California Forest Pest Conditions 2013

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California Forest Pest Council

CALIFORNIA FOREST PEST CONDITIONS 2013

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Mined aspen leaf, South Warner Mountains. Photo Credit: Bill Woodruff

Ozone damage to pine needles. Photo Credit: USDA Forest Service

Douglas-fir killed by Douglas-fir beetle, Plumas NF. Photo Credit: Danny Cluck

Big leaf mistletoe in cottonwood in the Big Valley Rancheria of the Pomo Indian Tribe. Photo Credit: Pete Angwin

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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, plant pathologists, biologists, and others interested in the protection of California's urban and wildland forests from injury caused by biotic and abiotic agents. The Council's objectives are to establish, maintain, and improve communication among individuals who are concerned with these issues. These objectives are accomplished by:

1. Coordinating the detection, reporting, and compilation of pest injury, primarily forest insects, diseases, and animal damage.
2. Evaluating pest conditions, primarily those of forest insects, diseases, and animal damage.
3. Making recommendations on pest control to forest management, protection agencies, and forest landowners.
4. Reviewing policy, legal, and research aspects of forest pest management and submitting recommendations to appropriate authorities.
5. Fostering educational work on forest pests and forest health.

The California Board of Forestry and Fire Protection recognizes the Council as an advisory body in forest health protection, maintenance, and enhancement issues. The Council is a participating member in the Western Forest Pest Committee of the Western Forestry and Conservation Association.

This report was prepared by Forest Health Protection, USDA Forest Service, Pacific Southwest Region and the California Department of Forestry and Fire Protection with other member organizations of the Council. It was published by the California Department of Forestry and Fire Protection and distributed by it and the USDA Forest Service.

The report can be found online at: http://www.fs.usda.gov/detail/r5/forest-grasslandhealth/?cid=fsbdev3_046704.

California Forest Pest Conditions 2013

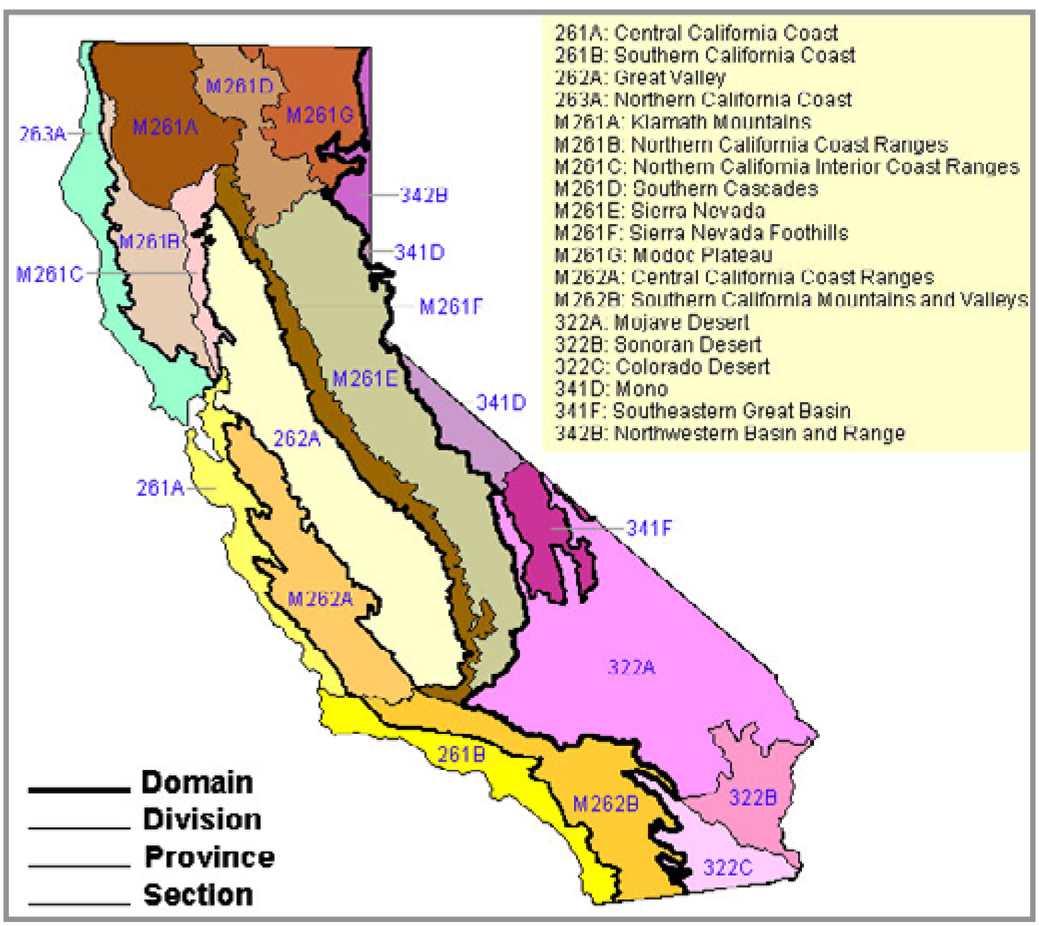
Introduction

By Tom Smith and Katie Palmieri

The 2013 edition of the California Forest Pest Conditions Report covers forest health and pest issues impacting California's forests, woodlands, and urban trees throughout the 2013 year, and is intended to be a resource for forest managers, pest management specialists, landowners, and other interested parties both within and outside of California.

The annual Forest Pest Conditions Report was first published in 1949 as the California Forest Insect Report. Over the years sections have been added, covering forest diseases, abiotic damage, animal damage, invasive weeds, aerial detection and monitoring of forest mortality, and US Customs and Border Protection international cargo pest interceptions.

This report is a publication of the California Forest Pest Council and its associated members; therefore, the information provided is from numerous sources. The primary source for forest health issues related to federally managed lands in California is the USDA Forest Service, Pacific Southwest Region, Forest Health Protection. Most of the information concerning issues on state and private lands is provided by the Forest Pest Management Unit of the California Department of Forestry and Fire Protection (CAL FIRE). Other major sources for information include the California Department of Food and Agriculture (CDFA), the University of California (UC), and UC Cooperative Extension. Without the valuable input from personnel within these and many other organizations, as well as concerned individuals, this publication would not be possible.



Map 1: Ecoregions of California, Bailey.

Information in this report is organized into several sections, including Insect Conditions, Disease Conditions, Abiotic Conditions, Animal Damage, Invasive Plants, and Monitoring, with topics listed in each section alphabetically by common name. Incidents of pests and pest damage are referenced by counties or according to ecological units of California as defined in Ecoregions and Subregions of the United States (Map 1, Bailey, et al., 1994).

This report is also available online at: www.fs.usda.gov/detail/r5/forest-grasslandhealth/?cid=fsbdev3_046704.

2013 Significant Events

By Tom Smith

Rainfall reached record low levels for the second year in a row in 2013. Much of the limited precipitation did not arrive until late spring and early summer, resulting in snowpack levels that were 20 percent of the annual state average. These environmental conditions as well as other stressors led to the following highlighted forest health issues.

- The invasive goldspotted oak borer (GSOB) spread to Riverside Co. Previously GSOB had only been found in San Diego Co.
- European gypsy moths were trapped in Butte Co. for the first time.
- Heavy infestations of balsam woolly adelgid were found in the northern coastal region.
- The new invasive polyphagous shot hole borer/fusarium complex spread from Los Angeles and Orange Cos. into Riverside, San Bernardino, and San Diego Cos. where it was found attacking numerous hardwood tree species.
- Bark and engraver beetle activity increased in drier parts of the state as well as in areas with high levels of storm damage to trees.
- Western pine beetle activity increased in overstocked ponderosa pine stands.
- Moderate Douglas-fir tussock moth defoliation and increased trap catches occurred in areas of the Sierra Nevada range.
- Sudden oak death mortality levels remained high and researchers found that coast redwood trees in infested forests have higher wildfire-related mortality levels. The pathogen continued to spread in the 14 infested coastal counties and was found less than 1 mile from both the Six Rivers NF and Trinity Co. boundaries.
- Increased levels of white pine blister rust infection on the alternate Ribes host suggests a possible increase in future outbreaks of the disease.
- Maple leaf scorch incidence increased throughout northern California.
- Gray pine decline and mortality was significant throughout the Sierra Nevada range and in coastal areas.
- Oaks throughout the Sierra Nevada foothills exhibited early leaf drop from the heat and dry conditions.
- New invasive weeds in California included goatsrue, mayten, and shiny geranium.
- The most common noxious weed in California remained yellow starthistle.

Insect Conditions

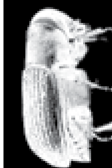
Insect Conditions in Brief

By Danny Cluck

Forest insect pests thrived in 2013 due in part to the ongoing statewide drought. May 1^{st} statewide precipitation was once again at 75 percent of average, and April 1^{st} snowpack water content was at 40 percent of average, the 5^{th} driest in the last 60 years. These extremely dry conditions placed additional stress on many forests that were already enduring excessive inter-tree competition, altered species composition, and high levels of disease. Trees growing under these types of conditions are highly susceptible to injury and mortality from various insect pests, including bark beetles, defoliators, and woodborers.

Highlights

- Western pine beetle-caused mortality of ponderosa pine and Coulter pine continued to impact lower elevation and drier sites and sites impacted by root disease and fire. Large groups of dead trees were reported from the southern Sierra Nevada range, south Coast Range, and the Mount Shasta areas.
- Mountain pine beetle continued to cause high levels of mortality in whitebark pine in the Warner Mountains and the eastern Sierra Nevada range. It also continued to kill large diameter sugar pine along the western slope of the Sierra Nevada range and large numbers of lodgepole pine in the Truckee River watershed.
- Douglas-fir beetle activity increased throughout northern California, resulting in large pockets of Douglas-fir mortality in Lassen, Plumas, and Shasta Cos. This is the highest level of activity recorded since the 1970s.
- Fir engraver beetle activity, although generally lower throughout the state, was responsible for elevated white fir mortality in the Warner Mountains and high levels of red fir mortality in Plumas and Siskiyou Cos.
- Flatheaded fir borer attacks on Douglas-fir growing in drier locations resulted in scattered mortality in Shasta, Tehama, and Sonoma Cos. Flatheaded fir borer activity was especially high in fire-killed white fir in the 2012 Reading Fire in Shasta Co., causing significant degrade in salvaged logs.
- Douglas-fir tussock moth populations continued to increase in northeastern California, causing various levels of white fir defoliation for the first time since the late 1980s. Approximately 6,000 acres of white fir sustained light to moderate defoliation in Plumas Co. Monitoring traps revealed very high moth populations from Lassen to Placer Cos.
- This was an outbreak year for the California oakworm in the North Bay area. Thousands of trees throughout Marin and Sonoma Cos. sustained various levels of defoliation.
- An outbreak of pinyon needle scale occurred in a small area of Riverside Co. This was the first ever report of this insect on four-needle pinyon or in southern California.
- The polyphagous shot hole borer and associated Fusarium dieback were found in California sycamore, castorbean, red willow, and white alder in Pasadena Glen and Santa Anita Canyon on the Angeles NF. To date, the polyphagous shot hole borer has attacked more than 110 different tree species.
- The goldspotted oak borer killed approximately 950 coast live oaks in San Diego Co. in 2013. Goldspotted oak borer-infested California black oaks were also detected for the first time in Riverside Co. in Idyllwild. This was the first instance of long-distance spread to a new county.
- Specimens of invasive European gypsy moth were trapped for the first time in Butte Co. by the California Department of Food and Agriculture gypsy moth trapping program.



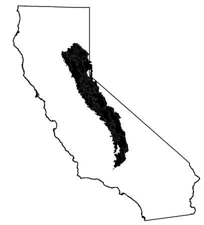
Invasive Insects

Balsam Woolly Adelgid
Adelges piceae
Contribution by: Tom Smith

263A

The infestation of balsam woolly adelgids continued along California's north coast, with heavy infestations in parts of Mendocino Co. (263A). Symptoms included gall-like deformities of twigs and dense woolly mats on the trunks of many grand firs as well as decline in smaller saplings.

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



M261E

On July 8 and 9, 2013, two adult male gypsy moths were trapped for the first time in Butte Co. (M261E). Each of the moths was detected in the Magalia area in traps about a mile apart. Gypsy moth is a pest of national concern. The USDA maintains a Federal Domestic Quarantine Notice against it (Section 301.45, Title7, Code of Federal Regulations) to prevent its artificial spread to uninfested areas of the US. CDFA is in the process of amending California government codes to add Butte Co. to the eradication area.

Fig 1: Goldspotted oak borer larvae in Idyllwild tree.

Photo by: K. Camilli

Goldspotted Oak Borer
Agrilus auroguttatus
Contributions by: Kim Camilli and Tom Coleman

M262B

The goldspotted oak borer (GSOB) continued to kill coast live oak at elevated levels in southeastern San Diego Co. (M262B) in 2013. Aerial surveys estimated 944 dead trees located primarily on the Descanso RD, Cleveland NF (see Fig. 3 on page 8). Coast live oak mortality increased when compared to 2012 tree mortality levels and was likely the result of GSOB injury interacting with drought stress.

Goldspotted oak borer-infested California black oaks were detected for the first time in Riverside Co. (M262B) in the town of Idyllwild. Approximately 28 new infested trees were found on private land within the community. This is the first instance of long-distance spread to a new county.

Fig 2: California black oak dieback in Idyllwild from goldspotted oak borer.

Photo by: K. Camilli

Polyphagous Shot Hole Borer/ Fusarium Dieback
Euwallacea sp.
Contributions by: Tom Coleman and Akif Eskalen

261B

In 2013, the polyphagous shot hole borer (PSHB, *Euwallacea* sp.) and Fusarium dieback (*Fusarium euwallaceae*) were found in California sycamore (*Platanus racemosa*), castorbean (*Ricinus communis*), red willow (*Salix laevigata*), and white alder (*Alnus rhombifolia*) in Pasadena Glen and Santa Anita Canyon on the Angeles

Fig 3: Goldspotted oak borer mortality on the Cleveland NF.

Photo by: T. Coleman

Fig 4: Polyphagous shot hole borer on white alder.

Photo by: T. Coleman

Fig 5: Female beetle (*Euwallacea* sp.).

Photo by: A. Eskalen

Fig 6: Staining symptoms on coast live oak.

Photo by: A. Eskalen

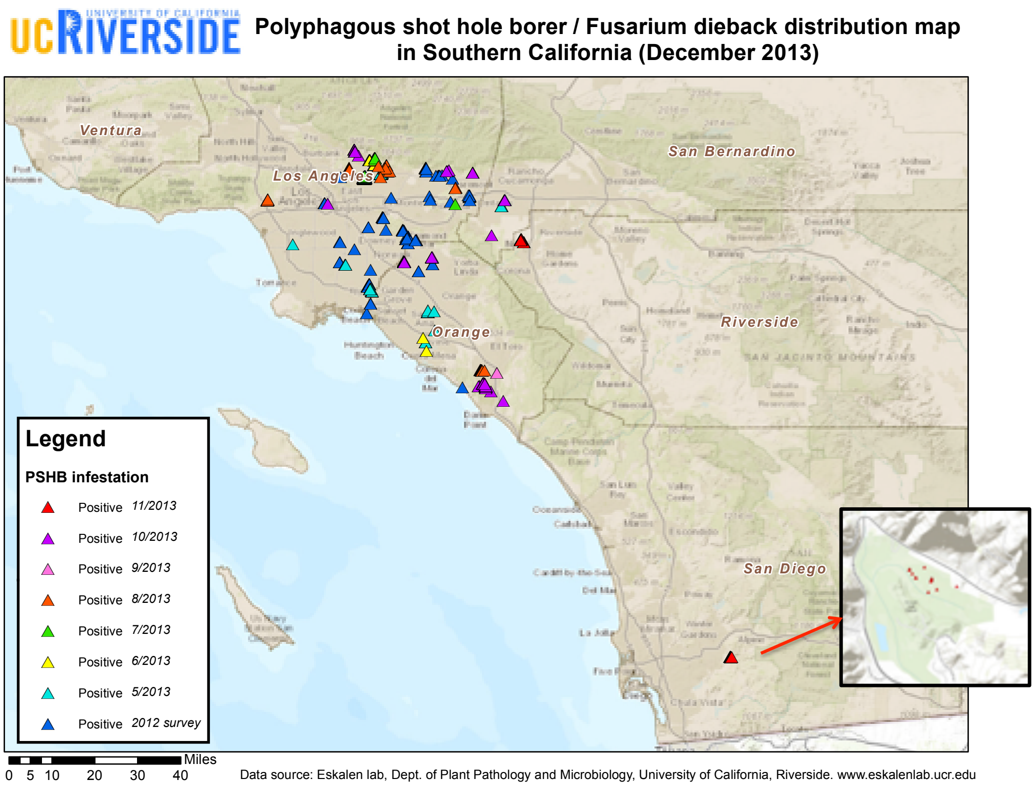
M262B

261B

NF, Los Angeles RD (Los Angeles Co., 261B). The ambrosia beetle attacked a wide range of diameter size classes (2 to 32 in. DBH) in Pasadena Glen. Ground surveys confirmed mortality of red willow and castorbean occurring at low levels within the area.

