystems around the world. They displace native species, change plant community structure, and reduce the value of habitat for wildlife. Invasive plants may disrupt ecosystem processes, such as fire regimes, sedimentation, and erosion, light availability, and nutrient cycling. The impact is especially severe in California, with its rich diversity of natural resources. California is home to 4,200 native plant species, and is recognized internationally as a "biodiversity hotspot". Approximately 1,800 non-native plants also grow in the wild in the state. A small number of these, approximately 200, are recognized by the California Invasive Plant Council as being invasive. Of these 200, there are many that occur in the forested areas of the state. Generally, these species will act to reduce native species biodiversity and affect wildlife habitat. There are several species or groups of species that may be considered especially troublesome in the forested areas of the state; this report focuses on those species.

Current Management Situation

In 2010, there were several organizational changes and project developments intended to improve the management of invasive plants in California and a coordinated 'all-lands' approach. These developments occurred at the statewide level and at regional, watershed, and multi-county levels. The discussion that follows provides a brief description of several of these efforts.

Invasive Species Council of California (ISCC)

The ISCC was established in early 2009, and is a state organization made up of department secretaries from several state agencies plus support staff. The purpose of the ISCC is to coordinate and ensure complementary, cost-efficient, environmentally sound and effective state activities regarding invasive species. Additionally, the ISCC is intended to promote a consistent approach to invasive species at the state level and enhance regional collaboration and inter-state efforts. For more information refer to the ISSC website at http://www.iscc.ca.gov/.

The ISCC established an advisory committee, called the California Invasive Species Advisory Council (CISAC) primarily tasked with making recommendations to develop and prioritize an Invasive Species Action Plan. One important accomplishment in 2010 was the completion of a listing of invasive species that have a reasonable likelihood of entering or have entered California for which a management action by the state might be taken. This list can be found online at http://ice.ucdavis.edu/invasives/ and is designed to be updated as new information is obtained. It includes over 1,700 species of plants, animals, fungi, and other organisms either in the state or at risk of becoming established in the state. The document, *Stopping the Spread: A Strategic Framework for Protecting California from Invasive Species*, was released for public comment on September 23, 2010 (http://www.iscc.ca.gov/cisac-strategic-framework.html). The goal of this framework is to reduce the damage caused by invasive species in California by improving the coordination and effectiveness of the state's response.

The goal of both ISCC and CISAC is to guide efforts to keep invasive species out of the state, find invasions before permanent establishment occurs, and take steps to eradicate incipient populations of undesirable species. Education and cooperation are key components to an effective invasives strategy.

Weed Management Areas

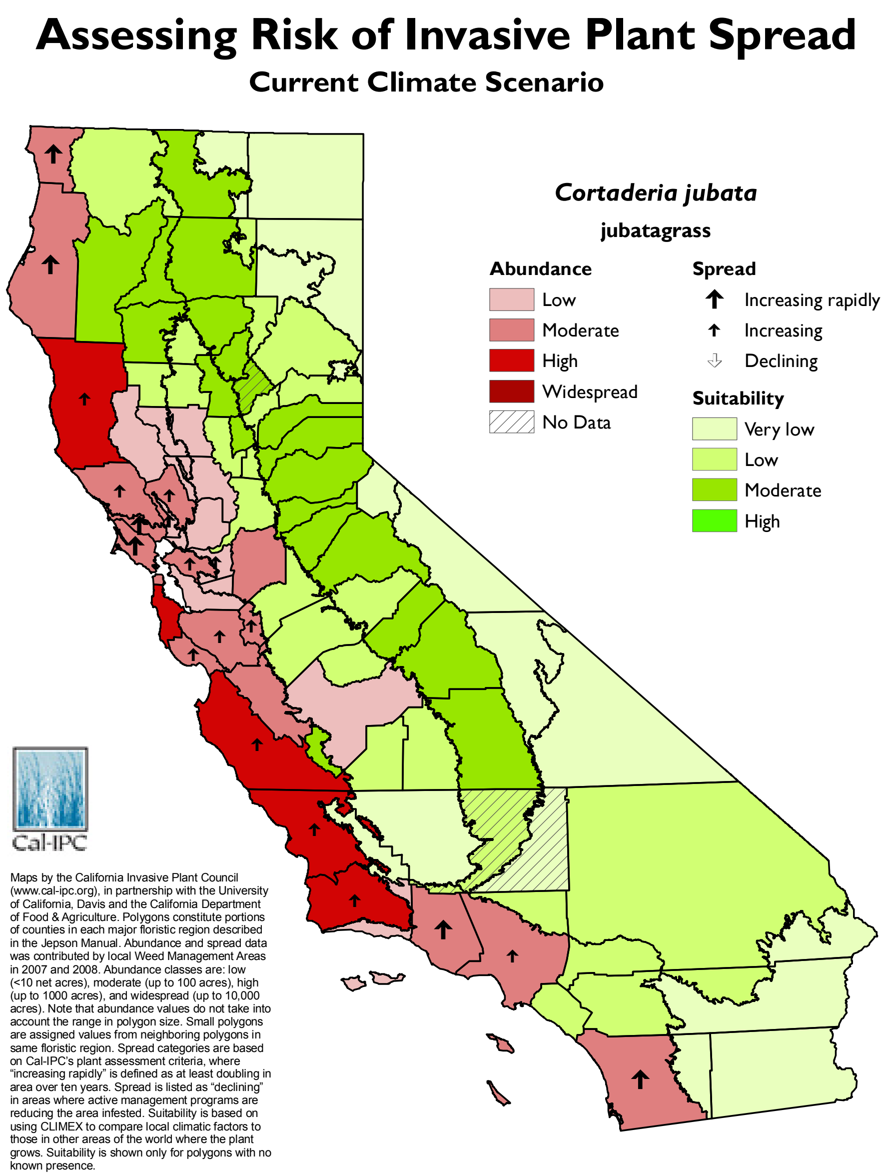
Weed Management Areas (WMAs) are local organizations that bring together landowners and managers (private, non-profit, city, county, State, Federal, and Tribal) in a county or multi-county geographical area to coordinate efforts and expertise against common invasive and noxious weed species. California has WMAs in every part of the state. WMAs are unique because they attempt to address agricultural (regulatory) weeds and “wildland” weeds under one local umbrella of organization. Although WMAs in California have been around for several years, they are maturing and continuing to pull together cooperators to be an effective and important local source of public education as well as coordinating cooperative treatments, mapping, and strategic planning. There was some funding for WMAs in 2010 from the state budget, but for most activities competitive or outside grant funds must be obtained.

State-wide Invasive Plant Mapping

The California Invasive Plant Council (Cal-IPC) has continued work on a statewide mapping and species distribution modeling effort that involves three interrelated projects: communicating and coordinating with local experts to map invasive plants while gathering existing GIS datasets; mapping potentially suitable habitat for these species under anticipated future climate change conditions; and building a statewide database for future users to contribute annual weed data to a centralized site.

Map 5: Assessing the Risk of Invasive Plant Spread, under current climate conditions.

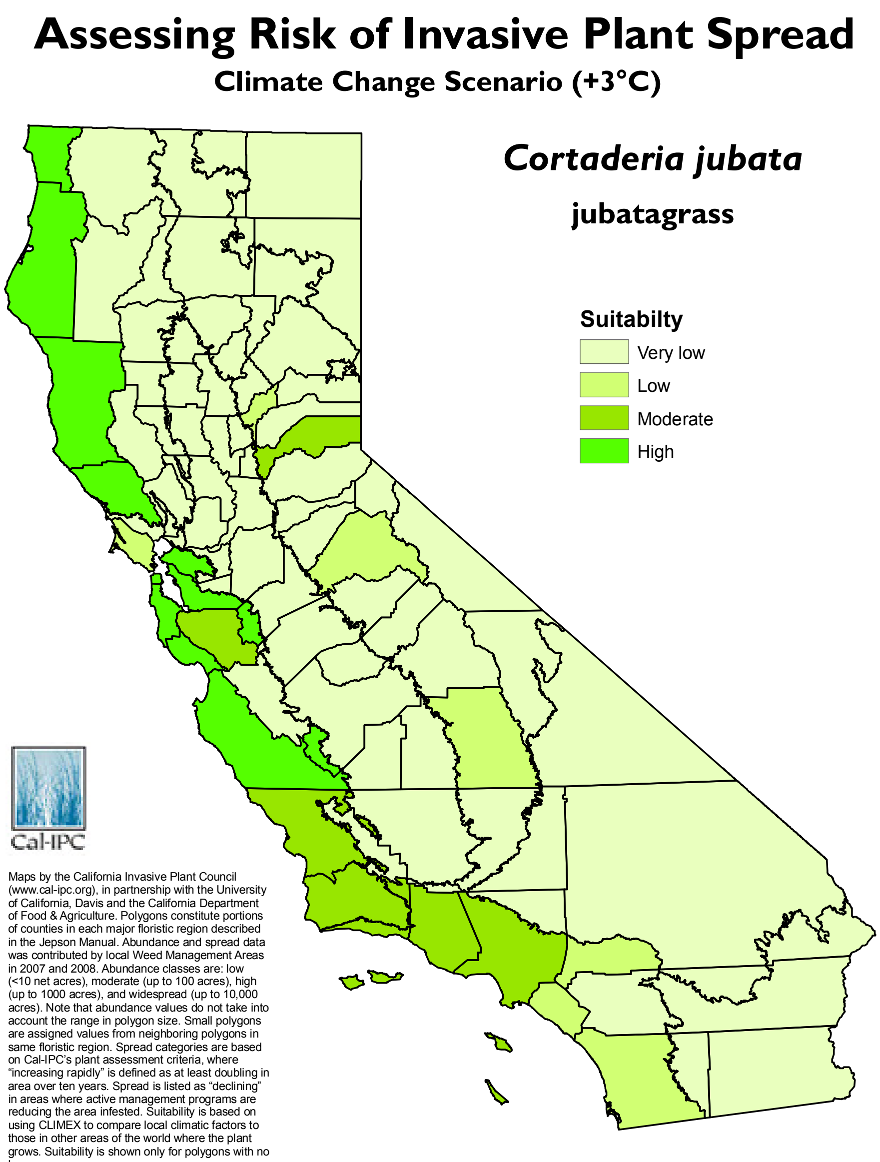
Map: Cal-IPC



The statewide mapping effort is intended to compile weed distribution data for all species on the Cal-IPC Inventory by USGS quadrangle by interviewing local experts. Currently, there are few statewide maps and very little quantitative data for most invasive plants in California. This statewide distribution information will assist local and regional land managers in identifying early detections and prioritizing treatments and will be available to view via an online mapping system.