This new exotic pest complex is caused by the fungus forming a symbiotic relationship with PSHB (morphologically indistinguishable from the tea shot hole borer, *Euwallacea fornicatus*), which is resulting in dieback and mortality on agricultural and landscape trees in the counties of Los Angeles (M262B and 261B), Orange (261B), and San Bernardino (M262B). When the beetle burrows into a tree, it inoculates it with the fungus, which attacks and plugs the tree's vascular tissue, blocking water and nutrients and eventually causing branch dieback. The fungus is the food source for the larvae (see page 27 for additional images).

California sycamore, box elder (*Acer negundo*), maple (*Acer* spp.), red willow, and castorbean



Map 2: Recent distribution map of fusarium dieback/ polyphagous shot hole borer in southern California.

Map by: Eskalen Lab, UC Riverside

are optimal trees to survey for signs of beetle presence as PSHB tends to infest these hosts first whenever present. Depending on the tree species, PSHB injury can be identified either by staining, gumming, or a white-sugar exudate on the outer bark in association with a single beetle entry hole. At advanced infestation stages, there are often many entry/exit holes (approximately 0.033 in) in the tree. Female beetles are black and approximately 0.07-0.1 in. long; males are brown and about 0.05 in. long.

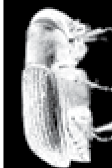
Fig 7: Beetle entry/exit hole on an avocado tree.

Photo by: A. Eskalen

To date, PSHB has attacked more than 110 different tree species, but can produce brood in approximately 24 species, including box elder, California sycamore, castorbean, avocado (*Persea americana*), coast live oak (*Quercus agrifolia*), English oak (*Q. robur*), valley oak (*Q. lobata*), California sycamore (*Platanus racemosa*), big leaf maple (*Acer macrophyllum*), Japanese maple (*A. palmatum*), red willow, goldenrain (*Koelreuteria paniculata*), olive (*Olea europaea*), persimmon (*Diospyros* sp.), silk (*Albizia julibrissin*), American sweet gum (*Liquidambar styraciflua*), coral (*Erythrina corallodendon*), weeping willow (*Salix babylonica*), blue palo verde (*Parkinsonia florida*), palo verde (*Cercidium floridium*), tortuosa (*Salix matsudana*), and white alder.

M262B

By the end of 2013 the complex had spread into Riverside Co. (M262B) and a separate infestation had been discovered in El Cajon, San Diego Co. (M262B).

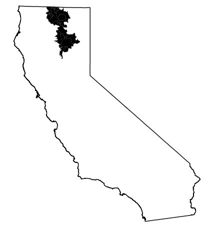


Native Insects

Bark Beetles

California Fivespined Ips

Ips paraconfusus
Contributions by: Danny Cluck, Tom Coleman, and Don Owen



M261D

A major winter storm in December 2012 caused extensive stem breakage of merchantable ponderosa pine on Bullskin Ridge, Shasta Co. (M261D). Broken trees with variable amounts of crown remaining occurred over an area of approximately 700 acres. A limited number of downed stems (less than 30%) were colonized by *Ips paraconfusus* from mid-March into May (elevation 2,300 ft.). Re-inspection of the area in July showed no evidence of Ips attack on live, unbroken trees. California fivespined Ips also attacked several ponderosa pines within a recent timber harvest unit near Burney Falls, Lassen NF (Shasta Co., M261D). This activity was related to green biomass material left on site due to winter/spring road access limitations.

M262B

Jeffrey pine was killed by several interacting factors along Hurkey Creek on the San Jacinto RD, San Bernardino NF (Riverside Co., M262B). A complex consisting of California fivespined Ips, California flatheaded borer, and black pineleaf scale killed approximately 15 trees across a 3-acre area. Tree mortality increased in the region from 2012 and will likely continue if drought conditions persist.

California fivespined Ips, California flatheaded borer, and dwarf mistletoe interacted to cause mortality of Jeffrey pine on the Los Padres NF, Mt. Pinos RD (Ventura Co., M262B). Tree mortality increased from 2012 to 2013 in the areas surrounding the community of Pine Mountain Club and along Tecuya Ridge. Aerial surveys mapped approximately 2,213 acres of Jeffrey pine mortality in these locations.

M261C

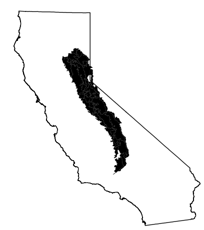
Douglas-fir Beetle

Dendroctonus pseudotsugae
Contributions by: Danny Cluck and Cynthia Snyder

Fig 8: Douglas-fir killed by Douglas-fir beetle, Plumas NF.

Photo by: D. Cluck

Aerial surveys identified Douglas-fir beetle-caused mortality in several pockets of large, mature Douglas-fir on South Fork Mountain, Shasta-Trinity NF (Shasta Co., M261C). Douglas-fir beetle-caused mortality also increased dramatically in portions of the Plumas and Lassen NFs (Plumas and Lassen Cos., M261E). Many large group kills (>30 trees) were observed in steep, north facing drainages where Douglas-fir grows in relatively pure stands. The current pattern of mortality resembles the previous outbreak in the late 1970s.



M261E

Fir Engraver

Scolytus ventralis
Contributions by: Beverly Bulaon, Danny Cluck, Don Owen, and Cynthia Snyder

M261G

Fir engraver beetle activity, often closely associated with stressors such as overstocking, drought, and root diseases, was concentrated in the drier forested areas of northern California. A slight increase in white fir mortality was observed in the Cal Pines subdivision of Modoc Co. (M261G). Mortality was elevated in the Blacks Mountain Experimental Forest and on Harvey Mountain, Lassen NF (Lassen Co., M261D) as well as in several locations

M261G

of the Warner Mountains, Modoc NF (Modoc Co., M261G). Fir engraver activity was also observed in the higher elevation red fir belt of the Plumas NF between Quincy and LaPorte (Plumas Co., M261E), and several Shasta red fir were found attacked near Panther Meadow Campground, Shasta-Trinity NF (Siskiyou Co., M261D).

Jeffrey Pine Beetle
Dendroctonus jeffreyi
Contributions by: Beverly Bulaon, Danny Cluck, and Cynthia Snyder

While not common in northwestern California, Jeffrey pine beetle was found causing Jeffrey pine mortality in the Lovers Canyon area of the Scott River RD, Klamath NF (Siskiyou Co., M261A). Pockets of up to 10 infested trees were found in plantations of mixed Jeffrey and ponderosa pines.

Fig 9: Jeffrey pine beetle infested Jeffrey pines were cut and removed from Manzanita Lake Campground, Lassen Volcanic NP.

Photo by: D. Cluck

M261D

Jeffrey pine beetle activity generally declined in Lassen Volcanic NP from 2012 (Shasta Co., M261D). Ten large diameter trees (>40 in. DBH) were attacked within Manzanita Lake Campground, with very few individuals and no large groups of attacked trees observed in the surrounding area. Green infested tree removal (~60 trees removed before beetle flight) and the application of anti-aggregation pheromones in early 2013 to high-value trees may have influenced the decline in activity. The beetles also appeared to be generally reduced from 2012 on the Lassen NF (Lassen Co., M261D). Inspections of fading trees revealed high numbers of woodboring beetle larvae that may be limiting bark beetle brood success. This same type of woodboring beetle activity was also observed on the Modoc NF (Lassen Co., M261D) in areas where Jeffrey pine beetle activity was increasing in 2012. Most areas on the Lassen and Modoc NFs where Jeffrey pine mortality was observed appeared to have several beetle species in addition to Jeffrey pine beetle attacking trees, including woodborers (ponderosa pine bark borer, *Acanthocinus princeps,* and California flatheaded borer, *Phaenops californica*), pine engraver beetles (*Ips pini*), and other bark beetles (emarginate ips, *I. emarginatus*).

Fig 10: Stump left after Jeffrey pine beetle infested tree removal from Manzanita Lake Campground, Lassen Volcanic NP.

Photo by: D. Cluck

M261E

Populations have remained at background levels on the eastern and western slopes of the southern Sierra Nevada range. On western slopes, small groups or singular pines (averaging 25 in. DBH) in drainages and rocky outcroppings around Spicer Reservoir are dying from a combination of Jeffrey pine beetle and dwarf mistletoe infection on the Stanislaus NF (Tuolumne Co., M261E); on eastern slopes, beetle activity has been primarily associated with recent prescribed fires on the Inyo NF (Mono Co., M261E). Scattered group mortality was also noted further north on the Humboldt-Toyaibe NF (Mono Co., M261E).

Fig 11: Cerambycid pupa in Jeffrey pine killed by Jeffrey pine beetle, Modoc NF.

Photo by: D. Cluck

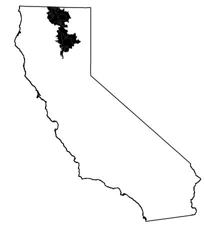
M261A

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

Mountain pine beetle is the primary cause of mature sugar pine mortality in northwestern California, with scattered individual dead trees or small pockets of two to three dead trees found throughout the species range. Lodgepole pine mortality also continued in and around Martin's Dairy Campground near the Shovel Creek drainage, Klamath NF (Siskiyou Co., M261D).

Fig 12: Lodgepole pines were attacked and killed by mountain pine beetle in the Silver Creek Campground, Tahoe NF.

Photo by: D. Cluck

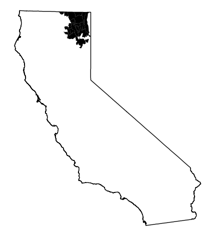


M261D

Activity in lodgepole and whitebark pine continued in most previously reported northeastern California areas. In the Warner Mountains, Modoc NF (Modoc Co., M261G), mountain pine beetle continued to attack larger diameter (>10 in. DBH) western white and whitebark pines. Attacks on whitebark pines were mostly associated with previous group kills. Mountain pine beetle activity increased in an area of lodgepole pine and ponderosa/Washoe pine in the Warner Mountains that had so far experienced low levels of mortality throughout the outbreak, with a few large diameter (>30 in. DBH) ponderosa/Washoe pines killed along with adjacent lodgepole pines. Attacks on lodgepole pine continued at Medicine Lake, Modoc NF (Siskiyou Co., M261D). Campground trees in the area were sprayed with insecticides to prevent further attacks. On the Lassen NF, mountain pine beetle activity declined dramatically in Ashpan Butte and Bunchgrass Valley (Shasta Co., M261D). However, attacks continued on scattered large diameter sugar pines (>24 in. DBH) in many mixed conifer areas within the western portions of the Lassen and Plumas NFs (Lassen Co. and Tehama Co., M261D and Plumas Co., M261E).

Fig 13: Whitebark pine mortality caused by mountain pine beetle continued in the Rock Creek Recreation Area, Inyo NF.

Photo by: B. Bulaon



M261G

M261E

Mountain pine beetle activity increased in lodgepole pines within campgrounds along the Truckee River, Tahoe NF (Placer Co., M261E). Sixty-five green infested trees were discovered within three campgrounds. These trees will be removed before beetles emerge; pheromone applications are scheduled for spring 2014 to help prevent further mortality.

In the southern Sierra Nevada range, mountain pine beetle continued to only attack five-needle pines in low- and high-elevation forests. Within mixed conifer zones, legacy-sized sugar pines were killed, with or without prior blister rust infection. Sugar pine stands that were attacked were very dense and were surrounded by small diameter understory trees. Attacked trees were identified in Yosemite NP as well as the Stanislaus and Sierra NFs (Tuolumne, Amador, Mariposa, and Madera Co., M261E).

In the sub-montane regions of the eastern Sierra Nevada range, beetle activity continued in whitebark pine stands, with the remaining green trees in previously infested stands

Fig 14: Pine engravers and western pine beetle in a ponderosa pine plantation, Eldorado NF.

Photo by: B. Bulaon

attacked. Hilton Lakes Wilderness, June Mountain Ski Area, and Glass Creek Wilderness (Mono Co., M261E) continued to lose whitebark pine as the beetles intensified and dispersed. Newly attacked groups of 2 to 13 trees were identified among standing dead trees along the Hilton Lakes Trail (Inyo Co., M261E). At June Mountain, where whitebark pine transitions to lodgepole pine in the lower plateau, activity appeared to be intensifying as mortality pockets coalesce.

M261E

Pine Engraver Beetles
Ips spp.
Contribution by: Beverly Bulaon

Engraver beetles were very active in one plantation at the Placerville Ranger Station, Eldorado NF (El Dorado Co., M261E), where many pines were killed by western pine beetle and Ips species.

M262B

Pinyon Ips
Ips confusus
Contribution by: Tom Coleman

Singleleaf pinyon pine was killed by pinyon Ips across 40 acres of the Los Padres NF, Mt. Pinos RD (Kern Co., M262B). Tree mortality increased from 2012 and was located in dense stands, primarily along Cuddy Valley Rd.

Pinyon Ips continued to kill singleleaf pinyon pine infected with black stain root disease on the San Bernardino NF, Mountaintop RD (San Bernardino Co., M262B). Mortality has been ongoing for approximately 4 years in the Broom Flat area east of Big Bear Lake, covering approximately 90 acres.

Fig 15: Red turpentine beetle found in dead ponderosa pine after the Rim Fire, Stanislaus NF.

Photo by: B. Bulaon

M261D

Red Turpentine Beetle
Dendroctonus valens
Contributions by: Beverly Bulaon and Don Owen

The red turpentine beetle increased with storm breakage of ponderosa pine on Bullskin Ridge, east of Redding, Shasta Co. (M261D). Broken trees with some residual foliage were free of attacks in late July; however, the majority of stems with no residual foliage were colonized. The first beetle attacks were observed in mid-April. By late July, mature larvae and brood adults were recovered.

On the Stanislaus NF (Tuolumne Co., M261E), red turpentine beetles were very active in campgrounds in early summer on legacy-sized ponderosa pines, particularly those next to parking or roadsides. Beetle attack was fairly heavy, with entire lower boles covered in pitch masses. In late fall, after the Rim Fire, some beetle pitch masses were also noted on burned ponderosa pines. Beetle attacks were also noted on mature ponderosa pines that were lightly burned 2 years ago on the Georgetown RD, Eldorado NF (El Dorado Co., M261E).

Western Pine Beetle
Dendroctonus brevicomis
Contributions by: Beverly Bulaon, Danny Cluck, Tom Coleman, Don Owen, and Cynthia Snyder

Western pine beetle continued to be the primary cause of ponderosa pine mortality in northern California, especially in overstocked plantations. The McCloud Flats area of the Shasta-Trinity NF (Siskiyou Co., M261D) continued to have extensive western pine beetle-caused mortality due to overstocking and black stain root disease (caused by *Leptographium wageneri*). The NF is currently writing NEPA for 1,147 acres of thinning to reduce the spread of root disease and subsequent bark beetle-caused mortality. The Lovers Canyon area of the Klamath NF had several scattered pockets of ponderosa pine mortality that ranged from 6-25 trees each. The Klamath NF is also working on a long-term project to thin about 2,700 acres within the wildland urban interface, containing threatened and endangered species habitat and encompassing several high-value recreation areas and access points to the Pacific Crest Trail.

Fig 16: Western pine beetle galleries under the bark of ponderosa pine at Lovers Canyon, Klamath NF.

Photo by: C. Snyder

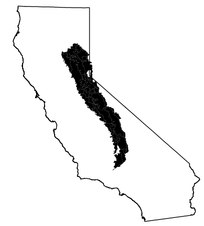
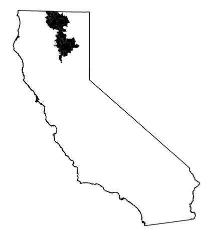


Fig 17: Western pine beetle-caused mortality of ponderosa pine, Log Springs Rd., Mendocino NF.

Photo by: C. Snyder



Log Springs Rd., Mendocino NF (Glenn Co., M261B), continued to have pockets of ponderosa pine mortality. On average, infested pockets consisted of three to six trees that were scattered within dense stands, many between marked treatment units. The NF was able to mitigate the impacts with a 250-acre salvage sale from an infested area approximately 10 miles southwest of Paskenta.

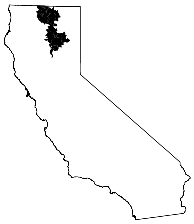
Fig 18: Western pine beetle and pine engraver beetle attacks on ponderosa pine near Burney Falls, Lassen NF.