Cal-IPC is using species distribution models to predict the spread, under existing and predicted future climate scenarios, of a subset of the Cal-IPC Inventory plants found in the Sierras. The ultimate goal of this project is to provide watchlists to the WMAs for early detection. While the specific focus of the current effort is in the Sierras, the models will use statewide data to incorporate a broader set of environmental conditions to calibrate the model (refer to maps 5 and 6).

In the near future, Cal-IPC will build an online system (to be linked with the Calflora online database, http://www.calflora.org/) to encourage land managers to submit their mapped information to one place. It will be shared with other land managers in the state to continue the effort of painting a regional picture of weed distribution. For more information on Cal-



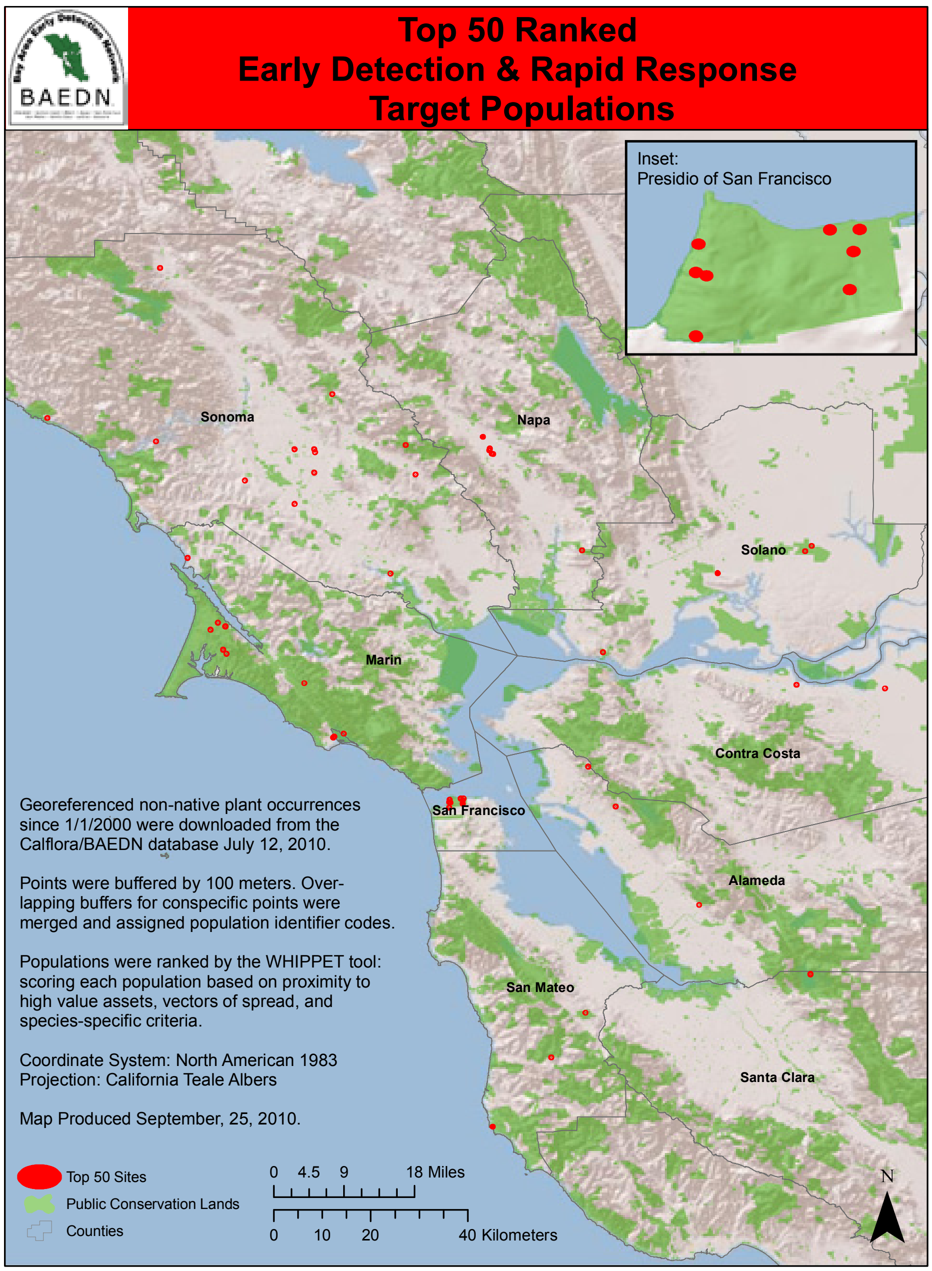
Map 6: Assessing the Risk of Invasive Plant Spread, with a projected temperature increase of 3 degrees C.

Map: Cal-IPC

IPC's efforts, contact Mapping Program Manager Dana Morawitz (dfmorawitz@cal-ipc.org) or Science Program Manager Elizabeth Brusati (edbrusati@cal-ipc.org).

Bay Area Early Detection Network Weed Mapping and Treatment Prioritization
The Bay Area Early Detection Network (BAEDN) was formed in 2006 and brings together partners from the nine counties in contact with the San Francisco Estuary: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Solano, Santa Clara, and Sonoma Counties. The goal of BAEDN partners is to work cooperatively to develop and implement an integrated ecological approach to the early detection of harmful and noxious weeds, and the rapid response to them. For information on BAEDN, go to http://BAEDN.org.

BAEDN has developed and began implementing in 2010 a regionally coordinated system of early detection and rapid response to new invasive plant species within the nine county area, with the goal of regional eradication of these species. In late 2010, BAEDN published an initial list of 73 priority invasive plant species for the San Francisco Bay Area. BAEDN facilitates detection and reporting of these target species through an online Calflora/BAEDN



Map 7: Results of use of WHIPPET model to prioritize populations of invasive plants for eradication activities in the San Francisco Bay Area.

Map: BAEDN

occurrence reporting system. This database allows for single occurrence reporting as well as uploading of existing datasets.

Target species populations identified from Calflora occurrence data were prioritized for eradication using a new tool developed through a partnership between CDFA and the University of California, Davis, led by Gina Skurka Darin: Weed Heuristics: the Invasives Population Prioritization for Eradication Tool (WHIPPET). 215 populations of target species have been prioritized. BAEDN staff is collaborating with partners across the region to ensure eradication treatment of each of these populations. WHIPPET factors both species-level measures of invasiveness and impact, with population-level factors of spread potential, risk to high value assets (i.e. sensitive conservation species, prime grazing lands, and/or parks and conservation lands), and eradication feasibility. BAEDN is the first organization to utilize WHIPPET to prioritize invasive plant occurrences in a landscape.

Yellow Starthistle Leading Edge Project

Yellow starthistle (*Centaurea solstitialis*) is the most widespread invasive plant in California and one of the most ecologically and economically damaging. Although areas of California remain uninfested, yellow starthistle has shown it can invade most bioregions, including the higher elevations of the Sierra Nevada Mountains. It has long been the consensus of invasive plant managers that the coordination of early detection and rapid response strategies are key in preventing the spread of yellow starthistle into the higher elevations of the Sierras.

A coordinated, regional containment project to control yellow starthistle populations along a 'no spread' eastern leading edge line was initiated by the California Department of Food and Agriculture (CDFA) in 2007. This eastern leading edge ranges from Plumas County in the north to Tulare County in the south, roughly along the 4,500 foot contour (see Map 8). This project is one of the first in California to address invasive species in a coordinated manner over a large region of the state. The project consists of mapping and control of yellow starthistle at the eastern edge, detection and eradication of outlier populations east of the line, a centralized database, and public education about the effort.

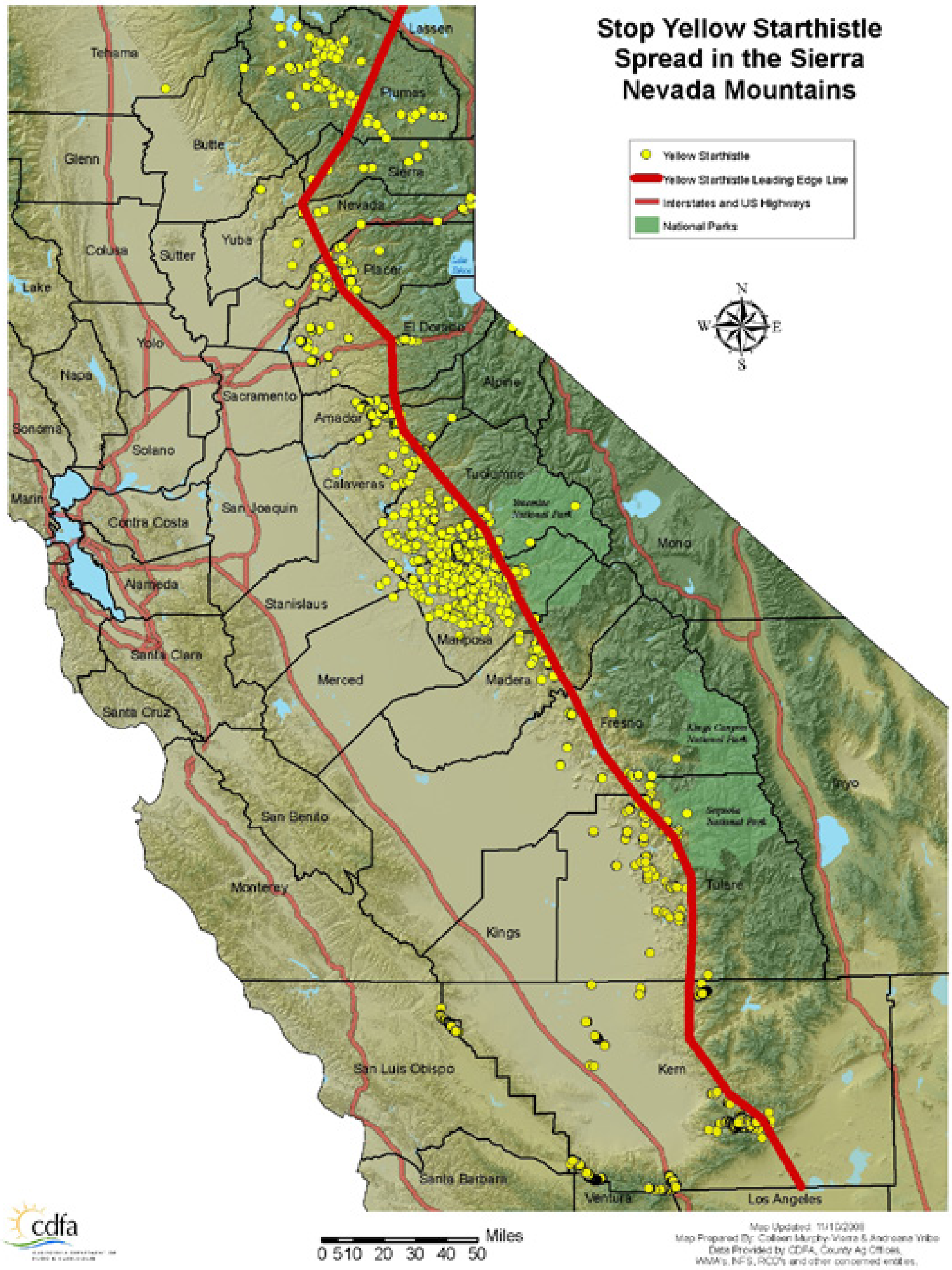
In 2010, there were Leading Edge projects in Mariposa, Calaveras, Madera, Placer, Fresno, Tulare, Tuolumne, Amador, El Dorado, Nevada, and Placer Counties, including lands within the National Forests and within Yosemite and Sequoia/Kings Canyon National Parks. These projects are collaborative between numerous agencies, including the counties, National Forests, National Parks, CalTrans, the WMAs, and others.

Smart Phone Observation Reporting Applications and Citizen Monitoring

In 2009, the National Park Service and the UCLA Center for Embedded Network Sensing partnered to design a smartphone application for the purpose of identifying the locations of invasive plants in the Santa Monica Mountains National Recreation Area. Since then, additional National Parks and National Recreation Areas have been added to the application. The *What's Invasive!* application can be downloaded onto certain brands of mobile phones. When users see an invasive plant while out on a hike or bike ride, they can take a photo from their phone and make notes about the occurrence. That location is then automatically uploaded to the *What's Invasive!* website, allowing park staff and the public to see maps of invasive plants and how they are spreading in the mountains. For information on the *What's Invasive!* application refer to the website http://whatsinvasive.com/index.php/about.

Combating invasive plants requires a significant investment of resources. The Santa Monica Mountains National Recreation Area spent $200,000 over a three year period to map invasive plants in the mountains. Assistance from citizen scientists to keep this map up to date will better equip park staff and volunteers to remove invasive plants.

Working in conjunction with Calflora, BAEDN is also developing a Smart Phone application for quickly and efficiently reporting plant occurrences. The system will automatically upload species lists, reporter name, date and time, location, and other data. The phone application



Map 8: Yellow Starthistle Leading Edge Containment Line

Map: CDFA

is currently in beta testing, and is part of an integrated plant mapping and management planning platform that would replace GPS hardware/software now used in the field. By streamlining data collection and management, this system will make it possible for all field personnel to quickly, accurately, and efficiently collect and manage native and invasive plant occurrence data.

Because of the scope of the invasive weed problem and the expense of conducting surveys, enlisting the interested public to assist in this effort is seen as key. These smart phone applications can be used by both the experienced weed surveyor as well as the lay public. In 2009, the San Francisco Bay Area National Parks developed a volunteer-based approach to assist park managers with the early detection of invasive plants (http://science.nature.nps.gov/im/units/sfan/vital_signs/Invasives/weed_watchers.cfm). This volunteer program is ongoing, with 3 years of data collected from the Golden Gate National Recreation Area, and 2 years of data from Pt. Reyes National Seashore. The volunteers are trained in the identification of 10 priority species of invasive plants, and are provided plant ID cards, plant information, and maps. Over 500 volunteer hours were donated in 2010. Either with some basic training in surveying or simply through personal interest, the public must be considered a valuable partner in locating invasive plants.

Invasive Plants Conditions

The species listed below are not an exhaustive list of all of the species impacting forested lands. Reports were received from many sources, including state-level organizations, the Weed Management Areas, counties, and State, Tribal, and Federal agencies. These species accounts involve invasive plants with impacts, or risks of impacts, on forested lands of the state.

Each species is listed by its common name, then by its scientific name. If the species is considered noxious by the state of California, the California Department of Food and Agriculture (CDFA) rating is provided. The CDFA noxious rating is followed by the Cal-IPC rating. Sources of common names, scientific names, and species descriptions are in part from DiTomaso and Healy (2007).

Included below is a brief description of the CDFA Noxious weed ratings in this report: (For more complete descriptions on ratings go to http://www.cdfa.ca.gov/phpps/ipc/encycloweedia/winfo_weedratings.htm):

A – Rated - Known to be economically or environmentally damaging and is either not known to be established in California or it is present in a limited distribution that allows for the possibility of eradication or successful containment. A-rated pests are prohibited from entering the state. If found in the state, A-rated weeds are subject to state or county enforced action involving eradication or containment.

B – Rated - Known to be economically or environmentally damaging and of limited distribution. B-rated pests are eligible to enter the state if the receiving county has agreed to accept them. If found in the state, they are subject to state endorsed holding action and eradication only to provide for containment, as when found in a nursery. At the discretion of the individual county agricultural commissioner they are subject to management.

C – Rated - Known to be economically or environmentally damaging and, if present in California, it is usually widespread. C-rated organisms are eligible to enter the state as long as the commodities with which they are associated conform to pest cleanliness standards when found in nursery stock shipments. If found in the state, they are subject to regulations designed to retard spread or to suppress at the discretion of the individual county agricultural commissioner. There is no state enforced action other than providing for pest cleanliness.

A brief description of the Cal-IPC ratings is included below (For more complete descriptions go to http://www.cal-ipc.org/ip/inventory/index.php#categories):

High – These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

Moderate – These species have substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance.

Limited – These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. These species may be locally persistent and problematic.

In addition to these ratings, if a species evaluation indicated a significant potential for invading new ecosystems, an Alert designation is used so that land managers may watch for range expansions.

Yellow Starthistle
Centaurea solstitialis
CDFA – C; Cal-IPC - High

Overview: Yellow starthistle (YST) is probably the most common and well known noxious weed in California. YST was introduced to California from its native Southern Europe in the 1850's and now infests approximately 20 million acres in the State. Most forested landscapes see YST encroachment on roads first, then openings, and certainly in areas that have burned recently. YST can invade most bioregions. It can grow into dense stands, crowding out native vegetation, providing physical barriers to recreation and access, reducing forage and land values, and depleting soil moisture. Although YST is too extensive in California to be eradicated, within many of the forested areas of the state, localized eradication or containment is a goal. The goal in the Sierras is to establish a containment line for it in the foothills. It is hoped that by controlling YST at the eastern leading edge, millions of acres of forested lands in the mid and upper elevations of the Sierras can be protected (see Leading Edge Project, p XX).

Fig 56: Yellow starthistle has moved into the higher elevations within the Stanislaus NF. Photo taken along Highway 120.

Photo: W. West, UCCE

Fig 57: Treatment of yellow starthistle continues near the entrance to Yosemite NP. This photo shows rapelling gear used in treating YST on steep slopes.

Photo: W. West, UCCE

Many counties in the Sierra foothills conduct cooperative YST control projects with private landowners through some type of cost share activity. In most cases, the herbicide is provided by the county while the control work is paid by the landowner. In 2010, such programs resulted in several hundreds of acres treated.