Photo by: J. Moore

Two pockets of ponderosa pine mortality developed in the spring at the southwest corner of Haynes Flat (Shasta Co., M261D). Roughly 50 trees were killed by the western pine beetle. Most trees still had beetles and were estimated to have been attacked during mid- to late summer 2012. Both pockets were on the edge of flood-irrigated pasture and one pocket straddled an irrigation ditch – site conditions which suggest possible stress due to altered water relations and last year's drought. A winter storm in December 2012 provided habitat for the beetles by causing stem breakage of merchantable ponderosa pine on Bullskin Ridge, Shasta Co. No significant bark beetle activity was noted through July 2013, but in late summer and fall, a number of western pine beetle group kills developed. The beetle population increased by colonizing trees that had lost most of their crowns to storm breakage. The beetles then shifted their attacks to undamaged, drought stressed trees nearby. Continued mortality is anticipated in spring 2014 and may increase significantly if drought conditions persist.

Fig 19: Western pine beetle in a mature plantation, Stanislaus NF.

Photo by: B. Bulaon



M261D

M261G

M261E

M262B

Beetle activity continued in previously reported locations within the Lassen, Plumas, Modoc, and Tahoe NFs (M261D, M261G, and M261E). In one location near Burney Falls, western pine beetles attacked several hundred trees in an area previously impacted by California fivespined ips. This area had recent harvest activity and an abundance of biomass material left on site due to winter/spring access issues. Other notable areas with elevated ponderosa pine mortality included the lower western slopes of the Warner Mountains, Modoc NF; the area of Old Station, Lassen NF; and private lands within the lower elevation pine belt of the Sierra Nevada range in Tehama, Butte, Yuba, Nevada, and Placer Cos. (M261D, M261E). Western pine beetle activity decreased in a few northeastern California locations, possibly due to an extreme cold spell in January 2013. Dead western pine beetle larvae were observed within the bark of infested trees in cold air sink areas of the Lassen NF.

Western pine beetle continued to be the most active bark beetle in the southern Sierra Nevada range, attacking all age classes of ponderosa pine. Starting with smaller diameter classes, trees in young plantations and natural stands were being killed by a combination of western pine beetle and *Ips* species. This is usually incited by other factors that attract beetles to the area like roadside fires or wind throw. Mature and young ponderosa pine plantations on the Stanislaus and Eldorado NFs (Tuolumne and El Dorado Cos., M261E) have had small group kills turn into large kills of up to 100 trees. Cedar Valley campgrounds in Sequoia NP (Fresno Co., M261E) experienced high levels of group mortality associated with dense clusters in campgrounds and recently burned sites. This valley sits on a long, narrow peninsula adjacent to the south fork of Kings River where recent water levels have been extremely low and bark beetle-associated mortality has been increasing. On the High Sierra RD, beetles continued to move through the nutmeg plantation (Fresno Co.), picking residual green trees missed in previous years, but also expanding into new areas.

The Sierra NF continued to have the most beetle activity in central California. Mature ponderosa pines surrounding Bass Lake (Madera Co., M261E) were dying in groups of 5-10 trees where previous activity had been noted. Larger groups continued to fade in older plantations around Pilot Peak and Sonny Meadows.

Coulter pine was killed by western pine beetle in several dense plantations on the Los Padres NF, Monterey RD (Monterey Co., M262B). Aerial surveys mapped approximately 620 acres of dead Coulter pine on the east side of the RD near Arroyo Seco Rd.

Defoliators

Black Oak Leaf Miner
Eriocraniella aurosparsella
Contribution by: Danny Cluck

No significant blotch mining of California black oak leaves by the black oak leaf miner occurred this year in the Blue Canyon area of the Tahoe NF (Placer Co., M261E). This is only the second year during the 9-year outbreak that defoliation was greatly reduced. The last year with limited defoliation was 2007. However, new and extensive areas of oak defoliation were detected by aerial survey near Sterling City (Butte Co., M261E).

California Oakworm
Phyrganidia californica
Contributions by: Tom Coleman and Steven Swain

This was an outbreak year for the California oakworm in the North Bay area, following the typical pattern of 5 to 7 years since the last outbreak (2007), which also followed a warm winter. Thousands of trees were repeatedly stripped of their leaves across a broad geographical region encompassing all of Marin and Sonoma Cos. (M261C). The pattern of damage was patchy, with some trees or stands suffering total defoliation, while other trees nearby remained relatively unscathed. Pesticide applicators primarily used *Bacillus thuringiensis* (Bt) formulations for control, though spinosad formulations were also used mid-season where generations overlapped and Bt did not provide adequate control. Other than for severe outbreak years, no control is generally needed or warranted for this pest.

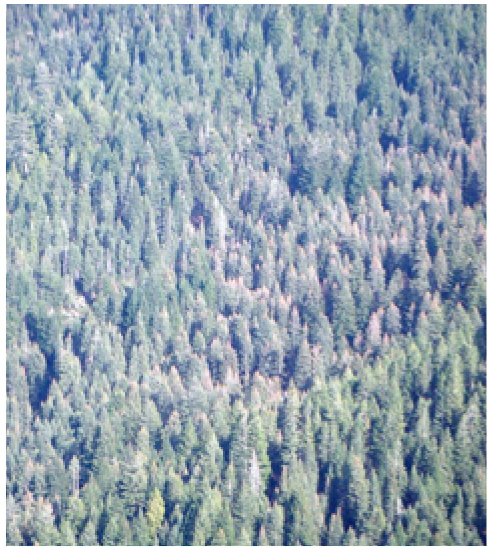


Fig 20: Defoliated tops of white fir, Plumas NF.

Photo by: D. Cluck

M261C

In the Carmel Valley area east of the Monterey RD, Los Padres NF (Monterey Co., M262B), a California oak worm outbreak collapsed. Heavy defoliation was limited to coast live oak located in isolated pockets along Carmel Valley Rd.

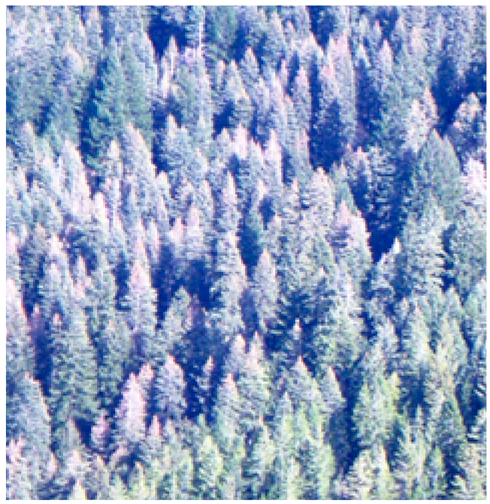


Fig 21: Defoliated tops of white fir, Plumas NF.

Photo by: D. Cluck

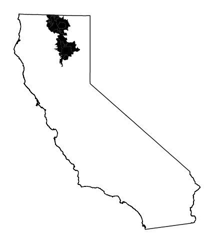
M262B

Douglas-fir Tussock Moth
Orgyia pseudotsugata
Contributions by: Beverly Bulaon, Danny Cluck, Don Owen, Tom Smith

Record high Douglas-fir tussock moth catches in the fall of 2012 were followed by light to moderate defoliation on the Plumas NF (~6,000 acres) south of Meadow Valley, east of Bucks Lake Wilderness, and east of Little Grass Valley Reservoir (Plumas Co., M261E). Defoliation was also observed on the west side of Burney Mountain on private timberland along Tamarack Rd. and on Ward Butte (Shasta Co., M261D). Most of the defoliation was limited to branch tips and tree tops of white fir. However, the Douglas-fir tussock moth feeding at Little Grass Valley Reservoir overlapped a previous white fir sawfly outbreak, leaving many trees completely defoliated. In the upper Lights Creek drainage, Plumas Co. (M261E), Douglas-fir tussock moth caused defoliation of white fir across roughly 500 acres. An egg mass survey conducted in the fall predicted continued defoliation in 2014, with some hot spots potentially experiencing severe defoliation.

Fig 22: Douglas-fir tussock moth defoliation of white fir.

Photo by: B. Bulaon



M261D

M261E

While early warning system trap catches in the southern Sierra Nevada range have increased (some traps exceeded 25 moths) since 2011 in historical locations, noticeable defoliation remained low.

Table 1: Number of Douglas-fir tussock moth pheromone detection survey plots in California by trap catch from 2001 - 2013

Year	# of plots reported/ % reported	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+
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%	95%	4%	1%											
2011	146	100	23	5	7	5	2	2	1	2	1	0	0	0	0
	*90%	68%	16%	3%	5%	3%	1%	1%	<1%	1%	<1%				
2012	133	76	18	5	7	4	7	3	4	4	4	1	1	0	0
	*82%	57%	14%	4%	5%	3%	5%	2%	3%	3%	3%	<1%	<1%		
2013	147	85	16	7	6	5	4	6	5	2	4	1	2	1	3
	*84%	58%	11%	5%	4%	3%	3%	4%	3%	1%	3%	<1%	1%	<1%	2%

*Some traps were not counted due to weather or because plots were burned in recent fires.

Fruittree Leaf Roller
Archips argyrospila
Contribution by: Tom Coleman

The fruittree leaf roller defoliated California black oak and low levels of interior live oak near Crestline and Lake Arrowhead on the western side of the San Bernardino NF, Mountaintop RD (San Bernardino Co., M262B). Defoliation levels are down from 2012.

M262B

Pandora Moth
Coloradia pandora
Contribution by: Danny Cluck

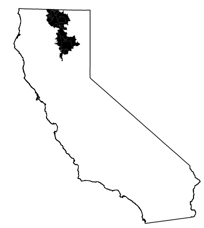
A suspected pandora moth outbreak partially defoliated approximately 200 acres of young ponderosa and Jeffrey pine plantations on the Lassen NF (Lassen Co., M261D). Larger diameter pines within and adjacent to plantations were also affected. Follow-up surveys will be conducted in 2014 to confirm the presence of this species.

Fig 23: Suspected pandora moth-caused defoliation of young ponderosa pine leader, Lassen NF.

Photo by: D. Cluck

White Fir Sawfly
Neodiprion abietis
Contributions by: Danny Cluck and Tom Smith

White fir sawfly-caused defoliation was greatly reduced in most areas throughout northeastern California. However, large numbers of larvae and defoliation were observed at Hamilton Mountain, Lassen NF (Lassen Co., M261D) and a few white fir saplings were defoliated in the La Porte area of Sierra Co. (M261E).



M261D

Other Insects

Alder Flea Beetle
Macrohaltica ambiens (= *Altica ambiens*)
Contribution by: Cynthia Snyder

White alders were defoliated by the alder flea beetle in Clear Creek drainage, a feeder to Whiskeytown Lake (Shasta Co., M261C). Trees re-foliated by the end of the season.

Fig 24: Jeffrey pine needles infested with black pineleaf scale.

Photo by: K. Camilli

Black Pineleaf Scale
Nuculaspis californica
Contributions by: Kim Camilli and Tom Coleman

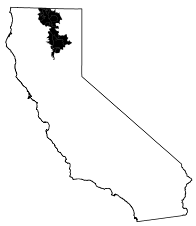
Black pineleaf scale was affecting a small population of Jeffrey pine in Tehachapi (Kern Co., M261E). The trees were dying back from the scale as well as from dwarf mistletoe.

M261E

High population densities of black pineleaf scale have impacted approximately 200 acres of Jeffrey pine in Idyllwild (Riverside Co., M262B) over the last 3 years. This year, 10 Jeffrey pines with severe infestations were subsequently attacked and killed by the California fivespined Ips within the infested area.

M261C

Cicada Damage
family *Cicadidae*
Contribution by: Don Owen


M261D

Nearly 100 young white fir trees (1-yr-old in 2012) died this spring in a Christmas tree plantation near Shingletown, Shasta Co. (M261D). Inspection of a subset of the trees showed that Cicada oviposition scars (eggs laid in 2012) were responsible. Tissue above scars was dead and discolored while tissue below was green. Scars were partially healed, but dissection showed that most had empty egg shells, indicating successful production of Cicada offspring. Incidental damage from Cicada is not unusual on branches of larger trees, but oviposition on stems of recently planted young trees is rare. The site is a converted brush field cleared in 2004, with several previous Christmas tree plantings.


M261E

Citrus Thrips
Scirtothrips citri
Contribution by: Tom Smith

Citrus thrips caused tip deformities and some branch dieback of Douglas-fir in a Christmas tree plantation in the Grass Valley area of Nevada Co. (M261E). Damage was severe enough in a number of trees to make them non-merchantable. Similar damage was reported at Christmas tree plantations from Grass Valley south to Cool in El Dorado Co. (M261E).


M261C

Flatheaded Fir Borer
Phaenops drummondi
Contributions by: Beverly Bulaon, Danny Cluck, Don Owen, and Steven Swain

Flatheaded fir borer activity contributed to Douglas-fir decline near Whitmore, Shasta Co. (M261C) in a predominantly ponderosa pine area, with Douglas-fir occupying north-facing slopes and areas near streams. Land managers expressed concern that root disease might be contributing to the decline, but individual tree inspections and mortality patterns did not support this. Rather, the trees appeared to suffer from periodic drought stress and attack by the borer – a common scenario for Douglas-fir on drier/warmer sites. Symptoms of decline included crown thinning from the top down, rounded tops on older trees (poor height growth), top and branch mortality, and resin streaming from the bole (indicative of borer attack). Tree mortality has been episodic at the site, with a handful killed by the borer in 2013. A 30+-year-old Douglas-fir plantation near Burney Creek (Shasta Co.) also had the borer colonizing and contributing to the mortality of trees with black stain root disease. The borer/black stain association was found in a number of widely scattered, second-growth Douglas-fir in surrounding mixed conifer stands.

Borer activity increased in drier mixed conifer stands with scattered Douglas-fir along the lower western slopes of the Lassen NF and adjacent private timberlands. This activity was highest where Douglas-fir was associated with drier pine and oak stands on south- and east-facing slopes. Notable activity was observed on private timberland along Little Giant Mill Rd. near Chapman Gulch, Tehama Co. (M261D) and along Deer Creek, Lassen NF (Tehama Co., M261D).

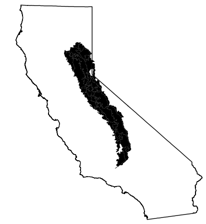
Flatheaded fir borer contributed to the decline and mortality of Douglas-fir at a certified American Tree Farm on Cohasset Ridge, Butte Co. (M261D). The ranch elevation is 2,900 ft. and supports mixed conifer and black oak. Trees were also inspected for root disease, and black stain was confirmed in one tree with advanced decline.


M261B

Localized severe infestations of flatheaded fir borer killed hundreds of small- to medium-sized Douglas-fir trees in an area several miles northeast of Glen Ellen on the western slope of the Mayacamas Mountains in the Trinity Rd. area of Sonoma Co. (M261B). The infestation appeared to be the result of Douglas-fir invading oak woodlands in wet years and then becoming stressed during dry years. The borers preferred colonizing the hundreds of

stressed firs, avoiding trees in drainages or near good water sources.

In central California, scattered flatheaded fir borer activity was mainly observed in midsized-diameter fading Douglas-fir. The most noticeable mortality was a patch kill of approximately 30 Douglas-fir trees in the Bridalveil Falls parking lot of Yosemite NP (Mariposa Co., M261E). The attacks were most likely incited by a recent low intensity underburn, as other tree species were also fading in the same area. Trees averaging about 18 in. DBH with very low scorch at the base were completely mass attacked by borers.



M261E

Flatheaded Wood Borer
Chrysobothris sp.
Contribution by: Don Owen

M261B

Numerous young incense cedars in a plantation near Brownsville, Yuba Co. (M261E) had moderately swollen and callused stem deformities that suggested some kind of past wounding or canker. Samples were shipped to the California Department of Food and Agriculture diagnostics lab. No pathogens were detected, but larvae of a *Chrysobothris* sp. wood borer were found in the underlying wood.

Gouty Pitch Midge
Cecidomyia piniinopis
Contribution by: Tom Smith

Gouty pitch midge caused twig and top dieback throughout a young ponderosa pine plantation on Sierra Pacific Industry land in Calaveras Co. (M261E). Symptoms included severely stunted and twisted twigs on trees up to 10 years old.

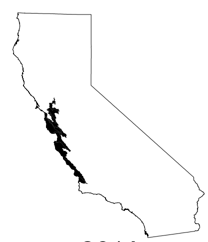
Jeffrey Pine Needleminer
Coleotechnites sp. near *milleri*
Contribution by: Beverly Bulaon

Fig 25: Jeffrey pine severely infested by Jeffrey pine needleminer in a South Lake Tahoe neighborhood.

Photo by: B. Bulaon

Jeffrey pine needleminer was found infesting Jeffrey pine in Al Tahoe, South Lake Tahoe (El Dorado Co., M261E), covering approximately 1 sq. mile. Damage is very similar in appearance to *Elytroderma* needle cast; however, Jeffrey pine needleminer-affected needles are hollow when held up to the light.

Oak Pit Scale
Asterodiapsis spp.
Contribution by: Steven Swain



261A

Oak pit scale affected hundreds of trees in the Glen Ellen and Sonoma region (Sonoma Co., M261B), most notably of which was in the Sonoma Valley Regional Park. Of the approximately 20 oak trees inspected in the park, all were infested to varying degrees; most (approximately 70 percent) were heavily infested. No mortality of larger trees was observed, but several smaller specimens were dead and had scars indicative of heavy infestations.

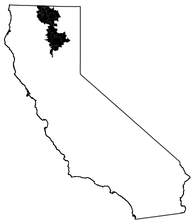
Oak Twig Girdler
Agrilus angelicus
Contribution by: Kim Camillli

261B

Oak twig girdler was affecting numerous coast live oak trees from Arroyo Grande to Los Alamos in San Luis Obispo and Santa Barbara Cos. (261A and 261B). High levels of damage were occurring on the infected trees, with smaller diameter twigs dying back. These insects are attracted to drought-weakened trees; however, overall tree health is typically not compromised by an infestation. The affected trees looked healthy, with deep green color and no crown thinning.

Fig 26: Coast live oak tree infected with oak twig girdler.

Photo by: K. Camilli



M261D

Pine Reproduction Weevil

Cylindrocoptorus eatoni

Contribution by: Don Owen

Plantation ponderosa pines stressed by drought and harsh site conditions were killed by pine reproduction weevils at two locations in northern California. In Shasta Co. (M261D), scattered mortality occurred across a 20-acre plantation just east of the confluence of Bailey and Rock Creeks. Contributing factors included a south-facing slope; areas of thin, rocky soil; brush competition; overstocking; and possible root disease (Armillaria from recently cut oak stumps). In Lassen Co. (M261G), scattered patches of trees were killed in a 70-acre plantation near Little Cleghorn Reservoir. In addition to pine reproduction weevil, Ips and woodborers were contributing to mortality, particularly among the larger diameter trees. Dying and adjacent living trees showed poor growth when compared with the majority of trees in the plantation. Needle and shoot elongation on surviving trees indicated the trees prematurely shut down growth during 2012. This pattern of poor growth and mortality was repeated at a number of distinct locations within the plantation, suggesting areas of poor (probably thin) soil.

Fig 27: Coast live oak leaves infected with oak twig girdler.

Photo by: K. Camilli

M261G

Pinyon Needle Scale

Matsucoccus acalyptus

Contributions by: Beverly Bulaon and Tom Coleman

An outbreak of pinyon needle scale that likely began 2 to 3 years ago was detected on the Santa Rosa Reservation (Riverside Co., M262B). While no tree mortality was observed, it has caused significant defoliation of four-needle pinyon pine over approximately 20 of the 75-acre infestation. Low-levels of defoliation were also observed on four-needle pinyon along Thomas Mountain of the San Bernardino NF, San Jacinto RD (Riverside Co., M262B). No previous outbreaks of this insect have been reported either on four-needle pinyon or in southern California.

Fig 28: Pinyon needle scale injury on four-needle pinyon pine on the Santa Rosa Reservation.

Photo by: T. Coleman

M262B

Pinyon needle scale has remained at outbreak levels in single-leaf pinyon on the Humboldt-Toyaibe NF (Mono Co., 341D). The scale is moving south and has been identified in several locations on the Inyo NF (Mono Co).

341D

Ponderosa Pine Twig Scale
Matsucoccus bisetosus
Contribution by: Don Owen

Ponderosa pine twig scale was found infesting the main stems and branches of high-value, 25-year-old ponderosa pines in a plantation along Tamarack Rd., Shasta Co. (M261D). The only symptom of infestation was on the upper stems where birds had chipped off bark in search of the scales. Branch and top dieback can occur if trees are subject to additional stress.

Red Gum Lerp Psyllid
Glycaspis brimblecombei
Contribution by: Kim Camillli

The red gum lerp psyllid, combined with drought, severe overcrowding, and secondary issues, such as the eucalyptus tortoise beetle and eucalyptus longhorned borer, was found affecting 38 sq. miles of red gum eucalyptus in Rancho Santa Fe (San Diego Co., 261B). Approximately three million trees were planted there by the Santa Fe Railroad company in the early 1900s to be harvested for railroad ties; however, the trees turned out to be unusable, so they were left unattended. Many trees began thinning and dying back, increasing hazardous conditions and fuel loads in the area. To mitigate current conditions, the area will be thinned, deep irrigated, and replanted with more fire-resistant tree species.

Sequoia Pitch Moth
Synanthedon sequoiae
Contribution by: Don Owen

Numerous attacks by the Sequoia pitch moth were noted on the upper boles of mature ponderosa pines in the Forbestown area of Butte Co. (M261E). Infested trees occurred in natural mixed conifer stands and had no obvious signs of injury or defect. What precipitated the attacks is unknown.

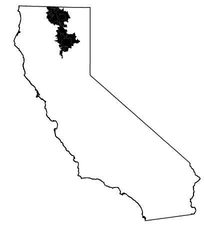
Twig Beetle on Pines
Pityopthorus boycei and *Pityophthorus* sp.
Contributions by: Beverly Bulaon and Danny Cluck

Twig beetles attacked several plantation pines on Antelope Mountain, Lassen NF (Lassen Co., M261D). Injury ranged from scattered branch flagging to whole tree mortality. Affected trees were growing on poor rocky soils and were also thought to be Jeffrey-Coulter hybrids planted in 1967.

The twig beetle appears to have increased in whitebark pine ecosystems within the eastern

Fig 29: Eucalyptus dieback in Rancho Santa Fe.

Photo by: K. Camilli



M261D

Fig 30: Twig beetle attacks caused branch flagging on this plantation pine, Antelope Mountain, Lassen NF.

Photo by: D. Cluck

261B

Fig 31: Twig beetles in whitebark pine, Rock Creek Recreation Area, Inyo NF.

Photo by: M. MacKenzie

M261E

M261E

Sierra Nevada range. Approximately 10 to 30 percent of green trees were infested, and all sizes were noted with broken twigs. Along Hilton Lakes Trail (Inyo Co., M261E), beetles were first observed in lodgepole pine, but infestations grew more severe in whitebark pine communities where the beetles appeared to choose whitebark over lodgepole pine. This beetle had been found 2 years ago on the southern side of the Rock Creek watershed (along Wheeler Ridge) with similar conditions (Inyo Co.). The correlation between twig beetle and mountain pine beetle host selection has not yet been determined.

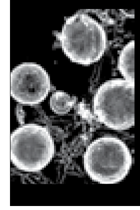
Fig 32: Woodboring beetle galleries in fire-killed white fir, 2012 Chips Fire, Lassen NF.

Photo by: D. Cluck

M261D

Woodboring Beetles
families Cerambycidae and Buprestidae
Contribution by: Danny Cluck

Woodboring beetle activity was especially high in fire-killed trees from the 2012 Reading Fire, Lassen NF (Shasta Co., M261D). Woodpeckers were actively feeding on larvae in fire-killed trees over the winter and by mid-summer, many pine species and some true fir had significant degrade due to deep larval galleries in the sapwood. Blue stain fungi were associated with many of these attacks. Earlier in the year, smaller diameter trees and the tops of larger diameter trees had the most beetle activity. Pines generally had more activity than true fir throughout the year, and completely blackened trees had more activity than red-needled trees. Numerous flatheaded fir borer, *Phaenops drummondi*, and spotted pine sawyer, *Monochamus clamator*, were collected from infested logs.



Disease Conditions

Disease Conditions in Brief

By Tom Smith

Precipitation remained low in California for a second year; however, there were some late seasonal rains in the spring and early summer. Snowpack also remained low throughout the state, making 2013 the driest year on record for California. Low precipitation can impact a number of diseases, increasing some while decreasing others, and leaves trees stressed, making them more vulnerable to forest pests and fire.

Invasive species remained a top disease concern for potential impacts to California's forests and woodlands. The new polyphagous shot hole borer/fusarium disease complex in southern California spread from Los Angeles and Orange Cos. into neighboring Riverside and San Bernardino Cos, and a potentially separate introduction was found in El Cajon, San Diego Co. Over 110 tree and woody plant species in urban and wildland settings were found to be hosts of the complex, with the most damage and mortality found in box elder, California sycamore, castorbean, avocado, coast live oak, English oak, valley oak, big leaf maple, Japanese maple, goldenrain tree, red willow, olive, persimmon, silk, American sweet gum, palo verde, blue palo verde, coral, weeping willow, tortuosa, and white alder.

Port-Orford-cedar root disease continued to spread at a Siskiyou Co. site in northern California, causing concern over potential spread to neighboring stands and other new uninfested areas.

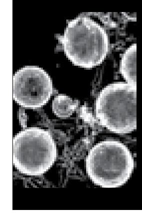
Sudden oak death remained the major cause of mortality in coastal California from Monterey to Humboldt Cos., with tanoak and coast live oak mortality severe in several locations. New infestations of the disease were found in parts of the northern coastal region of the state, including Jackson Demonstration State Forest and near the borders of the Six Rivers NF and Trinity Co. Aerial surveys of mortality found over 294,000 dead trees on approximately 47,500 acres, and research indicated that coast redwood wildfire-related mortality increases significantly in infested areas.

Increased levels of white pine blister rust infection on the alternate Ribes host was seen for the first time in many years and was common throughout the Sierra Nevada range, suggesting an increase in the disease on five needle pines is likely in the coming years. Screening for major gene and slow rusting resistance continued throughout the state.

Maple leaf scorch surveys in 2013 found the disease throughout northern California. Isolation of the causal organism has remained difficult.

Native diseases such as cankers, root rots, dwarf mistletoes, and rust diseases continued to damage and kill trees in California. Significant issues in 2013 included black stain and heterobasidion root diseases as well as abiotic problems, such as heat, frost, and drought damage.

Gray pines were found declining in many areas of the state, with significant damage found in the central and southern Sierra Nevada range as well as throughout the central coast and around Clear Lake, Lake Co. The exact cause was unknown, but was suspected to be a combination of severe drought stress, bark beetle attack, dwarf mistletoe infestation, and root disease.



Introduced Diseases

Dutch Elm Disease

Ophiostoma novo-ulmi
Contribution by: Tom Smith

Dutch elm disease continued to kill planted elm trees within Sacramento (Sacramento Co., 262A) as well as the Granite Bay area (Placer Co., 262A).

262A

Fusarium Dieback/Polyphagous Shot Hole Borer Complex

Fusarium euwallaceae
Contributions by: Tom Coleman and Akif Eskalen

In 2013, the polyphagous shot hole borer (PSHB, *Euwallacea* sp.) and Fusarium dieback (*Fusarium euwallaceae*) were found in California sycamore (*Platanus racemosa*), castorbean (*Ricinus communis*), red willow (*Salix laevigata*), and white alder (*Alnus rhombifolia*) in Pasadena Glen and Santa Anita Canyon on the Angeles NF, Los Angeles RD (Los Angeles Co., 261B). The ambrosia beetle attacked a wide range of diameter size classes (2 to 32 in. DBH) in Pasadena Glen. Ground surveys confirmed mortality of red willow and castorbean occurring at low levels within the area (see pages 8 and 9 for a distribution map and additional images).

Fig 33: Internal symptoms of beetle/ Fusarium on box elder tree.

Photo by: A. Eskalen

261B

This new exotic pest complex is caused by the fungus forming a symbiotic relationship with PSHB (morphologically indistinguishable from the tea shot hole borer, *Euwallacea fornicatus*), which is resulting in dieback and mortality on agricultural and landscape trees in the counties of Los Angeles (M262B and 261B), Orange (261B), and San Bernardino (M262B). When the beetle burrows into a tree, it inoculates it with the fungus, which attacks and plugs the tree's vascular tissue, blocking water and nutrients and eventually causing branch dieback. The fungus is the food source for the larvae.

Fig 34: A wilted box elder tree on the street in Ontario city.

Photo by: A. Eskalen

M262B

California sycamore, box elder (*Acer negundo*), maple (*Acer* spp.), red willow, and castorbean are optimal trees to survey for signs of beetle presence as PSHB tends to infest these hosts first whenever present. Depending on the tree species, PSHB injury can be identified either by staining, gumming, or a white-sugar exudate on the outer bark in association with a single beetle entry hole. At advanced infestation stages, there are often many entry/exit holes (approximately 0.033 in) in the tree. Female beetles are black and approximately 0.07-0.1 in. long; males are brown and about 0.05 in. long.

To date, PSHB has attacked more than 110 different tree species, but can produce brood in approximately 24 species, including box elder, California sycamore, castorbean, avocado

M262B

(*Persea americana*), coast live oak (*Quercus agrifolia*), English oak (*Q. robur*), valley oak (*Q. lobata*), California sycamore (*Platanus racemosa*), big leaf maple (*Acer macrophyllum*), Japanese maple (*A. palmatum*), red willow, goldenrain (*Koelreuteria paniculata*), olive (*Olea europaea*), persimmon (*Diospyros* sp.), silk (*Albizia julibrissin*), American sweet gum (*Liquidambar styraciflua*), coral (*Erythrina corallodendon*), weeping willow (*Salix babylonica*), blue palo verde (*Parkinsonia florida*), palo verde (*Cercidium floridium*), tortuosa (*Salix matsudana*), and white alder.

By the end of 2013 the complex had spread into Riverside Co. (M262B) and a separate infestation had been discovered in El Cajon, San Diego Co. (M262B).

M261B

Phytophthora Root Rot

Phytophthora cinnamomi

Contributions by: Elizabeth Bernhardt, Tom Smith, and Ted Swiecki

A stand of six mature green ash trees were found exhibiting severe dieback in Covelo (Mendocino Co., M261B). Symptoms were consistent with those of root rot typically caused by *Phytophthora cinnamomi*, which is often found in over watered yards.

263A

At two locations in the Mt. Tamalpias watershed (Marin Co., 263A), *P. cinnamomi* was confirmed for the first time causing root disease. *Phytophthora cinnamomi* was recovered via soil baiting samples collected in a root disease center along the Hoo-Koo-E-Koo Trail. Virtually all of the giant chinquapin (*Chrysolepis chrysophylla*) were killed within the affected zone, which covered at least 0.4 acre. Much of the mortality was relatively old, dating back to at least 2007 based on aerial imagery; however, recent tree mortality was observed along the zone edges. In addition to chinquapin mortality, evergreen huckleberry showed extensive dieback and coast redwoods had severe canopy thinning. The affected area was on a mid-slope position and extended at least 70 ft. downslope and 30 ft. upslope along a relatively level 100 ft. section of trail. Chinquapin mortality was previously associated with *P. cinnamomi* in the Oakland Hills.

At the second Marin Co. location, madrone mortality was associated with *P. cinnamomi* on dry upland sites above Bon Tempe Lake. The pathogen was baited from soil beneath dead and dying madrones at two sites separated by about 200 ft. on an upper hill slope above the south end of the Pumpkin Ridge Trail on Marin Municipal Watershed District land. At the uppermost site, canopy thinning consistent with root disease was also seen in California bay laurel and coast live oak. Additional madrone mortality consistent with *Phytophthora* root rot was observed 0.25 mile downslope from these infested sites. About 0.5 acre of symptomatic plants were seen across the three sites.

Fig 35: Dead Port-Orford-cedar at the Saint Germaine Foundation Property in Dunsmuir.

Photo by: P. Angwin

M261A

Port-Orford-cedar Root Disease

Phytophthora lateralis

Contributions by: Pete Angwin and Don Owen

Since its discovery in 2010 at Shasta Springs (Siskiyou Co., M261A), Port-Orford-cedar root disease has continued to infect and kill Port-Orford-cedar (POC) within the 6- to 8-acre stand that is centered over the springs. While a handful of dying trees were initially observed, the current estimate is 50-60 dead or dying trees, including some of the largest POC in the Sacramento River drainage. All POC in the stand are likely to become infected. Concern exists for POC at nearby Mossbrae Falls, an area frequently visited by the public. A natural break exists in the continuity of POC between the two stands and it is hoped that this, along with management actions, will prevent further disease spread.

In the mid-1990s *Phytophthora lateralis* was introduced to POC at the intersection of Bluff Creek Rd. (FS Rd. 13N01) and Fish Lake Creek (Humboldt Co., M261A). Port-Orford-cedar root disease rapidly spread in POC along Fish Lake Creek to the south side of Fish Lake. In 2010, POC began to die in a 5-acre patch 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. Although additional mortality was noted in 2013, the disease did not appear to have spread to the few POC within the campground.

Fig 36: Port-Orford-cedar root disease mortality adjacent to Fish Lake Campground, Six Rivers NF.