Status:
- Calaveras County – YST appears to have spread considerably around West Point in 2010.
- Tuolumne County – In cooperation with the Hwy 108 Fire Safe Council and a local homeowner's association, the county treated 10 acres within a fuelbreak near the homeowner's association.
- San Bernardino National Forest – Along with the Inland Empire RCD, has been working on eradicating YST in the Yucaipa Ridge/Oak Glen area and surrounding private lands. This work is considered high priority because of the low amounts of YST on the Forest presently.
- Lake Tahoe Basin - Small, isolated populations of YST throughout the Basin are treated by manual methods; such as hand pulling, clipping, and digging. The Lake Tahoe Basin Weed Coordinating Group has a goal of YST eradication.
- Santa Barbara County and the Los Padres

National Forest - YST is moderately controlled by an introduced rust biocontrol, which, anecdotally and counter to logic, appears to be more effective on hot hillsides. One infestation within Happy Canyon has been treated since 2006 and is about 90% eradicated. YST control has concentrated on spot infestations within the 2007 Zaca Fire area.

- Tahoe National Forest – Oregon Creek Day Use Area - Handpulled over 1,000 plants from about 2 acres, then seeded the area with native grass and lightly mulched with native grass straw.
- Yosemite National Park – spray treatments and handpulling of YST near El Portal and Foresta.

Knapweeds (spotted, diffuse, meadow, squarrose)
Centaurea biebersteinii (spotted)
CDFA – A; Cal-IPC - High
C. diffusa (diffuse)
CDFA – A; Cal-IPC - Moderate
C. debeauxii ssp. *thuillierii* (meadow)
CDFA - A; Cal-IPC - Moderate
C. virgata Lam. Var. *squarrose* (squarrose)
CDFA – A; Cal-IPC - Moderate

Overview: Bushy annuals to perennials with deep taproots, these are highly competitive plants that can form dense stands excluding native vegetation and wildlife. The genus *Centaurea* has over 500 species worldwide, none of which are native to California.

Spotted knapweed is a biennial or perennial and is extremely invasive wherever it occurs. Flowers are white, pink, or purple, and the flower bracts (phyllaries) are spineless. Seed viability of this species is between eight and fifteen years. Spotted knapweed can also reproduce vegetatively from lateral roots below the soil surface. A native of Europe, it has been found in all the areas of the state except for the deserts.

Fig 58: Squarrose knapweed in eastern Shasta County.

Photo: D. Bakke

Native to southeastern Eurasia, diffuse knapweed is typically a biennial plant that forms dense infestations. Flowers are white, pink, or purple and the phyllaries are spine-tipped. It is found throughout the state except the desert areas.

Native to Europe, meadow knapweed is a less common perennial plant similar to spotted knapweed. Flowers are pink to purple and the phyllaries are not spiny. Found primarily in the northern part of California.

Fig 59: Eradication is the objective of this longstanding treatment area on USFS and SPI, Silver Creek, El Dorado County.

Photo: D. Bakke

Native to Asia, squarrose knapweed is a perennial and is concentrated in the north part of the State. Most populations in forested areas are still small and easily controllable provided annual visits continue. The flowers are pink to pale purple and the phyllaries are spine-tipped.

Status: Work on knapweeds in California is geared towards eradication of local populations.

- El Dorado Noxious WMA, Sierra Pacific Industries, and the Eldorado National Forest, Pacific RD – along Silver Creek is an ongoing spotted knapweed eradication project; only known population of spotted knapweed in western El Dorado County. Established after the 1992 Cleveland Fire which demonstrates the need for continuous and long-term efforts.
- Kern County - Spotted knapweed infests mainly private property in the communities of Pine Mountain Club, Cuddy Valley, and Frazier Park in southern Kern County. This is of great importance to the Forest Service because these communities are either bordered by or completely surrounded by USFS property. These infestations are currently being surveyed and controlled chemically or manually depending on the property owners wishes. A few plants have also been removed along county road easements as they pass through the Los Padres National Forest.
- Humboldt WMA - has been working for several years to eradicate meadow knapweed from the county, near Weitchpec. New infestation area discovered last year; treated in 2010.
- Siskiyou County WMA and Klamath National Forest – Hawkinsville squarrose knapweed eradication project has been ongoing for several years; also ongoing eradication projects for spotted, meadow, and diffuse knapweeds.
- Lake Tahoe Basin Weed Coordinating Group - Small, isolated populations of spotted and diffuse knapweed throughout the Basin are treated by chemical and manual methods. This group has a goal of eradication.

Fig 60: Gary Donschikowski, Calaveras County Ag Dept, pulling spotted knapweed in Calaveras County, near Darby Russel burn area; treated for the last three years.

Photo: K. Wright, Calaveras County

- Calaveras County – 3.7 acre site in Cottage Springs off Highway 4 on BLM lands and on Winton Road on SPI land. Ongoing control efforts continue near Darby Russell Road. This area has been sprayed over the last three years and is considered under control.
- Tahoe NF, Yuba River RD – Spotted knapweed populations have been treated on Deadman Ridge (sprayed), along the Foresthill Divide Road (handpulled), Blue Canyon Exit, Hwy 80 (handpulled),and along the Cal Ida 25 Road (handpulled). Diffuse knapweed has been handpulled along Road 524.
- San Diego County, Mt. Palomar – A ten acre patch of spotted knapweed has been under management for about 15 years with the goal of eradication. There continues to be a decline in plant numbers in the area.

Saltcedar, Tamarisk
Tamarix ramosissima, Tamarix spp.
CDFA – B; Cal-IPC - High

Overview: Saltcedar is an aggressive invader of riparian areas in arid regions throughout the western United States. Tamarisk replaces native riparian species and can degrade habitat for local wildlife, increase wildfire danger, and decrease stream flows. Its name derives from its ability to extract salts from the soil through the roots and excrete salt from the leaves, increasing surface soil salinity, which in turn inhibits native plant establishment and growth. Flowers are white to pink.

Because of saltcedar's effectiveness in replacing native riparian trees, it has become the habitat of necessity for certain wildlife species. In July of 2010, USDA APHIS issued a policy letter to the states prohibiting the further interstate movement of all species of the saltcedar leaf beetle (*Diorhabda* spp.), an effective biological control for tamarisk, because of continuing concerns of impacts to the endangered southwestern willow flycatcher through loss of saltcedar riparian habitat. Any unauthorized movement of this biocontrol could be considered a violation of the Federal Endangered Species Act.

Status:

- Inyo/Mono Co WMA – 80 acres surveyed and mapped within the 2007 Inyo Complex Fire Project, along South Fork Oak Creek. This occurrence of saltcedar was not expected and was discovered after the fire.
- Inyo National Forest – In 2008, the Inyo approved a forest-wide invasive plant treatment plan. As part of that plan, the Forest has been treating tamarisk.
- San Bernardino NF – Planning completed in 2010 for Palm Canyon project in the San Jacinto Mountain Range, partly within designated wilderness. Work is scheduled to begin in 2011. This is a cooperative project with Low Desert WMA, Agua Caliente Band of Cahuilla Indians, and the Santa Rosa and San Jacinto Mountains National Monument.
- Cleveland NF - The Descanso Ranger District is undertaking a project to restore native riparian habitat on Cottonwood and La Posta Creeks along Buckman Springs Road in a cottonwood/willow riparian forest. The project will improve habitat for wildlife (including federally endangered Arroyo toad, Least Bell's vireo, and Southwestern Willow flycatcher), reduce the threat of wildfire and improve water quality downstream from the project site. Work began in 2009 with stem removals, then herbicide follow-up to prevent resprouting. Planting of native species is the final step. San Diego County did treatments downstream in 2006-07.

Fig 61: Workers remove dense tamarisk infestation, Cottonwood Creek area, Descanso RD, Cleveland NF.

Photo: L. Criley, Cleveland NF

- Santa Barabara County/LPNF - Tamarisk is found throughout the Santa Ynez Watershed. Efforts have focused on infestations located near known populations of California red-legged frog and arroyo toad. Treatments have occurred for over 15 years. The worst infestation is located around Gibraltar Reservoir, mostly on Santa Barbara City property. On the Los Padres National Forest, 5 acres were treated, including along the Santa Ynez River from the Forest border upstream to Gibraltar Reservoir, Santa Ynez River from Blue Canyon to Middle Santa Ynez Campground, and Aqua Caliente Creek.

Fig 62: Saltcedar patch along Santa Ynez River, Santa Barbara County.

Photo: D. Chang, Santa Barbara County

- Northern San Joaquin Valley WMA – working on 800 acres in the San Joaquin River National Wildlife Refuge.
- Shasta Co Ag (ARRA) – ongoing eradication projects along the North Fork of Cottonwood Creek.

Dalmatian toadflax
Linaria dalmatica subsp. dalmatica
CDFA – A; Cal-IPC - Moderate

Overview: This perennial plant arrived from the Mediterranean area of Europe in the late

Fig 63: Dalmatian toadflax in Lake Tahoe Basin.

Photo: D. Bakke

1800's as an ornamental because of its showy snapdragon-like yellow flowers. The wide-ranging, deep root system generates new shoots, and root fragments develop into new plants. It is found throughout California. Seed production is prolific and seeds remain viable for 10 years.

Status:

- Tahoe National Forest, Yuba River Ranger Disrict –a site near Henness Pass that has been treated for several years was declared eradicated in 2010.
- Kern County Dept of Agriculture, Kern WMA, and the Los Padres National Forest - Dalmatian toadflax infests Los Padres National Forest, Hungry Valley State Vehicle Recreation Area, and private properties in the Frazier Park area near the Kern, Los Angeles, and Ventura county borders. Survey and manual or chemical treatments continue. A small infestation in the Zaca Fire is nearly eradicated.
- Lake Tahoe Basin - Small, isolated populations of yellow and Dalmatian toadflax in the Basin are treated by manual methods: hand pulling, clipping, and digging. The Lake Tahoe Basin Weed Coordinating Group has the goal of eradication of these infestations.
- Klamath National Forest and Siskiyou County Dept of Agriculture – Dalmatian toadflax is considered a high priority weed in the county, with 30 acres infested on the Forest. The Klamath National Forest and the Siskiyou County Department of Agriculture have collected seeds to aid in testing bio-control agents for Dalmatian toadflax in its country of origin where the seeds will be grown.
- There are ongoing localized eradication programs in Modoc, Lassen, Humboldt, Calaveras, Del Norte, Plumas, Sierra, Shasta, and Nevada Counties.