Photo by: P. Angwin

M261C

Seiridium Canker
Seiridium cardinale
Seiridium unicorne
Contributions by: Pete Angwin and Kim Camilli

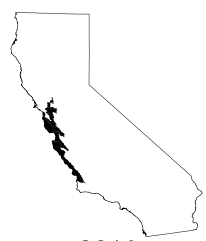
<u>*Seiridium cardinale*</u>
Seiridium canker caused branch dieback and topkill in three Port-Orford-cedar at the Redding Memorial Park cemetery in Redding (Shasta Co., M261C).

Fig 37: Branch dieback and topkill in ornamental Port-Orford-cedar at the Redding Memorial Park.

Photo by: P. Angwin

<u>*Seiridium unicorne*</u>
Seiridium canker was significant on Monterey and Leyland cypress in windbreak plantings in Santa Barbara, San Luis Obispo, and Kern Cos. (261B, 261A, M261E). Symptoms included tip dieback and progressive branch dieback, with girdling cankers causing branches to fade from green to yellow to reddish-brown. The pathogen was able to spread due to the close proximity in plantings.

261B



261A

Fig 38: Leyland cypress windbreak dieback from Seiridium canker.

Photo by: K. Camilli

Sudden Oak Death
Phytophthora ramorum
Contributions by: Kim Camilli, Phil Cannon, Susan Frankel, Heather Mehl, Don Owen, Katie Palmieri, Tom Smith, and Steven Swain

<u>Sudden Oak Death Tree Mortality and Infestation Status</u> - Sudden oak death (SOD, caused by *Phytophthora ramorum*) continues to be the primary cause of tree mortality in coastal California from Monterey Co. (261A) north to Humboldt Co. (263A), according to USDA FS Pacific Southwest Region, Forest Health Protection 2013 aerial survey. Tanoak mortality is severe in the Santa Cruz Mountains as well as along the coast in Sonoma, Marin and Monterey Cos. (263A, 261A), with the most severely impacted areas in Jenner and Guerneville (Sonoma Co.) as well as Big

263A

Map 3: Oak and tanoak mortality associated with sudden oak death, detected via aerial survey during 2013.

Photo by: Z. Heath

263A

261A

M261A

M262A

Sur and Mill Creek (Monterey Co.). In coastal Mendocino Co. (263A); new pockets of tanoak mortality were seen in and near Fort Bragg. Intense coast live oak mortality was mapped in the Oakland hills (Alameda Co., 261A) and east of Watsonville (Santa Cruz Co., 261A), about nine miles from the closest SOD confirmation. Similar to past years, no tanoak mortality was observed in Del Norte Co. (263A). The total number of acres with recent mortality and number of trees killed due to SOD in California is slightly lower than last year's levels, with over 294,000 dead trees on 47,500 acres. California's 2012 SOD mortality levels were the highest since 2007, and elevated mortality levels continued into 2013, particularly in cooler coastal areas.

Phytophthora ramorum has been confirmed near the Six Rivers National Forest (SRNF) and the Trinity Co. (M261A) line, with infected tanoak and California bay laurel less than 1 mile from both the SRNF boundary and Trinity Co. boundary. The pathogen is spreading from the Redway area, further north in the Larabee Creek corridor, and is now approximately 7.5 miles south of the town of Bridgeville (Humboldt Co., 263A).

Other significant new finds include an infestation at Jackson Demonstration State Forest (Mendocino Co., 263A), and at Golden Gate Park (San Francisco Co., 261A) in a nursery adjacent to the AIDS Memorial Grove. The Golden Gate Park discovery was part of the 2013 SOD Blitz survey, with over 400 volunteer surveyors, led by Matteo Garbelotto, UC Berkeley. For more SOD Blitz results, see the UC Berkeley Forest Pathology and Mycology website at http://nature.berkeley.edu/garbelotto/english/index.php.

Stream Monitoring Survey

In 2013, 136 waterway sites distributed throughout Del Norte, Humboldt, Mendocino, Sonoma, Monterey, San Luis Obispo (261A), and San Benito (M262A) Cos. were monitored for *P. ramorum*. Waterway monitoring is a collaborative effort lead by Heather Mehl out of David Rizzo's laboratory, UC Davis.

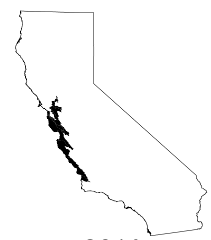
In Humboldt Co. (263A), *P. ramorum* was detected for the first time in Roaring Gulch, an upper tributary of Redwood Creek located in Redwood Valley. With the exception of a monitoring site on Redwood Creek, all watersheds monitored in Redwood NP remained negative. All watersheds monitored on Hoopa Valley and Yurok Tribal lands also continued to be *P. ramorum* negative. In the McKinleyville area, two new monitoring sites located upstream of a residential development area tested positive for *P. ramorum*, and in southern Humboldt Co. (263A), a new monitoring site along the southwestern border of the SRNF (North Dobbyn Creek) was consistently *P. ramorum* positive.

In Mendocino Co. (263A), a new monitoring site on a tributary of the South Fork of the Eel River (Hollow Tree Creek) tested *P. ramorum* positive once in March. The South Fork of the Noyo River (SRNF) watershed in the Jackson Demonstration State Forest (JDSF) was intensively sampled this year to pinpoint the source of inoculum detected in the watershed in 2012. *P. ramorum* was recovered from the North Fork of the SRNF and from a small tributary of the South Fork of the SRNF (Peterson Gulch). The Little North Fork of the Big River (LNFB), sampled in Mendocino Woodlands SP, tested *P. ramorum* positive for the first time in May and June. The LNFB watershed spans both Mendocino Woodlands SP and JDSF lands. Several ground surveys have been conducted in response to this find, but terrestrial infections in this watershed have not been identified.

In Sonoma Co., (263A) multiple watersheds in the Kruse Rhododendron State Natural Reserve and Salt Point SP were sampled in response to a terrestrial *P. ramorum* detection in this area in 2012. *P. ramorum* was recovered from all sampled watersheds, indicating extensive pathogen spread along this portion of the Sonoma coast.

263A

There were no new positive watersheds in Monterey Co. (261A), and all watersheds monitored in San Luis Obispo Co. (261B) were *P. ramorum* negative this year. In 2012, *P. ramorum* was detected through PCR-based diagnostics in San Carpoforo Creek, a watershed spanning both Monterey and San Luis Obispo Cos.; however, no samples from this watershed were positive in 2013.



261A

261B

<u>Management</u>

In Humboldt Co., 2013 has been a year of transition for SOD management, with the Redwood Valley eradication effort shifting from direct control (the rapid removal of infected tanoak and bay laurel) to a still evolving strategy of conservation management, where stand species composition is redirected toward conifers, with a goal of tanoak retention at low levels and slowed pathogen spread.

Since 2011, an isolated outbreak (initially detected on privately owned properties in 2010) in Redwood Valley has been under direct control, with 350 acres and a buffer zone treated with herbicide or by removal of infected trees. The multi-agency collaborative effort, led by University of California Cooperative Extension, Humboldt and Del Norte Cos., has relied on early detection and rapid response. Despite treatment, wet springs led to pathogen spread in 2010, 2011, and 2012; consequently, eradication would now require treatment of more than 2,000 additional acres. The infestation spread to steep, rocky, densely vegetated terrain around Lacks Creek, instigating the Bureau of Land Management (BLM) Arcata Field Office to propose an indirect approach roadside buffer, intended to meet multiple forest health objectives, including development of SOD-resistant and -resilient stands, conversion of tanoak-dominated stands to conifers, a fuel break, and slowed pathogen spread toward Hoopa and Yurok lands as well as Redwood National and State Park. However, the infested trees were not removed due to accessibility issues. This strategic response continues to evolve as new infestations are detected.

In Big Sur (Monterey Co.), where millions of trees have been killed by *P. ramorum* since the mid1990s, management focus is on decreasing fuel loads. The Los Padres NF and the Nature Conservancy's Fire Learning Network initiated Fire Scape Monterey in the spring of 2011, which brings community members and 27 public and private organizations together to work on local fire issues. Fuel reduction projects have been conducted at the Santa Lucia Preserve in Carmel Valley with hundreds of standing dead tanoaks felled and chipped on site. Additionally, the California Department of Forestry and Fire Protection is supporting multiple fuel reduction projects in the region, and the Palo Colorado community and Mid-Coast Fire Brigade have pooled resources to implement a self-funded project to collectively remove fuels along four miles of shared roadway.

In San Mateo Co. (261A), the San Francisco Public Utilities Commission (SFPUC) has been applying Agri-Fos® annually since 2008 as a large-scale field application for protection of a high-value tanoak stand above Crystal Springs Reservoir. The pathogen was first detected in the stand in 2011. The trunk spray application of potassium phosphite did not appear to impede SOD development in the stand, where about 15 percent of the trees died in the treated area (a level slightly higher than the untreated control plot). The SFPUC has discontinued trunk spray applications, but is continuing trials with removal of California bay laurel to protect coast live oak in another part of the watershed.

Research Highlights

Coast redwoods are nearly four times more likely to die during forest fires in SOD-infested forests than in non-infested forests, according to a recent study conducted by Metz and others (2013). Tanoak killed by SOD result in more fuel for wildfires as well as decreased moisture levels in affected forests as shade diminishes in the absence of trees. These dynamics make SOD-infested forests dryer and facilitate flame travel into the canopy, allowing fire to scorch nearby redwood crowns.

Hayden and others (2013) identified tanoak traits and seedling families with increased survivorship in planted trees, and a framework to further identify seed parents for restoration. Expanding on this, Richard Cobb and David Rizzo, UC Davis are working with the Hoopa, Yurok, SRNF, BLM-Arcata Field Office and others to determine the level of resistance to *P. ramorum* of culturally significant tanoaks in Humboldt Co.

Little is known about the basic ecology of tanoak, the tree species most susceptible to *P. ramorum* in California. Wright and Dodd (2013) conducted a pollination study in cooperation with the Midpennisula Regional Open Space District and demonstrated that tanoak is primarily an insect-pollinated species, though some level of wind pollination is likely. Prior to the study, it was assumed that tanoak was wind pollinated.

Cobb and others (2013) published a new conservation strategy for tanoak that incorporates both pathogen-centric management and host-centric preventative treatments to reduce rates of *P. ramorum* spread and local prevalence as well as increase protection of individual trees. The strategy is based on recent findings identifying heritable disease resistance traits, ameliorative treatments that reduce pathogen populations, and silvicultural treatments that shift stand composition, holding promise for increasing the resiliency of tanoak populations.

Resources

Progress on SOD research and management has been compiled in two volumes: the Proceedings of the Sudden Oak Death Fifth Science Symposium (available online at http://www.fs.fed.us/psw/publications/documents/psw_gtr243/) and Tanoak: History, Ecology, and Values published by the California Botanical Society as a special issue of Madroño, Volume 60, Number 2. Over a decade of research on tanoak is reviewed, and many of the papers were presented orally at "Tanoak Wild: A Celebration," June 22, 2012, as part of the Fifth SOD Science Symposium. 2013. The issue is available at http://www.calbotsoc.org/special_issues.html.

SODMAP mobile is a new app available for the iPhone and Droid. Developed by the UC Berkeley Forest Pathology and Mycology Lab, the app is intended for field use and allows the user to identify the locations of trees sampled for *P. ramorum* and determine the health of each tree at the time of sampling. The app can also calculate the risk of infection at the location where the user is by using the number of sampled trees in the area and proximity of positive trees. High- or moderate-risk ratings indicate action may be needed to preventively protect oak trees. This tool can assist in helping property owners and managers as well as tree care professionals make management decisions; however, other factors must be taken into consideration, such as host distribution, weather patterns, and land management goals.

Also new this year is "A Reference Manual for Managing Sudden Oak Death in California," by Swiecki and Bernhardt (2013), which provides background information and guidance for resource management professionals and landowners that are managing SOD in California.

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White Pine Blister Rust

Cronartium ribicola

Contributions by: Pete Angwin, Joan Dunlap, Tom Smith, and Bill Woodruff

M261E

Monitoring

White pine blister rust (WPBR) remained a problem throughout the Sierra Nevada range (M261E), affecting sugar pines and other five needle pines. For the first time in several years, the incidence of rust infection on the leaves of the alternate host (*Ribes* spp.) was significant, suggesting possible disease spread or intensification in the near future.

The disease continued to be a major concern in the 10-acre, ecologically significant population of foxtail pine (with some western white pine) at Lake Mountain Lookout on the Happy Camp RD, Klamath NF (Siskiyou Co., M261A). Encroachment by red fir also threatens the population.

Fig 39: Western white pine sapling with a WPBR canker growing into the bole from an infected branch. Orange blisters contain aeciospores of the rust fungus *Cronartium ribicola*.

Photo by: B. Woodruff

M261A

White pine blister rust was also observed on overstory and understory western white pine near the Sierra Nevada crest, south of Yuba Pass on California Highway 49 in Sierra Co. (M261E). Symptoms included seedlings, saplings, and mature western white pine with dead or dying tops and branches as well as cankers, indicating the area is at risk for future infections. A large number of mature western white pine had older dead or flagging branches, which were probably killed by WPBR; however, a large number of the pines appeared to be disease free. Symptoms of WPBR on numerous western white pines of all

Fig 40: Western white pine sapling with dead top resulting after the bole was girdled by a WPBR canker.

Photo by: B. Woodruff

M261E

M261D

sizes appeared to be the result of 'slow rust' WPBR resistance. Possible WPBR slow rust resistance (SRR) in western white pine in this area is of interest to the USDA FS Pacific Southwest (PSW) Region 5 Genetic Resources staff for future study.

Resistance Program

The USDA FS, PSW Region 5 Genetic Resources staff has a program of screening primarily sugar pine (*Pinus lambertiana*) for genetic resistance to WPBR (*Cronartium ribicola*). Screening for major gene resistance (MGR) occurs at the Placerville Nursery, Eldorado NF (El Dorado Co., M261E), and for SRR at two field sites on the Happy Camp RD, Klamath NF (Siskiyou Co., M261D). To date, 1,805 live MGR sugar pines have been identified via the rust resistance screening of their seedling progeny at the Placerville Nursery. However, it is expected that some of the trees on the Stanislaus NF (Stanislaus Co., M261E) were lost in the Rim Fire this past summer. In addition to these trees, 1,041 SRR trees were selected from 673 families at the Happy Camp field site, many of which have been clone banked and/or added to seed orchards.

This past spring, 12 new MGR sugar pine trees (out of 264 families) and two new MGR western white pines (out of 53 families) were identified during rust resistance screening in Placerville; parent trees were located on the Plumas, Tahoe, Klamath, Lassen, Shasta-Trinity, and Stanislaus NFs (M261E). In winter 2014, 288 new sugar pine and nine western white pine families will be sown for MGR screening from forests across the Region; 180 will be from northern forests, 71 from the Lake Tahoe Basin and an adjacent seed zone, and 37 from southern California forests. These areas are underrepresented with regard to MGR trees relative to the western Sierra Nevada range NFs. In addition, 77 families will come from private industry lands.

On the Klamath NF, activities related to slow rust evaluations continued with the planting of 465 MGR sugar pine seedlings from 113 families, 41 western white pines from two MGR families at the Happy Camp outplanting field site, and 5,384 untested seedlings from 261 non-MGR North Zone families at the nearby Classic field site, all of which were grown at the Placerville Nursery. Evaluations led to the selection of 90 new sugar pines with SRR traits from 1,600 surviving trees in four fields. After a second review, selected material will be grafted and added to the Foresthill seed orchard, representing material from northern California forests that includes both MGR and MGR-SRR sugar pines. Also, for the fourth consecutive year, trees in the SRR heritability study were scored. Rust mortality is now at 58 percent of the original 7,512 trees. Four percent of those trees currently show no sign of infection, six percent show complete slow rust reactions (bark or blight) with no fungal activity, and 25 percent of the live trees show inactive slow rust traits or are rust free. The SRR families are continuing to show increased disease resistance and durability to the virulent strain of blister rust inoculum on the site. In contrast, the 2006 MGR sugar pine planting, which is adjacent to the study site, has 93 percent mortality and no clean trees. The results are providing evidence for the usefulness of SRR in the Region 5 Sugar Pine Rust Resistance Program and are consistent with the genetic approach to SRR for western white pine in other regional programs.

The 2013 sugar pine cone crop was generally light. In central and northern California, cone collections were made from 20 proven MGR sugar pine trees on public and private lands. At the Foresthill seed orchard, over 1,800 cones from MGR trees were bagged for collections; their seed will be added to the regional seed bank. Cones were also collected from 100 new MGR candidates in northern California forests and seven new candidates in southern California forests. The collections were completed using contractors, forest staff, a non-profit organization at Lake Tahoe, and Forest Service smokejumpers in Redding. Private industry staff also collected cones from 76 MGR-candidate trees. As part of an ongoing genetic conservation effort in high-elevation white pines, cones were also collected from whitebark pines in the region.

Native Diseases

Blights and Cankers

Bacterial Leaf Scorch
Xylella fastidiosa
Contribution by: Melody Lardner

Fig 41: Sweetgum tree exhibiting early symptoms of infection by *Xylella fastidiosa*.

Photo by: M. Lardner

Sweetgum, a non-native landscape tree in California, continued to exhibit signs of bacterial leaf scorch across in the Inland Empire of San Bernardino and Riverside Cos. (M262B) in such locations as Redlands, San Bernardino, Loma Linda, Bloomington, Riverside, Moreno Valley, and Hemet. Some trees died while others continued to exhibit crown dieback. Symptoms were often present throughout entire neighborhoods.

M262B

Botryosphaeria Canker
Botryosphaeria sp.
Contributions by: Don Owen and Tom Smith

Botryosphaeria canker caused limb and top dieback on planted incense cedar and giant sequoia trees at Turtle Bay Exploration Park in Redding, Shasta Co. (M261C). The canker is associated with heat and drought stress and is quite common on sequoia in Redding. Incense cedar often does well in the area except on droughty sites or when planted too densely.

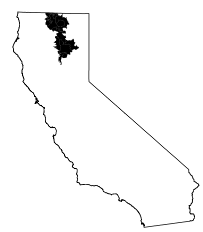
M261C

Birch trees planted throughout the San Joaquin Valley showed significant amounts of Botryosphaeria canker, especially in Merced (262A).

262A

Cytospora Canker
Cytospora abietis
Contribution by: Don Owen

Drought-stressed red fir in the vicinity of Stouts Meadow, Shasta Co. (M261D) suffered branch dieback due to Cytospora canker and associated dwarf mistletoe. The most heavily damaged trees had mistletoe infections throughout the crown and flagging in more than 50 percent of the crown. Cytospora-caused dieback has occurred here during previous droughts.



M261D

Dothistroma Needle Blight
Mycosphaerella pini
Contribution by: Tom Smith

Dothistroma needle blight caused the tips of 1-year-old ponderosa pine needles to turn reddish-brown in a stand of mature trees near Coulterville, Mariposa Co. (M261E). The stand has not previously shown signs of the blight.

M261E

Elytroderma Needle Cast
Elytroderma deformans
Contribution by: Danny Cluck

Signs and symptoms of elytroderma needle cast were apparent on the foliage of Jeffrey

Fig 42: Elytroderma needle cast on Jeffrey pine, Plumas NF.

Photo by: R. Tompkins

M261E

263A

pines growing in a plantation near Bucks Lake, Plumas NF (Plumas Co., M261E). The lower crowns of most trees were infected.

Fireblight
Erwinia amylovora
Contribution by: Steven Swain

Fireblight was a serious problem in the North Bay area this year, presumably due to exceptionally warm weather (80° F) during two weeks in February that coincided with the bloom of many pome trees (pears, apples, and quince). Ornamental and fruiting pears were hit particularly hard, with only a few examples of damage to apples and quince. In many cases, ornamental pears (*Pyrus calleriana*, notably 'Aristocrat,' but others as well) were damaged so severely that therapeutic pruning could not produce an aesthetically pleasing result, so owners elected to remove the trees. The damage was region-wide, afflicting thousands of trees in communities from Corte Madera to Point Reyes Station to Sebastopol (263A). In one Corte Madera shopping center alone, more than 40 trees were being considered for removal due to the extensive damage. Local tree companies could not keep up with demand for pruning services from May to July.

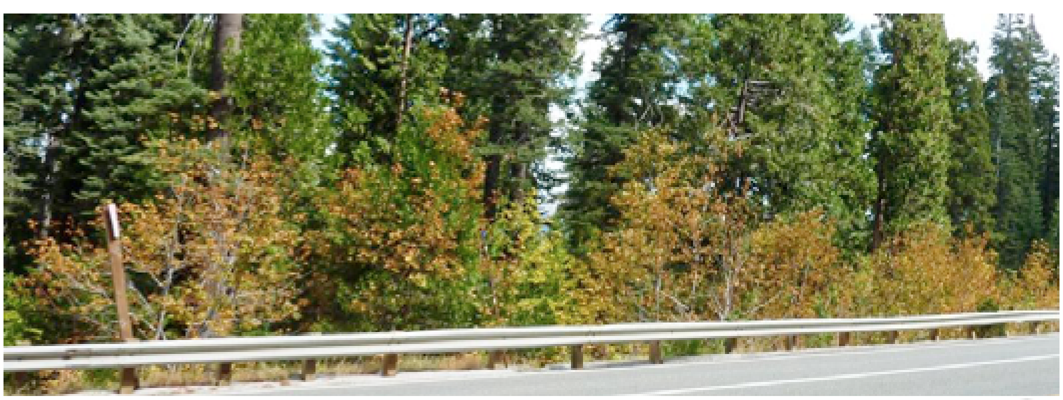
Maple Leaf Scorch
Unknown cause
Contributions by: Danny Cluck and Bill Woodruff

Maple leaf scorch (MLS) may have first been reported in California's 1964 Forest Pest Conditions Report: "*Big leaf maple appeared to have a blight that inhibited full leaf development and caused a browning of the leaf margins. Sometimes only the terminal growth was affected but in other trees the entire leaf compliment was dwarfed. This blight in varying degrees of intensity was reported from central Oregon to Yosemite National Park.*" Since then, scorching of big-leaf maple has appeared in the report either as an abiotic disease or one possibly caused by insects or bacteria vectored by insects. The cause of MLS has yet to be proven.

In 2012, bacteria in 11 of 108 big-leaf maple samples sent to Rutgers University from 85 locations in northern California was identified via PCR analysis as *Xylella fastidiosa*, and bacteria from four of the 11 samples was identified as *X. fastidiosa* subsp. *Multiplex*. That same year, none of the samples sent to UC Davis, UC Riverside, or Texas A&M for culturing tested positive for *X. fastidiosa*. A viable *X. fastidiosa* isolate has never been recovered from California big-leaf maple; therefore, Koch's Postulates have yet to be completed to prove that it is the cause of MLS.

Fig 43: Maple leaf scorch along CA Highway 20.

Photo by: B. Woodruff



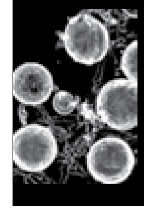


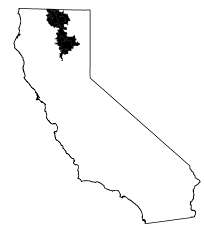
Fig 44: Big-leaf maple leaves with symptoms of maple leaf scorch.

Photo by: B. Woodruff

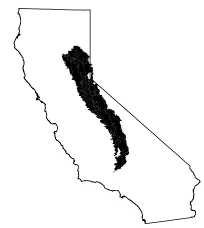
Fig 45: Declining big-leaf maple with maple leaf scorch along CA Highway 70 near Cresta just above North Fork Feather River.

Photo by: B. Woodruff

M261B



M261D



M261E

In 2013, MLS symptoms were again present throughout northern California. A subset of the 2012 MLS big-leaf maple sample trees were once again tested for *X. fastidiosa* using PCR screening at Rutgers University, UC Riverside, and Texas A&M labs. Trees in Nevada, Plumas, Shasta, Sierra, Tehama, and Trinity Cos. (M261B, M261D, M261E, and 262A) were sampled. Leaf samples were collected several weeks apart from each sample tree throughout the summer in an attempt to learn if *X. fastidiosa* in big-leaf maple can be more readily detected and/or isolated from leaves of different ages. In addition to the standard practice of screening petiole tissue for *X. fastidiosa*, labs were also asked to screen leaf tissue from some of the samples to learn more about where the bacteria resides in the leaf. Wood was also drilled from the trees for DNA screening. Final 2013 PCR leaf and wood screening results are pending. Preliminary verbal reports are that a few *X. fastidiosa* positives have resulted from leaf samples.

A systemic insecticide trial (IMA-jet, Imidacloprid, EPA #74578-1) was conducted on big-leaf maple in 2012 in Plumas Co. (M261E) in an attempt to eliminate leafhopper feeding on foliage. Subsequent observations of treated and untreated trees in 2012 and 2013 indicated that leafhopper feeding was greatly reduced on the treated trees, which also had larger leaves and reduced scorch symptoms. Additional trials are planned for 2014 in an attempt to increase crown volume and improve the health of symptomatic high-value big-leaf maples.

Fig 46: Marssonina leaf blight infecting aspen at Martins Dairy, Klamath NF.

Photo by: D. Cluck

262A

Marssonina Leaf Blight
Marssonina populi
Contribution by: Danny Cluck

Marssonina leaf blight was reported in several aspen stands on the Lassen and Plumas NFs (Lassen Co. and Plumas Co., M261D and M261E) causing browning of foliage and early leaf drop. Infections likely increased with warm and wet weather events in June and July.

Red Ring Rot
Porodaedalea (*Phellinus*) *pini*
Contribution by: Pete Angwin

Fruiting bodies of *Porodaedalea pini* (also known as *Phellinus pini*) were common on Douglas-fir in Stony Point, Hayward Flat, and Fawn Group Campgrounds near Trinity Lake in the Trinity Unit of the Whiskeytown-Shasta-Trinity National Recreation Area (Trinity Co., M261A) and on ponderosa pine in Hayward Flat Campground.

Fig 47: *Porodadalea pini* fruiting bodies in Douglas-fir at the Fawn Group Camp near Trinity Lake, Shasta-Trinity NF.

Photo by: P. Angwin

M261A

Mistletoes

Big Leaf Mistletoe

Phoradendron macrophyllum
Contribution by: Pete Angwin

Big leaf mistletoe was widespread and severe in cottonwood, willow, and ash at Long Tule Point in the northeast corner of the Big Valley Rancheria of the Pomo Indian Tribe at Clear Lake (Lake Co., M261B). Long Tule Point is a 3-acre lakeside park that is used by the tribe as a gathering place for a variety of community events, including the annual Traditional Tule Boat Festival.

Fig 48: Big leaf mistletoe in cottonwood in the Big Valley Rancheria of the Pomo Indian Tribe.

Photo by: P. Angwin

M261B

Grey Pine Dwarf Mistletoe

Arceuthobium occidentale
Contribution by: Don Owen

Dwarf mistletoe and drought stress caused dieback and mortality of numerous grey pines on a rural residential property near Jones Valley, Shasta Co. (M261A). Mistletoe was present on nearly every grey pine, with the most heavily impacted trees having infections throughout their crowns and exhibiting the most damage and mortality.

Western Dwarf Mistletoe

Arceuthobium campylopodum
Contribution by: Pete Angwin

Western dwarf mistletoe was present in moderate to high levels in ponderosa and knobcone pine along 4 miles of Forest Service road between State Route 89 and the Mount Shasta Ski Park (Siskiyou Co., M261D). Dwarf mistletoe ratings of 4 to 6 were not uncommon.

Fig 49: Western dwarf mistletoe in ponderosa pine along the road to Mount Shasta Ski Park, Shasta-Trinity NF.

Photo by: P. Angwin

M261D

Moderate levels of western dwarf mistletoe were present in ponderosa pine in Unit 526-41 of the Lovers Canyon area of the Klamath NF (Siskiyou Co., M261A). Although pines with dwarf mistletoe ratings of 4 to 5 were scattered throughout the stand, brooming was not pronounced. Sanitation thinning has been proposed for the unit to help reduce the mistletoe.

A large (approximately 2-acre) infection center of western dwarf mistletoe was present in ponderosa pine near the entrance of Stony Point Campground near Trinity Lake in the Trinity Unit of the Whiskeytown-Shasta-Trinity National Recreation Area (Trinity Co., M261A). Dwarf mistletoe ratings ranged from 1 to 4.


M261A

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

Dwarf mistletoe bole cankers were present and causing significant defect in three white firs in Lovers Camp Campground on the Scott River RD, Klamath NF (Siskiyou Co., M261A). The trees are slated for removal as part of an effort to reduce tree hazards in developed recreation areas.

Root Diseases

***Armillaria* Root Disease**
Armillaria mellea
Contributions by: Kim Camilli and Melody Lardner


Fig 50: *Armillaria* fruiting bodies on the root system of a dying Deodar cedar.

Photo by: D. Chudy

A few Deodar cedars (non-native landscape tree) were killed by Armillaria root rot in Oak Glen, San Bernardino Co. (M262B). The soil around the trees had become saturated because of a broken irrigation system.


M262B

Armillaria root rot was also found affecting 12 Jeffrey pines in Tehachapi (Kern Co., M261E). The presence of old stumps and black oaks were an indicator that the disease has been in the area for quite some time.


M261E

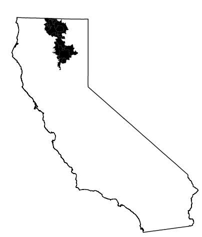
Black Stain Root Disease
Leptographium wageneri var. *ponderosum* and *L. wageneri* var. *pseudotsugae*
Contributions by: Pete Angwin and Don Owen

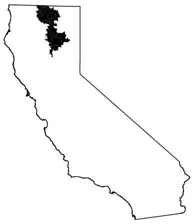

Fig 51: Black stain root disease in dying ponderosa pine at the Mud Flow Research Natural Area, Shasta-Trinity NF.

Photo by: P. Angwin

Leptographium wageneri var. *ponderosum*
The McCloud Flats area of the Shasta-McCloud Management Unit, Shasta-Trinity NF, Siskiyou Co. (M261D) continued to have extensive ponderosa pine mortality due to overstocking and the combined effects of Heterobasidion root disease (*Heterobasidion irregulare*), black stain root disease (*Leptographium wageneri*), and western pine beetle (*Dendroctonus brevicomis*). The NF staff are currently writing NEPA for 1,147 acres of thinning to reduce root disease spread and subsequent bark beetle-caused mortality.

Conspicuous concentrations of ponderosa pine mortality around black stain root disease centers (caused by *Leptographium wageneri* and western pine beetle, *Dendroctonus brevicomis*) have been evident at the Mud Flow Research Natural Area of the Shasta-McCloud Management Unit, Shasta-Trinity NF (Siskiyou Co., M261D) for years. While a windstorm during the winter of 2008-2009 blew


M261D



M261D

down large numbers of the root-diseased pines and the area was thinned in 2012-13, mortality of the remaining pines continued in 2013.

<u>*Leptographium wageneri* var. *pseudotsugae*</u>
Black stain root disease was diagnosed in a 30-year-old Douglas-fir plantation near Burney Creek, Shasta Co. (M261D). With the single-species plantation favoring movement of the pathogen between trees, small groups of mortality and declining, diseased trees were scattered throughout the property. The flatheaded fir borer was colonizing and contributing to tree death as well. The disease was also found in widely scattered, second-growth Douglas-fir in surrounding mixed conifer stands.

M261E

Dead and declining Douglas-fir were inspected at a certified American Tree Farm on Cohasset Ridge, Butte Co. (M261E). At 2,900 ft. in elevation, the ranch supports mixed conifer and black oak trees. Flatheaded fir borer was the immediate cause of mortality, but trees were also checked for root disease. Black stain was confirmed in one tree with advanced decline.

Heterobasidion Root Disease
Heterobasidion occidentale and *H. irregulare*
Contributions by: Pete Angwin, Kim Camilli, and Don Owen

<u>*Heterobasidion irregulare*</u>
The McCloud Flats area of the Shasta-McCloud Management Unit, Shasta-Trinity NF, Siskiyou Co. (M261D) continued to have extensive ponderosa pine mortality due to overstocking and the combined effects of Heterobasidion root disease (*Heterobasidion irregulare*), black stain root disease (*Leptographium wageneri*), and western pine beetle (*Dendroctonus brevicomis*). The NF staff are currently writing NEPA for 1,147 acres of thinning to reduce root disease spread and subsequent bark beetle-caused mortality.

Fig 52: Gray pine infested with Heterobasidion root rot.

Photo by: K. Camilli

M261A

Three ponderosa pines adjacent to a known Heterobasidion root disease infection center were removed from the Hirz Bay Group Camp on the Shasta Unit of the Whiskeytown-Shasta-Trinity NRA (Shasta Co., M261A). One had a fading, chlorotic crown and the other two were green.

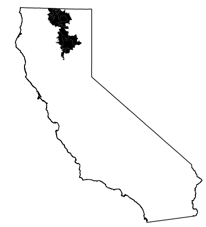
Heterobasidion root disease was found on gray pine in Mariposa Co. (M261F). This pathogen is seldom a problem in open stands, but can spread rapidly in well-stocked stands. Severely affected trees grow at a slower rate and are more susceptible to bark beetle attack. Tree death tends

Fig 53: Gray pine dieback over landscape.