Scotch thistle
Onopordum acanthium ssp. *acanthium*
CDFA – A; Cal-IPC - High

Overview: Native to Europe, this biennial species was once used in Scotland as a barrier around castles. Scotch thistle has spiny leaves, conspicuously spiny-winged stems ,and spiny flower heads with white or purple flowers. It is most easily controlled in the early rosette stage, as once this plant reaches mature size (1.5 – 3 m tall) it can grow into nearly impenetrable thickets. Typically grows in disturbed areas, often with high soil moisture, and can be found throughout the state. It reproduces via seed, which can remain viable in the soil for several decades.

Status:

- There is on-going eradication work on localized populations in Nevada, Siskiyou, Calaveras, Lassen (Big Valley area), Plumas, Sierra, and eastern Shasta Counties, and Klamath National Forest.
- Fall River RCD – Has been working on eradicating Scotch thistle for several years in the Fall River Valley using a combination of digging and herbicide (aminopyralid).
- Kern County Agriculture Dept, Kern WMA, and Los Padres National Forest - Scotch thistle infests a ranch bordered by the Los Padres National Forest near Lake of the Woods. This infestation is currently being surveyed and revealed plants are manually removed. To date, this work has prevented spread into the National Forest.

Musk Thistle
Carduus nutans
CDFA – A rated; Cal-IPC - Moderate

Overview: Native to Europe, this biennial species was introduced in the early part of the twentieth century and is now relatively widespread in the United States, although in California, its current distribution is largely limited to the Klamath Range, Cascade Mountains, Modoc Plateau, and the Northern Sierras. The stems have prickly wings and the leaves are prickly. Flowers are purple to pink, borne on solitary stems that are often bent over, leading to another common name of nodding thistle. Seeds are normally not long-lived in the soil.

Status:

Fig 64: Musk thistle growing along Truckee River, Nevada County.

Photo: E. King, Nevada County

Fig 65: Musk Thistle in Sierra Valley, Plumas County, treated summer 2010.

Photo: D. Bakke

- Nevada County, Nevada/Placer WMA, and the Tahoe National Forest - Musk thistle was first introduced into Nevada County in the late 1970's either during fire suppression activities or reseeding work in the Boca Hill Area of the Tahoe National Forest. In the years following, musk thistle invaded state and private lands in the Truckee River Watershed. Since the mid-1980's the Nevada County Department of Agriculture has been working to eradicate all musk thistle populations found on state and private lands. The infestation now covers 35,000 acres (gross) and is spreading down the Truckee River into the state of Nevada, colonizing areas in Sierra County to the north, and threatening the Lake Tahoe Basin to the south. The current net infestation of 26 acres within Nevada County is at a critical juncture. The size and locations of these populations are at a stage where eradication remains a viable option. In 2009, an effort was undertaken to manage this species using a watershed-based approach, with the eventual objective of eradication. This brings together many partners, including Nevada County Department of Agriculture, California Department of Fish and Game, California Department of Food and Agriculture, California Conservation Corps, Placer County Department of Agriculture, Tahoe National Forest, and many private landowners. The effort is complex, involving many landowners both large and small, many different agencies, tribal governments, several counties, and two states. In 2010, agreements were developed between Nevada County and the Union Pacific Railroad (for access), Nevada Energy (for permission to treat), and private landowners and consultants for access to private lands.
- Siskiyou Co WMA – The WMA is continuing a containment and leading edge strategy; Black Butte area near I-5, protecting Mt. Shasta Wilderness Area, also protecting downstream Shasta and Sacramento Rivers. Leading edge is east of Weed.
- There is on-going eradication work on localized populations in Lassen, Modoc, Plumas, and Shasta Counties.

Thistles (Bull, Canada, Italian, Plumeless, Wooly Distaff)
Cirsium vulgare (Bull)
CDFA – C; Cal-IPC - Moderate
Cirsium arvense (Canada)
CDFA – B; Cal-IPC - Moderate
Carduus pycnocephalus (Italian)
CDFA – C; Cal-IPC - Moderate
Carduus acanthoides (Plumeless)
CDFA – A; Cal-IPC - Limited
Carthamus lanatus (Wooly distaff)
CDFA- B; Cal-IPC – Moderate (w/ Alert)

Overview: The most common of these invasive thistles found in forestland in California is the bull thistle. This biennial species reproduces from seed and is often found in recently disturbed areas, such as harvest units, burned areas, and roadsides, can be a direct competitor with conifer seedlings, and can be found throughout California. Canada thistle, a perennial, forms dense clumps with an extensive root system. It can reproduce vegetatively from the extensive root system as well as from seed. It is also found throughout California. Italian thistle is an annual with stems that have prickly wings and prickly leaves and is found throughout northern and central California. Plumeless thistle is a biennial that is closely related to both Italian and musk thistle and is found primarily within Northern California. Wooly distaff thistle is an annual species with spiny leaves and yellow flowers.

Fig 66: Bull thistle in ponderosa pine plantation.

Photo: D. Bakke

Generally thistles are more commonly found in pastures and meadows, in riparian habitats, and in disturbed sites (along roads, powerlines, etc). Thistles reduce recreational access, grazing value, and wildlife habitat. If dense enough, once they dry out at the end of the summer they can rapidly increase rates of fire spread, carrying fire into and through forested areas, especially plantations.

Status:
<u>Bull thistle</u>
Because of its widespread distribution, there is little management focused on bull thistle in California forests. However, in sensitive habitats, there is on-going control activity:

- Tulare County WMA – bull thistle is found in higher elevation areas throughout Sequoia/ Kings Canyon National Parks. Bull thistle is found in association with fire and is likely increasing in abundance within the parks.
- Lake Tahoe Basin - The majority of weed sites contain bull thistle; it is found in a variety of habitats ranging from meadows to dry slopes. Small infestations of bull thistle have been contained and reduced in size by clipping and hand digging or pulling.

<u>Canada thistle</u>

- Lake Tahoe Basin - Small, isolated populations of Canada and Russian thistle throughout the Basin are being treated, with the goal of eradication.
- Mendocino National Forest and Glenn County Agriculture - One Canada thistle location was discovered in the Mendocino NF in Glenn County during a survey nine years ago. This site is very close to eradication and produces only a few plants each year.
- Klamath NF – moderate priority weed – 15 acres infested.
- Modoc National Forest – In 2008, the Modoc approved a forest-wide invasive plant

treatment plan. As part of that plan, Canada thistle eradication work has been occurring near Reservoir F, Fairchild swamp, and at a site south of the Highgrade Recreation Trail.
- Ongoing eradication work is occurring on small populations in Del Norte, Inyo, Mono, and Nevada Counties.

Italian thistle
- Siskiyou County and Siskiyou County WMA – For several years the Salmon River Restoration Council has surveyed and treated by hand a 25 acre area in Forks of Salmon on private land. There has been a significant reduction in the numbers of plants. Public education efforts have included a local Italian Thistle Day (May 1) and the development and use of a weed awareness poster.
- There are ongoing eradication efforts in Yosemite National Park (near El Portal), the Klamath National Forest, and elsewhere in Siskiyou County.

Plumeless thistle
- Calaveras County WMA – Work has been ongoing for several years near Sheep Ranch to eradicate this species.
- Mendocino National Forest and Glenn County – Seven plumeless thistle locations have been worked on and monitored for many years. Only two of these sites have produced one or more plants in the past three years.
- Modoc County – there is a program of ongoing eradication work of localized populations.

Fig 67: Removing plumeless thistle (Carduus acanthoides) in Glenn County, Ed Finley in picture.

Photo: G. Hinton, Glenn County

Wooly distaff thistle
- Los Padres National Forest – There is a small population (1 acre) treated on the San Luis RD, off Old Sierra Madre Road that has had two treatments and seen a 50% reduction in the number of plants, but will need treatments for several more years to be eradicated.
- Yolo County – Work has been ongoing to eradicate a 400 acre infestation, which is nearing completion - no plants were found in 2009.
- Calaveras County – Work is ongoing to eradicate this thistle.

Perennial pepperweed, tall whitetop
Lepidium latifolium
CDFA – B; Cal-IPC - High

Overview: Perennial pepperweed, a native of Eurasia, has small white flowers and an extensive, creeping root system. It can reproduce vegetatively from the root system, and physical disturbance of the root systems can lead to further spread as new plants grow from root fragments. Highly competitive, it often forms dense colonies that displace native vegetation and wildlife. It is typically found in moist or seasonally wet sites, including wetlands, riparian areas, meadows, roadsides, and irrigation ditches. It is found throughout California.

Status:
- Plumas National Forest – An integrated eradication plan for an 800 acre area along the Middle Fork of the Feather River near Beckwourth was approved in 2010. Goat grazing was used in 2010 to reduce above ground biomass, which would be followed by herbicide treatments.
- Kern County – along the South Fork Kern River Wildlife Area, in eastern Kern County, adjacent to the Sequoia National Forestm, is an ongoing effort to eradicate perennial pepperweed. An MOU has been in place between the California Department of Fish and Game and the Audubon Kern River Preserve.
- Inyo National Forest – Within the Golden Trout and South Sierra Wildernesses there is

one small infestation near a popular hiking trail. The goal is to eradicate this population and continue to monitor these trails for any spread. An initial herbicide treatment occurred in 2010.
- Lake Tahoe Basin - Small, isolated populations of tall whitetop within the Basin are treated by manual and chemical methods with the goal of eradication.
- Yosemite National Park – A small population located in Foresta has been eradicated but monitoring continues.
- There are ongoing eradication efforts in Nevada, Calaveras (Cottage Springs/Dorrington area), Lassen (Big Valley), Mono (Long Valley, near Owens River), Shasta (Fall River area), and San Diego Counties, and Klamath National Forest.