Photo by: K. Camilli

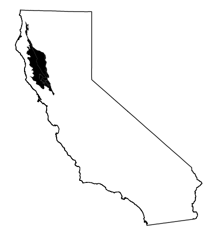
M261F

to occur in localized areas, although the disease may occur throughout severely affected stands. As a tree becomes infected, it appears thin, yellow, and has tufted branches with short needles. The pathogen primarily infects through freshly cut pine stumps and spreads via spores produced from conks and root to root contact between trees.


M261D

<u>*Heterobasidion occidentale*</u>
Root disease contributed to the windthrow of a small group of white fir (less than 10 trees) near Tamarack Rd., Shasta Co. (M261D). Roots of the trees were well decayed and exhibited laminant decay typical of *H. occidentale*.

Phytophthora cambivora **Root Disease**
Phytophthora cambivora
Contributions by: Elizabeth Bernhardt and Ted Swiecki


M261B

Multiple patches of manzanita mortality (*Arctostaphylos stanfordiana* ssp. *raichei* and *A. canescens* ssp. *canescens*) on a Sonoma Co. (M261B) property were associated with *P. cambivora*. The property was located in the southern Mayacamas Mountains about 3 miles northeast of the town of Sonoma. *Phytophthora cambivora* was baited from soil collected in two of the mortality patches. Most mortality had appeared within the previous year, suggesting that the introduction was recent. At least 11 discrete affected areas were found within a 30-acre area, each containing several to dozens of dead manzanitas. Most of the sites were near unpaved roads used within the property and several were near excavations made for percolation tests. Digging equipment used for the tests may have introduced and/or helped spread contaminated soil throughout the mostly undeveloped property.

Rust Diseases

Western Gall Rust
Peridermium (*Endocronartium*) *harknessii*
Contributions by: Danny Cluck and Don Owen


M261F


M261E

Western gall rust caused branch flagging on ponderosa pine on Cohasset Ridge (M261D) and near Forbestown, Butte Co. (M261F). Gall rust is quite common on ponderosa pine throughout this part of the northern Sierra Nevada range and has led to concern about the severity and impact of infections, as many young pine plantations are heavily infested. Despite areas with high infection levels, most mature trees did not exhibit symptoms of decline. Young pines are more susceptible to damage since bole infections can lead to cankers, decay, and stem failure as the trees mature.

Ponderosa pine trees chronically infested with western gall rust showed elevated branch dieback in many areas of Nevada Co. (M261E), including within the Foresthill Work Center, Tahoe NF. Drought stress is likely an influencing factor.

Abiotic Conditions

Alder Tree Damage

Contribution by: Tom Smith

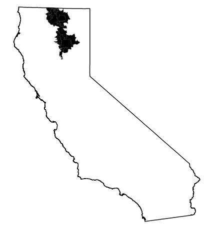
Mature alder trees were dying in a stand in the Sierra Foothills of Tulare Co. (M261F). The area had suffered from severe flooding in previous years causing significant stream channel alterations. Some of the trees had the majority of their root systems exposed to the air while others had been buried by thick layers of sand and silt. No significant insects or diseases were found.

M261F

Frost Damage/Winter Injury

Contributions by: Danny Cluck, Melody Lardner, and Don Owen

Frost damage was noted on a variety of hardwood and conifer species throughout northern California. Particularly hard hit were oaks of all ages and young Douglas-fir and white fir. Damage was greatest on trees at certain elevations, presumably because the trees were at a similar and susceptible stage of growth. Inspection of weather records indicated the damage most likely occurred May 22nd, when a low of 27° F was recorded in Yreka (Siskiyou Co.) and a low of 25° F in Burney (Shasta Co.).



M261D

North of Deetz Rd. and west of Black Butte near the city of Mount Shasta, Siskiyou Co. (M261D), black oaks throughout the area (elevation 3,900 to 4,300 ft.) had varying levels of frost damage which occurred in the youngest tissue and included leaf browning, defoliation, and twig dieback. Damage was greatest along a ridge where oaks exhibited poorer growth and a high level of oak lecanium scale (*Parthenolecanium quercifex*) infestation. Young white fir, and, to a lesser extent, Douglas-fir also showed symptoms. Severe frost damage occurred to Douglas-fir seedlings planted at 4,600 ft. elevation immediately west of Terry Lake, Shasta Co. (M261D). Few, if any, are expected to survive. Frost damage was extensive on black and Oregon white oaks along State Highways 89 and 299 in the 4-corners area (where the highways intersect) of eastern Shasta Co. (elevation 2,900 to 3,200 ft.).

Fig 54: Ponderosa and Jeffrey pine plantation with frost injury to foliage, Plumas NF.

Photo by: D. Cluck

Several hundred young ponderosa and Jeffrey pines growing in a plantation on the Plumas NF (Plumas Co., M261E) were affected by cold winter temperatures that caused needle browning. Shoots were not injured and most trees survived.

Fig 55: Cold injury to manzanita at Children's Forest in the San Bernardino Mountains.

Photo by: B. Poole

M261E

Manzanita appeared to have been damaged by frost injury in the San Bernardino Mountains at

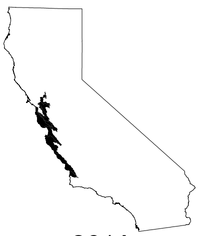
Fig 56: Gray pine mortality north of Pinnacles National Monument, San Benito Co.

Photo by: J. Moore

the Children's Forest as well as in scattered locations in Big Bear and Holcomb Valleys (M262B). Several cold periods with low snowfall may have left the shrubs susceptible to cold injury in early 2013.

Palm trees (especially fan palms) across the Inland Empire in San Bernardino and Riverside Cos. (M262B) were affected by severe frost in early 2013 which scorched the exposed fronds.

M262B



261A

M261C

M261F

M262A

M261B

Gray Pine Decline
Various Causes
Contributions by: Kim Camilli, Tom Coleman, Susan Kocher, Martin MacKenzie, and Tom Smith

Elevated levels of branch flagging and mortality of gray pine were found in the vicinity of Mount Reynolds, Mount Harlan, and Beartrap Ridge (San Benito and Santa Clara Cos., 261A) northeast of the Los Padres NF, Monterey RD. Aerial surveys estimated tree mortality covered approximately 12,200 acres. Grey pine flagging and mortality were also observed on the west side of the Sawmill/Liebre Ridge of the Angeles NF, Santa Clara-Mojave RD (Los Angeles Co., M262B) impacting approximately 40 acres. Tree mortality is likely the result of a pest complex that includes infections of dwarf mistletoe, attack from *Orthotomicus sabiniana*, and drought stress.

Significant gray pine (*Pinus sabiniana*) dieback also occurred in Amador, Calaveras, El Dorado, Fresno, Madera, Mariposa, Monterey, and San Luis Obispo Cos. (M261C, M261F, M262A), with damage increasing to the south in the Sierra Nevada foothills.

Pinus sabiniana dieback was severe around Clear Lake in Lake Co. (M261B) and the surrounding areas. In many cases, trees died from the top down and from the tips inward. Trees were thin and lighter in color than healthy trees, with scattered and grouped mortality. Most trees were infested with dwarf mistletoe.

The overall cause of gray pine death and decline throughout the state is unknown. Plausible causes include the severe drought, dwarf mistletoe, root disease, overcrowding of trees, and understory and secondary bark beetle attack.

Heat and Drought
Contributions by: Beverly Bulaon, Tom Coleman, Don Owen, and Tom Warner

Drought was the overriding damage agent this year, with over 104,000 acres affected. Low precipitation during the 2012-2013 winter season exacerbated conditions that were already present throughout the state and likely led to the high levels of host discoloration noted. Affected trees were found primarily in the foothills on native oaks, which often shed leaves prematurely in response to the summer's highest temperatures. Blue, valley, and canyon live oak in the Sierra Nevada foothills experienced a second year of early leaf drop, with

Fig 57: Premature leaf drop of California black oak on the Cleveland NF.

Photo by: T. Coleman

the largest damage polygons identified in woodlands leading up to Tahoe, Eldorado, Sierra, and Sequoia NFs.

Many blue oaks in the northern end of the Sacramento Valley (M261C and M261F) began changing color and dropping leaves in mid- to late July. The response varied across the landscape and between individual trees.

Hundreds of conifers of various species and ages died along a side branch of Burney Creek as it enters Haynes Flat, Shasta Co. (M261D). This branch of the creek went dry this year. Most dying trees were small- to intermediate-size incense cedars, but white fir, Douglas-fir, and ponderosa pine were are also dying, including some of the largest trees in the stand. All dying trees were growing in alluvial soil within the flood plain of the creek.

Drought stress also caused premature leaf drop of California black oak on the Angeles, San Bernardino, and Cleveland NFs (Los Angeles, San Bernardino, and San Diego Cos., M262B) which was evident by early August and commonly observed on north-facing slopes in mid-slope areas. Engelmann oak also had premature leaf drop in areas of San Diego Co.

Coast live oak succumbed to drought stress in Los Alamos Canyon of the Cleveland NF, Trabuco RD (Riverside Co., M262B). Tree mortality was located adjacent to the creek in the bottom of the canyon. A total of 15 dead trees were observed during ground surveys. Only secondary insect injury was observed on the trees.

Overstory conifer mortality also often becomes visible in southern Sierra Nevada forests after 2 years of consecutive drought, particularly on the west side. Ground surveys of white fir showed losses in all age classes, but understory saplings and pole-sized trees (not visible in aerial surveys) were found fading in large groups.

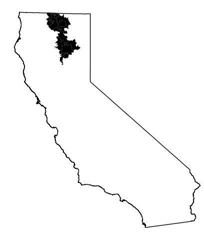
Mechanical Damage of Tanoak

Contribution by: Tom Smith

A stand of approximately a dozen mature tanoak trees were checked for sudden oak death (disease caused by the pathogen *Phytophthora ramorum*) in the New Bullard's Bar Reservoir area of Yuba Co. (M261E). Disease symptoms were not found; however, damage from heavy equipment and a burn pile were noted.

M261C

M261F



M261D

M262B

M261E

Fig 58: Dead hardwoods along the old lakeshore of Lake Red Bluff at the Red Bluff Recreation Area.

Photo by: P. Angwin

262A

Water Stress

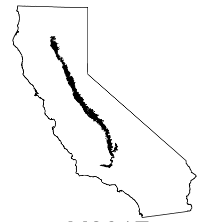
Contribution by: Pete Angwin

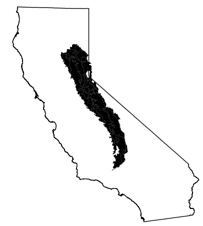
In the fall of 2011, the gates of the Red Bluff Diversion Dam along the Sacramento River were permanently opened, ending the annual summer formation of Lake Red Bluff at the Red Bluff Recreation Area, Mendocino NF (Tehama Co., 262A). Hundreds of hardwoods along the old lakeshore, including box elder, cottonwood, and oak died as result of the lower water table.

Animal Damage

Sapsucker or Woodpecker Damage
Sphyrapucys spp. or *Melanerpes* spp.
Contribution by: Tom Smith

Numerous holes from sapsuckers or woodpeckers were found on various oak species around Ione, Amador Co. (M261F) and on young ponderosa pines near Coulterville, Mariposa Co. (M261E). All of the affected trees appeared to be healthy.


M261F


M261E

Invasive Plants

Status of Invasive Plants

By Dave Bakke

Invasive plants damage ecosystems around the world. They displace native species, change plant community structure, and reduce the value of habitat for wildlife and other native species. Invasive plants may disrupt physical ecosystem processes such as fire regimes, sedimentation, and erosion; light availability; and nutrient cycling. They can impact our health, agriculture, and recreation. 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 state. A small number of these (approximately 200) are recognized by the California Invasive Plant Council (Cal-IPC) as being invasive. Of these 200, there are many that occur in the forested areas of the state. This report focuses on only a few species of invasive plants that are affecting (or could be affecting) forestlands in California.

Current Management Situation

With reduced invasive plant management budgets at all levels of government continuing in 2013, it is critical that work be prioritized to focus on the highest priority species and occurrences of those species. To that end, several tools and processes are being used throughout the state.

Stopping the spread of invasive plants at the landscape level requires coordinated action by multiple land management entities. This action must be based on clear delineation of population distributions and should take into account projections of future suitable range based on climate models. Cal-IPC has worked with partners in seven multi-county regions of the state toward completing regional strategic plans and eradication work plans using a standardized process involving CalWeedMapper to identify top-priority eradication and surveillance targets. Cal-IPC’s statewide mapping dataset and Cal-IPC/Calflora’s CalWeedMapper tool provide capacity for developing strategies based on such information. Funding from the California Wildlife Conservation Board is available to continue the effort with additional multi-county regions. As part of the planning process, opportunities are identified for pursuing and identifying funding, partners, mapping, and permitting needs. With funding in short supply, it is likely that regional coordination, an early detection/rapid response approach, and strategic grant proposals will be more attractive to funders. Refer to http://www.cal-ipc.org/WMAs/index.php for links to existing plans resulting from this effort. At the end of 2013, an eighth region is going

Map 4: Cal-IPC Regions for developing strategic plans.

Map by: CAL-IPC

through this process involving the North Sierra Region (Butte, Nevada, Placer, Plumas, Sierra, Sutter, and Yuba Cos.).

As a result of these regional analyses, several funded projects are moving forward. Cal-IPC is working regionally in the central Sierra Nevada range with Tuolumne, Calaveras, Amador, Alpine, and El Dorado Cos. on regional eradication of purple starthistle, Canada thistle, and diffuse knapweed. These species were identified as regional priorities using the data in CalWeedMapper. The work is funded through the National Fish & Wildlife Foundation (NFWF). Humboldt and Del Norte Cos. teamed up with Cal-IPC to apply for NFWF funding to eradicate key populations of leafy and oblong spurge; Sakhalin, Japanese, and Himalayan knotweed; rush skeletonweed; and saltcedar, priorities based on analysis through CalWeedMapper. In a complementary NFWF proposal, the Mid-Klamath Watershed Council applied for funding to control spurges along the Klamath River in neighboring Siskiyou Co.

Fig 59: WHIPPET logo.

Logo by: CAL-IPC

A new online tool (WHIPPET) is being developed by Cal-IPC, the USDA Forest Service, and the US Fish & Wildlife Service based on the original assessment process designed by Gina Darin for UC Davis and the California Department of Food and Agriculture (CDFA). The tool is designed to compare factors for a set of weed populations and determine the relative cost effectiveness of eradication for each population. It can assess multiple species in a location and includes factors such as control cost and the isolation of the population. Once available online, this tool will provide a systematic way to establish local priorities. A beta version of the online WHIPPET program should be available for testing in 2014.

The California Interagency Noxious and Invasive Plant Committee (CINIPC) is developing a *Blueprint for Coordinated Landscape-Scale Management of Invasive Plants in California*. This document is intended to provide the framework for statewide coordination, sharing of resources, and strengthening of programs. It reaffirms the need for landscape-level solutions to invasive plants and the need to maintain and support the Weed Management Areas in California. CINIPC, an organization originally made up of 14 state and federal land management agencies, started in 1995 through an MOU to coordinate the management of invasive plants in California. Its mission is to facilitate, promote, and coordinate the establishment of an integrated pest management partnership between public and private landowners.

Several large-scale strategic plans are in revision or were recently completed in 2013. Cal-IPC is working with the California Department of Fish & Wildlife to integrate invasive plant management recommendations into the state's Wildlife Action Plan, which is under revision. The USDA Forest Service published their new national strategic plan on invasive species management in August.

New 2013 Species Reports

Goatsrue (Professor Weed)
Galega officinalis
This federal noxious weed was initially found at the border of Lake and Mendocino Cos. It is a perennial plant in the pea family and resembles wild licorice. Native to the Middle East where it is cultivated as a forage crop and used as an ornamental, it is currently found in two California watersheds - one flowing westward in Mendocino Co. toward the coast (about 100

Fig 60: Goatsrue (*Galega officinalis*).

Photo by: Wikipedia Commons

Fig 61: Goatsrue (*Galega officinalis*).

Photo by: D. Kelch

plants), while the other larger population is in the Clear Lake drainage (Lake Co.) flowing towards the east. The Lake Co. occurrence is spreading quickly and is made up of thousands of plants up to 6 ft. tall. The Mendocino Co. occurrence is along road ditches and has been treated. Goatsrue is a major problem in Utah and Washington. It is toxic to livestock.

Fig 62: Mayten (*Maytenus boaria*) showing leaves and fruit.

Photo by: P. Shaw

Mayten

Maytenus boaria

Native to South America, this tree has been cultivated for many years, but appears to now be naturalizing. Growing up to 60 ft. tall, it has an extensive root system and an ability to sprout new growth after cutting and other control methods. A significant population can be found on Ring Mountain in Tiburon/Corte Madera (Marin Co.) and also in the East Bay Hills (Berkeley Hills, Wildcat Canyon in El Cerrito, Claremont Canyon), Alameda Co. where it appears to have established after the Oakland Hills fire.