Leafy spurge
Euphorbia esula
CDFA – A; Cal-IPC – High (Alert)

Overview: This perennial plant has a deep (up to 9 m) and creeping root system and establishes large clonal colonies. It is an erect plant with milky white sap that can be toxic to humans and some livestock if ingested. Although fairly common in some western states, in California, the distribution is limited to a large infestation in north central California and a few smaller populations in other northern California counties. Eradication is considered a high priority.

Fig 68: Leafy spurge growing along Scott River, Klamath NF, Siskiyou County.

Photo: D. Bakke

Status:
- Siskiyou County - Leafy spurge has been known to exist in Scott Valley of Siskiyou County for many years. The main infestations occurred in irrigated pastureland in Quartz Valley and within the riparian zone of the Scott River. In 2000, a cooperative survey revealed that leafy spurge sporadically infests over sixty miles of the Scott and Klamath rivers (in approximately 350 occurences) in Siskiyou County. Flood events since 2000 have dramatically increased the spread of leafy spurge. The harsh terrain and dense vegetation of both rivers make survey and treatment difficult. Two collaborative meetings were held in 2008, resulting in the support of many watershed stakeholders interested in controlling the spread. As a result, many stakeholders have become aware of the environmental hazards of a growing leafy spurge infestation and are cooperative in survey and treatment efforts. This collaborative effort is leading to the development of a leafy spurge watershed management plan.
- Eradication work continues on several other small infestations of leafy spurge in Del Norte, Lassen (near Susanville), and Modoc Counties.

Red sesbania
Sesbania punicea
CDFA – B; Cal-IPC – High (Alert)

Overview: Red sesbania is a South American deciduous shrub or small tree with compound leaves and red, pea-like flowers. Foliage, flowers, and seeds contain compounds that can be toxic to humans and animals when ingested. Seeds are borne in pods that are brown when mature; seed dispersal is mostly via flowing water. Red sesbania is an invasive weed of California riparian forests. In general, cottonwood, valley oak, and California sycamore are the dominant canopy species. It occupies both low floodplains and high terraces in willow and cottonwood dominated riparian forests. During flood years, red sesbania can be distributed into the surrounding grasslands and oak woodlands. An effort to map red sesbania statewide and to develop a statewide strategic plan began this year. In the coming years, priority populations will be targeted for treatment using the WHIPPET tool described previously.

Fig 69: Red Sesbania after foliar treatment, along Feather River, near Oroville, Butte County.

Photo: D. Bakke

Status:

- Butte County RCD – Survey, mapping, and treatment of the uppermost population of red sesbania along the Feather River, near Oroville, in cottonwood/oak riparian forest.
- Solano county WMA – Eradication work in cooperation with NRCS, Dixon RCD, and others near Ryer Island and Rio Vista in Cottonwood/willow/oak riparian forest.
- Placer County RCD – Eradication work along Dry Creek near Hansen Ranch. Near the headwaters of Dry Creek (Granite Bay area) there has been overbank distribution affecting grasslands and oak woodland due to localized flooding.

Tree-of-heaven
Ailanthus altissima
CDFA – C; Cal-IPC – Moderate

Overview: This is a fast growing deciduous tree with large compound leaves and a creeping root system (up to 15 m in all directions) that suckers freely. The leaves have an unpleasant skunky odor, especially when crushed. Clonal thickets are common, and can crowd out native vegetation and wildlife. Native to China, tree-of-heaven was introduced as an ornamental as well as a medicinal plant by Chinese immigrants during the Gold Rush. Flowers are greenish yellow to white. It is scattered throughout California except for deserts, Great basin, and areas east of the Sierras. This species has been rapidly expanding in recent years in oak woodlands and mixed pine/oak forests in the foothills of the Sierra Nevada Mountains.

Status:

- San Bernardino National Forest – A cooperative program of eradication in the Applewhite Campground and Picnic Areas along Lytle Creek continues. Cooperators include the Inland Empire RCD and Americorps. Four acres were treated this year in the Applewhite area and along Lytle Creek.
- Yolo/Solano RCD – A CCC crew worked with Yolo/Solano RCD to remove trees along Putah Creek in both counties. Trees were either previously treated with herbicides, with CCC removing the dead trees from recreation areas, or cut and treated using herbicides on the cut stump.
- Yosemite NP - Tree-of-heaven's known distribution in Yosemite NP is confined to El Portal and Yosemite Valley. Many plants are located near homes in El Portal; public outreach materials and activities are being developed to reach these residents.

Fig 70: James Law, Inland Empire RCD, treats tree-of-heaven in Applewhite Picnic Area, San Bernardino NF.

Photo: D. Nelson, San Bernardino NF

Brooms (Spanish broom, Scotch broom, French broom)
Spartium junceum (Spanish)
CDFA – C; Cal-IPC – High
Cytisus scoparius (Scotch)
CDFA – C; Cal-IPC - High
Genista monspessulana (French)
CDFA – C; Cal-IPC - High

Overview: These species were introduced into California for erosion control. Although there are other species of broom in California, these are the three most common. These woody brush species can be found throughout the state, in low to mid-elevation woodlands and forests. As nitrogen fixers, these species affect soil chemistry and can therefore encourage the establishment of other invasive plant species. They also crowd out native vegetation, often developing into dense monospecific stands. They provide strong competition to seedling conifer tree species, and represent lower forage values as compared to native vegetation. Brooms burn readily, can carry fire into the tree canopy, and so represent an increased risk of crown fire. They resprout after fire, and often there is a seedling flush as well, indicating they are well-adapted to fire disturbance. Brooms have a very long-lived soil seedbank, requiring a long-term effort for eradication.

Status:
Spanish Broom

- Butte County – CCC crew worked on clearing Spanish broom from the headwaters of the Chico watershed, 3 acres, 10-12' tall, approx 1,000 plants, using a weed wrench. This location is a seed source for downstream infestations.
- San Bernardino National Forest – a project to remove Spanish broom along State Hwy 18 resulted in over 69,000 pounds of biomass being removed on 23 acres along 5.2 miles. Cooperative project involving USFS, CalTrans, CalFire, the Mountain Area Safety Taskforce (MAST), and the Inland Empire RCD. Caltrans and the Forest Service have been manually removing broom for many years by mowing and cutting, resulting in an increase in plant biomass and seed numbers over time. In 2009, the San Bernardino National Forest completed the environmental analysis to control Spanish broom along the road prism of these highways using chemical and manual methods. Treatment areas will be monitored in 2011 for regrowth or seedling establishment. The Inland Empire RCD is working with the Santa Ana Orange County Weed Management Area to map broom along another highway and compiled a list of 155 landowners to contact for potential future removal along several other highways.

Fig 71: Rapelling for broom control near Hwy 18/138 interchange, San Bernardino NF, September 2010.

Photo: D. Kopp, San Bernardino NF

- Los Padres National Forest and Santa Barbara County – There are infestations of broom in the Santa Ynez River area, around recreational residences near the river, on the Fremont fuel break and along East Camino Cielo. In 2010, the Los Padres NF treated 15 acres within these areas. There are large patches of Spanish broom and French broom along Highway 154 that have not been treated due to the size, the lack of adequate tools, and personnel.
- Angeles National Forest – Spanish broom was widespread within the 2009 Station Fire area before the fire; stands are now vigorously resprouting. The fear is that seed will spread away from currently infested roadsides. A management plan is being

developed.

- There is ongoing eradication work against Spanish broom in the Tahoe National Forest, the Inyo National Forest, and eastern Shasta County.

Fig 72: Spanish broom resprouting after the Station Fire, Angeles NF.

Photo: D. Bakke

Scotch broom and French broom

- Found alongside highways throughout the forested areas of central and northern California (e.g., Interstates 5, 80, US 101, 50) including the Coast Range, Cascades, and Sierra Nevada Range.
- Marin County – Currently developing a new vegetation management plan for broom in the lands of the Marin Municipal Water District.
- Plumas National Forest – The Slapjack Project includes a control effort against French and Scotch broom that will be implemented in late 2010.
- Eldorado National Forest – Extensive areas on Georgetown Ranger District; there is a project in planning to treat broom as part of the Big Grizzly Fuels Reduction Project EIS.
- Eradication work continues on small populations in the Lake Tahoe Basin, Yosemite National Park (El Portal and elsewhere), Santa Cruz County (San Lorenzo Valley); eastern Shasta County, Siskiyou County, Trinity County (along Hwy 299), Tahoe National Forest (Yuba River Ranger District).

Fig 73: Scotch broom, Eldorado NF.

Photo: D. Bakke

Slender false brome

Brachypodium sylvaticum

CDFA – A; Cal-IPC – Moderate (Alert)

Overview: A perennial grass from North Africa and Eurasia, slender false brome is an aggressive invasive plant that often forms dense stands of up to 90% cover, successfully out-competing native vegetation. Introduced into Oregon in the 1930's, it was first identified in California in San Mateo County near Woodside in the redwood forest understory of Midpeninsula Regional Open Space District's (MROSD) Thornewood Preserve and the surrounding residential neighborhood in January 2004. If left untreated, slender false brome is expected to continue to invade redwood forests, exclude native forest species, inhibit tree seedling establishment, and alter fire regimes. Eradication of slender false brome in California is possible at this early stage because of the limited area it occupies and the ongoing cooperation and commitment of local county and state agencies.

Fig 74: Slender false brome (*Brachypodium sylvaticum*), mature plants, San Mateo County.

Photo: R. Pummer, San Mateo County

Status:
The MROSD, in addition to treatments on its own land, has developed a management program and reimbursement plan to assist private property owners in treating slender false brome on their properties. The management program includes pretreatment surveys, herbicide application or manual control measures (handpulling), and post-treatment restoration, erosion control, and monitoring. Pretreatment surveys determine site conditions to guide the selection of treatment methods that will provide effective control and protect sensitive resources. Since the program began, numerous property owners have participated in the cooperative management program. Fifty-one acres of slender false brome have been treated. This eradication project will continue.

Cheatgrass, Medusahead
Bromus tectorum (cheatgrass, downy brome)
CDFA – not rated; Cal-IPC - High
Taeniatherum caput-medusae (medusahead)
CDFA – C; Cal-IPC - High

Overview: An annual grass, cheatgrass is native to Eurasia and is found throughout California. It is the most common forage species in the Great Basin. Medusahead, another annual grass, is native to Europe and has been in the western United States since the late 1800's. While cheatgrass is common throughout California, medusahead is more common in the oak woodlands. These two grasses are formidable competitors with native grasses and forbs. Once established, medusahead can reach densities of 2,000 plants per square meter, creating a dense litter layer that suppresses other plants and contributes to fire danger in summer. Although they are not shade tolerant, thus limiting their development in forested areas, they can rapidly invade disturbed sites such as logged or wildfire areas. Once established, they deplete soil moisture earlier in the season and cure earlier than native plants. Because of the early curing, they can affect wildfire timing and interval, resulting in fires occurring more often and earlier in the season. This change in fire regime works against the native species and provides ideal conditions for these grasses to dominate. This is especially an issue in the eastside pine type and the Modoc plateau.

Status:
- Cheatgrass and other non-native annual grasses represent a threat to the Southern California chaparral type as they can change the fire frequency once established. This is a concern within the 2009 Station Fire on the Angeles National Forest. Evidence of this type conversion can be seen along State Hwy 243 leading to the San Bernardino National Forest from Interstate 10, where the chaparral type has been largely converted to annual grasses on this northwest facing slope.
- Tulare County WMA – Cheatgrass is widespread within Sequoia and Kings Canyon National Parks in both forested and non-forested areas. Infestations are increasing throughout the park, often in association with fire. Management is limited to situations considered high priority (e.g., meadows) or where eradication possibilities are considered high.
- Lake Tahoe Basin - Small, isolated populations of cheatgrass in the Basin are treated by manual and chemical methods. The Lake Tahoe Basin Weed Coordinating Group aims to manage these infestations to eradication.
- Yosemite National Park - Cheatgrass is widespread in Yosemite and difficult to control. A pilot herbicide study was initiated this year. A plan is under development to document its distribution in the park and target some treatments to slow spread farther into the wilderness.
- Santa Clara County – Work is ongoing to eradicate medusahead in the Arastradero Preserve in the north portion of the county in oak woodlands.
- Modoc County – Cheatgrass is impinging within the Great Basin ecosystems of Modoc County as a result of shifts to a Pinyon-Juniper tree cover, resulting in more common and intense fires.

Giant Reed, Arundo
Arundo donax
CDFA – B; Cal-IPC - High

Overview: This bamboo-like perennial grass can grow very tall (up to 8 m) and form very dense stands. It has well developed rhizomes which allow for vegetative propagation from intact and fragmented rhizomes, as well as fragmented stems. Arundo was brought into California by early Spanish settlers from the Mediterranean area. It is found in riparian areas throughout California, especially along coastal waterways in Southern and Central California and waterways flowing into and through the Sacramento and San Joaquin Valleys. Very dense stands of arundo crowd out native vegetation, decreasing wildlife habitat and affecting water quality by reducing stream shading, changing sediment movement, and reducing stream bank stability. Arundo can carry fire up riparian channels into the forested lands adjacent to the streams, and in this sense acts like other invasive annual grasses (e.g., cheatgrass) in changing the natural fire regime and fire behavior in riparian forests.

Status:

- Over the last several years there has been a concerted effort to map arundo in the Southern and Central California Coast; this effort was completed in 2010 and maps can be found on-line: http://www.cal-ipc.org/ip/mapping/arundo/index.php.
- Mariposa County – In a follow-up to herbicide work done in 2009 along Mariposa Creek, Department of Corrections crews cut and removed most of the arundo treated in 2009. Approximately 95% of the arundo clumps have been eradicated.
- Angeles National Forest – Within the 2009 Station Fire, previous stands of arundo are vigorously resprouting, especially in Big Tujunga Canyon.
- Santa Barbara County - There is approximately 7 net acres of arundo along the Santa Ynez River outside of the Los Padres National Forest. Mapping and treatment of arundo is part of the Santa Ynez River Tamarisk and Arundo Project. Planning and obtaining landowner permission to treat continues; treatment is scheduled to start in late summer of 2011.
- There is on-going control work on the Sierra National Forest (along Merced River in areas of Stanislaus NF administered by Sierra), Cleveland National Forest (Trabuco RD), Yosemite National Park (El Portal), Yolo, San Luis Obispo, Del Norte, eastern Kern (SF Kern River), and Shasta (Stillwater Creek to Sacramento River and NF Cottonwood Creek) counties, and the San Bernardino National Forest.

Fig 75: Cutting Arundo in Cajon Wash, San Bernardino NF.

Photo: D. Nelson, San Bernardino NF

Blackberry (Himalaya and Cutleaf)
Rubus discolor (Himalaya)
CDFA – not rated; Cal-IPC – High
Rubus laciniatus (Cutleaf)
CDFA – not rated; Cal-IPC – not rated

Overview: Himalaya blackberry, introduced from Eurasia, is the most common non-native bramble invading natural areas of California. Cutleaf blackberry is a closely related species, native to Europe, but with a more limited distribution in California. Both have biennial stems, perennial roots, and edible, black berries. These two invasive species can be distinguished from native blackberries in that the stems are angled in cross-section, not round, and the leaves are evergreen, not deciduous. Himalaya blackberry is found throughout California except the desert areas and is often associated with moist open sites and riparian habitats.

Status:

- Tulare County – Himalaya blackberry is found in a retired spray field in the Giant Forest in Sequoia/Kings Canyon National Parks. It is also associated with drainages in southern areas of the park, but does not appear to be spreading rapidly. Control efforts are underway and appear to be successful in slowing the spread.
- Yosemite National Park – Himalaya blackberry is considered a high priority plant, and along with cutleaf blackberry, is found in scattered locations throughout the park; treatment is ongoing by hand and herbicide.
- Shasta/Trinity Counties –Eradication work of Himalaya blackberry continues along Hwy 299.

Rush skeletonweed, hogbite
Chondrilla juncea
CDFA – A; Cal-IPC - Moderate

Overview: This herbaceous perennial or biennial plant, native to Southern Europe, has stiff and wiry stems to about 1 m tall, with milky sap and deep taproots (2-3 m). The flowers are bright yellow and borne on stems developing from a rosette. It is not common in California although it can grow in most areas of the state. In the wildlands, rush skeletonweed is found most often in disturbed soils of roadsides and rangelands.

Status:

- Tahoe National Forest – On the Yuba River RD in the Oregon Creek Day Use Area, over 1,000 plants were handpulled on about ½ acre. The area was then seeded with native grass and lightly mulched with native grass straw.
- Eradication work continues on small populations of rush skeletonweed in Calaveras (near Winton, Dorrington, and along USFS road 7N08 and the Mokelumne River overpass bridge), Lassen (near Susanville), Del Norte, Plumas, Sierra, Sonoma, and Siskiyou Counties.

Dyer's wood, Marlahan mustard
Isatis tinctoria
CDFA – B; Cal-IPC – Moderate

Overview: Introduced from Europe, this biennial has bright yellow flowers and distinctive dark hanging fruits with a single seed in each. The name dyer's wood is derived from historical cultivation in Europe as a source of blue dye. In California, it is primarily found in Northern California, as far south as the Bay Area and the Central Sierra Nevada Mountains inhabiting forests, rangelands, and rights-of-ways.

Fig 76: Dyer's Woad , Siskiyou County.

Photo: D. Bakke

Status:

- In the northern part of the State, it is considered beyond eradication. Forest managers have adopted a strategy that sets containment lines at certain points in the watersheds, beyond which treatment is initiated to eliminate outlier populations.
- Klamath National Forest, Siskiyou County Department of Agriculture, and The US Fish and Wildlife Service (Yreka office) – These three have a cooperative agreement to control the spread of dyer's woad into Siskiyou Mariposa Lily and Yreka Phlox habitats on private lands. Dyer's woad is considered the main threat to the Siskiyou Mariposa

Lily (*Calochortus persistens*), a candidate for Federal endangered species listing, and Yreka Phlox (*Phlox hirsuta*), a listed Federal and state endangered species. Multiple treatments are required to achieve a reduction in plant density due to the dense seed beds within infestations. The goal of treatment is to prevent all seed set of the dyer's woad and eventually deplete the seed bed entirely. The Siskiyou County Department of Agriculture chemically treated on private lands, and the Klamath National Forest non-chemically treated on Federal lands; 169 net acres was treated over about 1,800 gross acres. The Klamath National Forest, through an agreement with the Siskiyou Satellite of the California Conservation Corps in Yreka used hand digging methods.

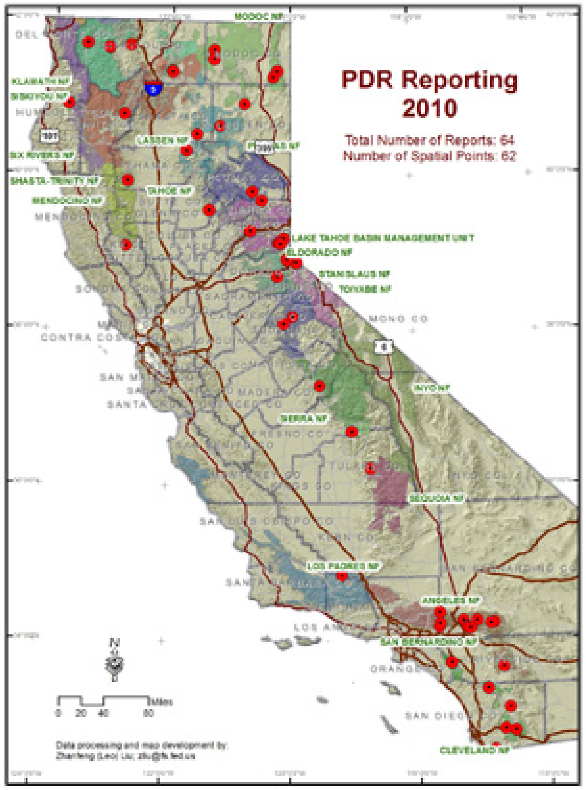
- There is ongoing eradication work of dyer's woad in Plumas and Sierra Counties.

Monitoring

California Insect and Disease Atlas

The California Insect and Disease Atlas (CAIDA) has been continuously developed and improved in 2010. In addition to the electronic pest data collection application, Trimble GPS units equipped with the same CAIDA form have also been deployed for real time data logging in the field with spatial information automatically recorded. A total of 64 reports were submitted for 2010; the site distribution is shown on the map to the right (Map 9).

Significant progress was also made in the development of the CAIDA Web Portal (Figure 77). The website is expected to be fully operational by the end of 2011. It will make the entire CAIDA database, both tabular data and spatial coverage, available to the public via the internet, allowing users to quickly query the data, as well as display and print maps. The web portal will also provide password controlled access that will allow direct online data entry to the database.



Map 9: 2010 Pest Detection Reporting SUmmary

Map: Z. Liu

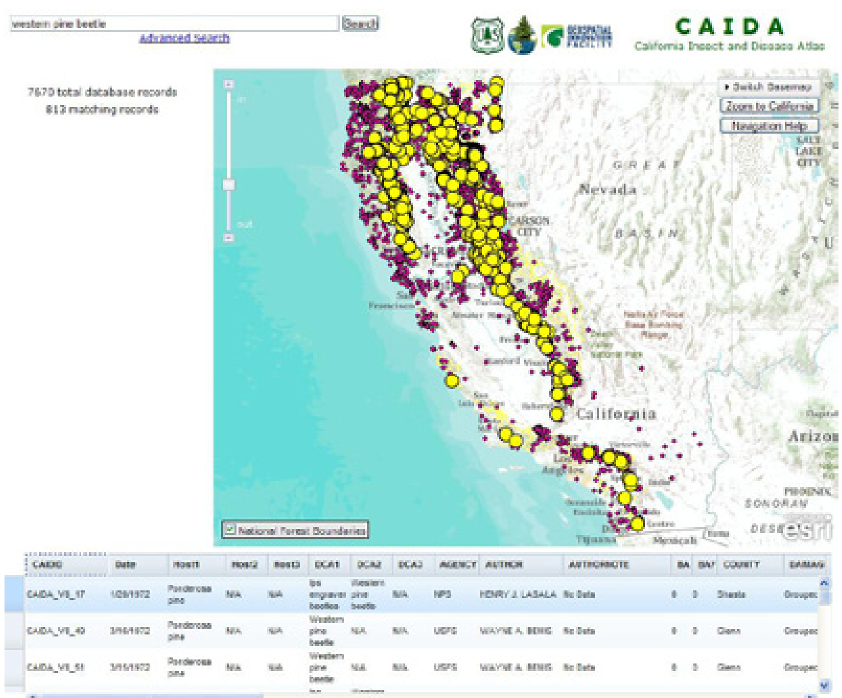


Fig 77: CAIDA Web Portal.

Image: Z. Liu

Insect and Disease Risk Modeling and Mapping

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 most recent results were published in 2006. A new iteration of the national model is underway and scheduled to be completed in 2012.

Surfaces representing the presence/absence and density of individual tree species have been modeled by the Forest Health Technology Enterprise Team (FHTET). The accuracy of these surfaces is critical to ensuring the correct host/pest models are generated in the correct locations. Validation of these surfaces continued throughout 2010 with comments as well as stand information recorded in questionable areas being returned to FHTET to calibrate the host models. Forest Health Protection staff are recording stand information in the normal course of their field visits, which is also provided to FHTET.

Development of host/pest specific models began in 2010. FHTET developed a modeling and mapping application, RMAP, based on ESRI's ArcMap software (see below). This application greatly increases the ease with which a model can be built, as well as substantially decreasing the amount of time it takes to build one. Region 5 Forest Health Monitoring staff facilitated several modeling and training sessions in Regions 5, 6, and 10.

2006 risk maps are available on the USDA Forest Service, Forest Health Monitoring website at: http://www.fs.fed.us/r5/spf/fhp/fhm/risk/.

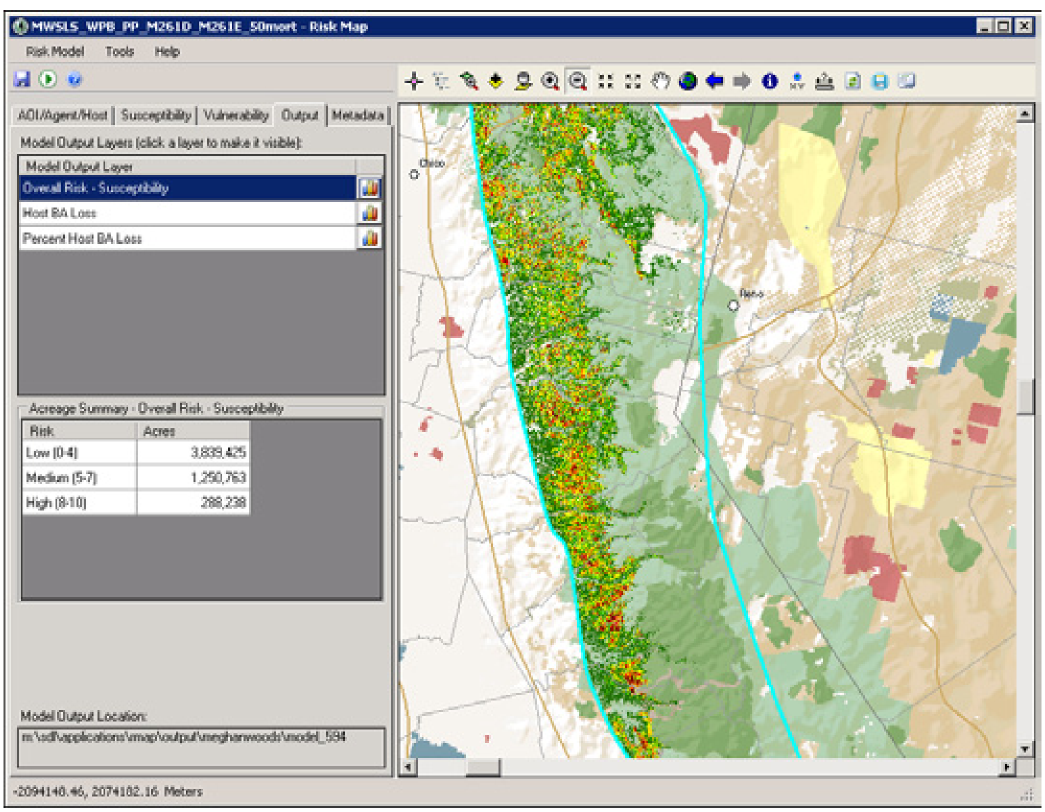


Fig 78: Risk Mapping application screen shot.

Image: M. Woods

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 auroguttatus*
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* spp.
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 furnissi*

Gouty pitch midge	*Cecidomyia piniinopis*
Incense cedar scale	*Xylococculus macrocarpae*
Jeffrey pine needleminer	*Coleotechnites* sp. near *milleri*
Needle fascicle scale	likely *Matsucoccus fasciculensis*
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*
Redwood bud/gall mite	likely *Trisetacus sequoia*
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	*Diplodia pinea* and *D. scrobiculata*
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 morbida*
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	
Heterobasidion root disease	*Heterobasidion irregulare* *Heterobasidion occidentale*
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. *murrayana*
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*
	Canyon live oak	*Quercus chrysolepis*
	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.

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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 ☐ 5. Chemical ☐ 2. Disease ☐ 6. Mechanical ☐ 3. Animal ☐ 7. Weed ☐ 4. Weather ☐ 8. Unknown ☐	**9. Size of Trees Affected:** 1. Seedling ☐ 4. Sawtimber ☐ 2. Sapling ☐ 5. Overmature ☐ 3. Pole ☐	**10. Part(s) of Tree Affected:** 1. Root ☐ 5. Twig ☐ 2. Branch ☐ 6. Foliage ☐ 3. Leader ☐ 7. Bud ☐ 4. Bole ☐ 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 PO 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 2690 N. State Street Ukiah, CA 95482	Forest Pest Management CA Dept of Forestry & Fire Protection 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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