Fig 63: Mayten tree in downtown Sacramento.

Photo by: D. Kelch

Shiny Geranium

Geranium lucidum

First reported in the 2011 Forest Health Report, this low growing annual with shiny leaves continued to spread in Del Norte Co. Shiny geranium has been found along Highway 101 and in Redwood NP. There is a risk of rapid spread primarily downhill

Fig 64: Shiny geranium (*Geranium lucidum*) in Oregon oak woodland.

Photo by: B. Newhouse

Fig 65: Shiny geranium.

Photo by: B. Newhouse

and with water. If established, it will affect the understory forb component of the redwood forest. It is a state listed noxious weed in Oregon.

2013 Invasive Plant Species Updates

The following updates by no means represent all of the invasive plant work accomplished in California in 2013; these species accounts represent highlights. Reports were received from many sources, including state-level organizations, Weed Management Areas, counties, and state and federal agencies. These accounts involve invasive plants with impacts, or risks of impacts, on state forested lands.

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 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[1].

Brief descriptions of the CDFA noxious weed ratings (for complete descriptions 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 or suppress spread at the discretion of the individual county agricultural commissioner. There is no state-enforced action other than providing for pest cleanliness

Brief descriptions of the Cal-IPC ratings in this report (for 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.

1 DiTomaso, Joseph M., Evelyn A. Healy. 2007. Weeds of California and Other Western States. University of California Agriculture and Natural Resources; Publication 3488. 2 volumes.

In addition to these rating, 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.

Artichoke Thistle
Cynara cardunculus
CDFA – B; Cal-IPC - Moderate

Native to the Mediterranean, this large perennial is related to the commercial globe artichoke and can grow to 8 ft. tall. It is found in California, Oregon, and Washington at lower elevations and near the coast, favoring disturbed, open sites in grasslands, chaparral, coastal sage scrub, riparian areas, and abandoned agricultural fields. Dense colonies can displace native vegetation and can exclude wildlife and livestock. The leaves are grayish colored, spiny, and deeply pinnate-lobed, and the plant has large purple flower heads. Plants can live for many years. Seeds are wind dispersed and can survive for several years in the soil.

Fig 66: Artichoke thistle (*Cynara cardunculus*).

Photo by: Wikipedia Commons

- Santa Barbara Co. - The Agricultural Commissioner's office is working to control artichoke thistle where it threatens to spread onto USDA Forest Service lands. The county has been treating artichoke thistle on the Gaviota Coast and has been able to significantly reduce an 8-acre infestation to less than 90 percent of its former size; eradication is the goal. There is artichoke thistle on the Los Padres NF.

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

These species were purposefully 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 the soil chemistry and therefore can encourage other invasive plant species to become established. 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 and can carry fire into the tree canopy, increasing crown fire risks. 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 eradication effort.

- Tuolumne Co. - CEQA documentation is being prepared for the county to remove leading edge populations of Spanish broom found on roadsides, private property, and BLM land.

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

This perennial plant originally came from the Mediterranean in the late 1800s as an ornamental

Fig 67: Toadflax weevil (*Mecinus janthius*) on Dalmatian toadflax, Siskiyou Co.

Photo by: M. Knight

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

- Siskiyou Co. – The biocontrol insect *Mecinus janthinus*, or the toadflax stem weevil, has been spreading within Siskiyou Co. The results are encouraging, with infestations showing up to 50-75 percent control (dead plants, no flowers or seeds produced) within 2 years. This biocontrol insect has been expanding into California from Oregon. It is not approved for release in California because it may impact native snapdragon species.

Fig 68: Dyer's woad along a roadway in Siskiyou Co.

Photo by: D. Bakke

Dyer's Woad
Isatis tinctoria
CDFA – B; Cal-IPC - Moderate

Native to Europe, this member of the mustard family (Brassicaceae) was cultivated for centuries there as a medicinal herb and a source of blue dye (hence its common name). Today it is found throughout the western US. Most commonly a biennial, it is sometimes a winter annual or short-lived perennial plant. Dyer's woad reproduces only by seed. It flowers in spring, producing umbrella-shaped pannicles of small, bright yellow, 4-petaled flowers. These develop into hanging blue/blackish fruits.

Fig 69: Dyer's woad showing seedpods, above Happy Camp on the Klamath NF.

Photo by: D. Bakke

- Plumas Co. - Cal-IPC is working to put environmental compliance in place for two invasive plant projects in the Sierras with funding from the Sierra Nevada Conservancy. In the Plumas NF, NEPA documentation is being prepared for herbicide applications needed to eradicate incipient populations of dyer's woad.
- Alpine Co. - The detection of the first known population of dyer's woad in Alpine Co. was the result of outreach efforts to partners regarding early detection. It was believed to have been introduced by well drilling equipment at Leviathan Mine. The land manager monitored the population. It was treated three times, with most plants treated before seed set.
- Lassen Co. - Fall River RCD is actively controlling an infestation in eastern Lassen Co. and has dug/sprayed errant plants found along Hwy. 299.
- Siskiyou Co. WMA - Experimental trials are in progress to test the efficacy of the naturally occurring rust *Puccinia thlaspeosus* as a control method for dyer's woad.

Leafy Spurge, Oblong Spurge, Carnation Spurge
Euphorbia esula (leafy)
CDFA – A; Cal-IPC – High (Alert)
E. terracina (carnation)
CDFA – B; Cal-IPC – Moderate (Alert)

Fig 70: Pulled carnation spurge (*Euphorbia terracina*), Santa Barbara Co.

Photo by: D. Chang

Leafy spurge is a perennial plant that has a deep (up to 9 m.), 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 central northern California and a few smaller populations in other northern California counties. It is considered a high priority for eradication.

Carnation spurge, also known as false caper, is a short-lived perennial herb found in coastal southern California and in the Bay Area. Native to southern Europe, it spreads by seed which can last from 3 to 5 years. It is reported to cause dermatitis and vision impairment and has allelopathic properties. Carnation spurge can form dense patches in a wide variety of habitats, such as disturbed grasslands, coastal bluffs, dunes, salt marshes, riparian areas, and oak woodlands. Although it was recently introduced to southern California and is not yet widely distributed, it has the potential to spread rapidly after fires and into undisturbed native plant communities.

- Santa Barbara Co. - A small patch of carnation spurge was found for the first time in the county in May 2010. It has since spread.
- Los Angeles Co. – Carnation spurge was widespread in Los Angeles Co. in the Malibu region. Outbreaks appeared to be associated with fire disturbance. County stakeholders reported its presence in many disparate locations. Landowners have been generally cooperative and helpful. The county is working with landowners, pooling resources to attempt to locally eradicate this weed.
- Siskiyou Co. – Fish and Wildlife Service, the county agricultural commissioner's office, and Klamath NF personnel worked together on an Environmental Assessment for a landscape-level project involving leafy spurge. Treatment on federal land is occurring in limited areas utilizing a tarping/mulching method.

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

Native to Europe, this biennial species was introduced in the early part of the 20th century and is now relatively widespread in the US, although in California, its current distribution is largely limited to the Klamath Range, Cascade Mountains, Modoc Plateau, and the northern Sierra Nevada range. The stems have prickly wings and the leaves are prickly. Flowers are purple to pink and borne on solitary stems that often are bent over, leading to another common name of nodding thistle. Seeds are normally not long lived in the soil.

- Nevada Co. - Surveys (700 acres) and treatments (65 acres) of known musk thistle infestations in eastern Nevada Co. were accomplished. The county collaborated with the California Department of Fish and Wildlife, Truckee River Watershed Council, and the Tahoe NF to treat large musk thistle infestations along the Truckee River. New infestations were found; likely the result of unseasonably warm spring weather.

Perennial Pepperweed, Tall Whitetop, Perennial Peppercress
Lepidium latifolium
CDFA – B; Cal-IPC - High

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 roots 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.

- Modoc Co. - Located in southeast Modoc Co., the Bear Ranch has not yet seen a decrease in the amount of perennial peppercress populations over several years of treatment. This may be the result of large amounts of irrigation water present throughout the year. Overall, 800 acres were surveyed and 57 acres were treated in Modoc Co.

Fig 71: Medusa-like puncturevine found on a river access site, washed down from up river, Siskiyou Co.

Photo by: D. Payne

Puncturevine, Goatshead
Tribulus terrestris
CDFA – C; Cal-IPC – not rated

Puncturevine is a prostrate summer annual, with green to reddish-brown stems, spreading radially from a central crown. It has even pinnate compound leaves, with three to seven pairs of leaflets per leaf. The seed is enclosed in burs, with stout spines that can injure people and animals as well as puncture bicycle tires. It reproduces only by seed, and the burs travel via tires, shoes, and clothing, as well as fur, feathers, and feet of animals. Seedlings emerge from early spring through summer, often following spring rains or summer thunderstorms. The foliage can be toxic to livestock, especially sheep, if eaten in quantity. It is commonly found along roadsides or other rights of ways or in open, disturbed areas such as orchards and vineyards.

Fig 72: Puncturevine close-up, showing leaflets and flower.

Photo by: D. Bakke

- There have been anecdotal reports of exceptional growth of puncturevine in 2013, with occurrences being seen in new places and existing populations rapidly expanding. The mild winter and wet spring may have resulted in ideal germination conditions in 2013. Whether this population expansion will persist is unknown at this time.
- Shasta Co. – Insect bio-control does not work in northeastern California due to the inability of the agent (a weevil) to overwinter and survive cold winters. The prevalence of vehicle movement (e.g., farming/ranching, construction, recreational), livestock, pets, and foot traffic has resulted in an explosion of puncture vine in disturbed areas. The Fall River RCD has given public talks and produced educational outreach materials in an effort to educate the public about the importance of prevention and how to control puncturevine.

- Trinity Co. – There was a tremendous increase in puncturevine along roadsides, abandoned lots, and parking lots. The county received numerous phone calls reporting findings and requesting help with identification and treatment recommendations. Prior to 2013, the only location of puncturevine in the county was in Salyer on the Trinity-Humboldt Co. line. Now it is abundant in Weaverville and along the Trinity River. No treatments occurred in 2013.
- Siskiyou Co. – Puncturevine has increased exponentially in the county, particularly in river access areas (put-ins and take-outs) and road inaccessible areas along the Klamath River. It is thought to be the result of frequent summer thundershowers, leading to season-long germination. Chronic areas continued to flourish, with very robust plants.

Spotted Knapweed
Centaurea biebersteinii
CDFA – A; Cal-IPC – High
Squarrose Knapweed
C. virgata Lam. Var. *squarrose*
CDFA – A; Cal-IPC - Moderate

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 that is extremely invasive wherever it occurs. Flowers are white, pink, or purple, and the flower bracts (phyllaries) are without spines. Seed viability of this species has been observed to be anywhere from 8 to 15 years. Spotted knapweed can also reproduce vegetatively from lateral roots below the soil surface. A native of Europe, it has been found everywhere in California except deserts.

Squarrose knapweed is native to Asia and is a perennial that is concentrated in the northern 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.

El Dorado Noxious WMA, Sierra Pacific Industries, and the Eldorado NF, Pacific RD – The only known population of spotted knapweed in western El Dorado Co. is along Silver Creek, where an ongoing spotted knapweed eradication project is underway. Eradication efforts led to a dramatic decrease in 2012 and again in 2013. A total of 60 plants were eradicated in 2013, compared with 150 in 2011 and 500 in 2010. Established after the 1992 Cleveland Fire, this population demonstrates the need for continuous and long-term efforts.

- Siskiyou Co. - Control and eradication of squarrose knapweed is a long-term commitment in this region. Yearly and timely treatments are needed to prevent the plants from seeding. Continually depleting the root system is the only way to permanently reduce and eventually eradicate a population. In 2013, the treated acres in Hawkinsville totaled 6 net acres scattered over 2,700 acres. This represents a 97.3 percent decrease in treated acres over 14 years.
- Shasta Co. –Five landowners are aggressively treating squarrose knapweed with chemical supplies provided by Fall River RCD. A 30-acre site was reduced to a 10-acre infestation with bio-control plot in the center. Due to aggressive control efforts, the site has been significantly reduced, with only 19 plants found in June 2013.
- Siskiyou Co. - The total treated acres of spotted knapweed in this area has declined despite a large new find in the spring of 2013. The new site was found along the Scott River and treated in rosette stage, preventing 2013 seed set. Unfortunately, the remains of previous years' plants are clearly in abundance, indicating a heavy seed bank.

Stinkwort
Dittrichia graveolens
CDFA – not rated; Cal-IPC – Moderate/Alert

Stinkwort is a member of the Asteraceae (sunflower) family. It is native to the Mediterranean region of Europe, North Africa, and the Middle East. Stinkwort is closely related to tarweed and, like tarweed, is strongly aromatic. It was first reported in California in 1984 in Santa Clara Co. and has since spread. It appears to be moving up in elevation into Sierra Nevada forests, having been found above Challenge Forest in Yuba Co. around the 3,000 ft. elevation and in Placerville, El Dorado Co. at the 2,000 ft. elevation.

Stinkwort is not palatable to animals and can be poisonous to livestock as well as cause contact allergic dermatitis in humans. It is primarily found along roadsides in California, but its biology suggests that it could also be invasive in open riparian areas, overgrazed rangelands, and oak woodlands. Stinkwort has a unique life cycle among annual plants. Unlike most summer or late season winter annuals, it flowers and produces seed from September to December.

A statewide strategy and action plan to address stinkwort is underway. There is still much to learn about the risks this species presents to California wildlands, including likely elevational range and whether it will be a problem away from roadsides or heavily disturbed sites. A study published this year[2] indicates that a short-lived seedbank is likely (2-3 years), indicating that intensive efforts could effectively control or eradicate populations. It has rapidly spread throughout the San Francisco Bay Area and Sacramento Valley as well as into the foothills, and is now moving northward out of San Diego Co., having recently been found in Los Angeles Co.

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

Yellow star thistle (YST) is probably the most common and well known noxious weed in California. It was introduced to California from its native southern Europe in the 1850s 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 recently burned. It can invade most bioregions and 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 yellow starthistle 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 regional goal in the Sierra Nevada range is to establish a containment line for it in the foothills. It is hoped that by controlling YST at the eastern leading edge, that millions of acres of forested lands in the mid and upper elevations of the Sierra Nevada can be protected.

- Alpine Co. - Yellow starthistle 2011 fall treatments decreased populations by 99 percent by 2012. Efforts this year have shown another 96 percent decrease between 2012 and 2013, with the majority of the sites not having any detected plants.
- Tulare Co. – Contact was made with 110 small landowners to provide them with YST program information and to schedule treatment of their property; 64 small landowner properties were treated from March to May 2013. The county also partnered with the Tulare Co. Resource Management Agency's Roads Department to survey the five active county material pits for YST and other noxious weeds. In the spring of 2013, 226 acres were treated under the program.
- Plumas/Sierra Cos. – The counties cooperated with CalTrans in highway treatments of YST and issued nine operator ID numbers for landowners to treat 220 gross acres of YST.
- Nevada Co. - The leading edge survey for YST in Nevada Co. was completed.

2 Brownsey, R., G. Kyser, J. DiTomaso. 2013. Seed and Germination Biology of Dittrichia graveolens (Stinkwort). Invasive Plant Science and Management 2013 6:371-380.

Monitoring

Asian Gypsy Moth,
U.S. Customs and Border Protection

By Robin Wall

Asian Gypsy Moth (AGM), *Lymantria dispar asiatica*, is a significant pest the US Customs and Border Protection (CBP) is confronting. Endemic to East Asia, AGM is considered a major forest pest with a wide host range, capable of quickly damaging valued American woodlands.

Fig 73: Egg masses are usually velvety in texture. They can be 1.5 in. long and .75 in. wide, and they can be as small as a dime.

Photo by: R. Wall

The adult is attracted to lights, including those during evening operations at seaports on maritime vessels and, by extension, the associated cargo. Females have the potential to attach hundreds of eggs to cargo vessels bound to the US from shipping ports in Korea, Japan, China, and east Russia.

During AGM high-risk flight periods, and as per USDA Animal and Plant Health Inspection Service Plant Protection and Quarantine (PPQ) regulations, vessels must present the required pre-departure certification indicating they are free from AGM adults and egg masses. All foreign vessels that visited AGM countries are boarded on arrival by CBP agriculture specialists and thoroughly inspected.

AGM has been intercepted at each major California seaport, including Long Beach, Oakland, and San Diego. In California, most of the AGM discovered continues to be found on vessels from Japan. Of the 44 AGM national interceptions in 2012, 45 percent were detected in California. In 2013, 40 AGM were intercepted nationally, 23 percent of which were detected in California.

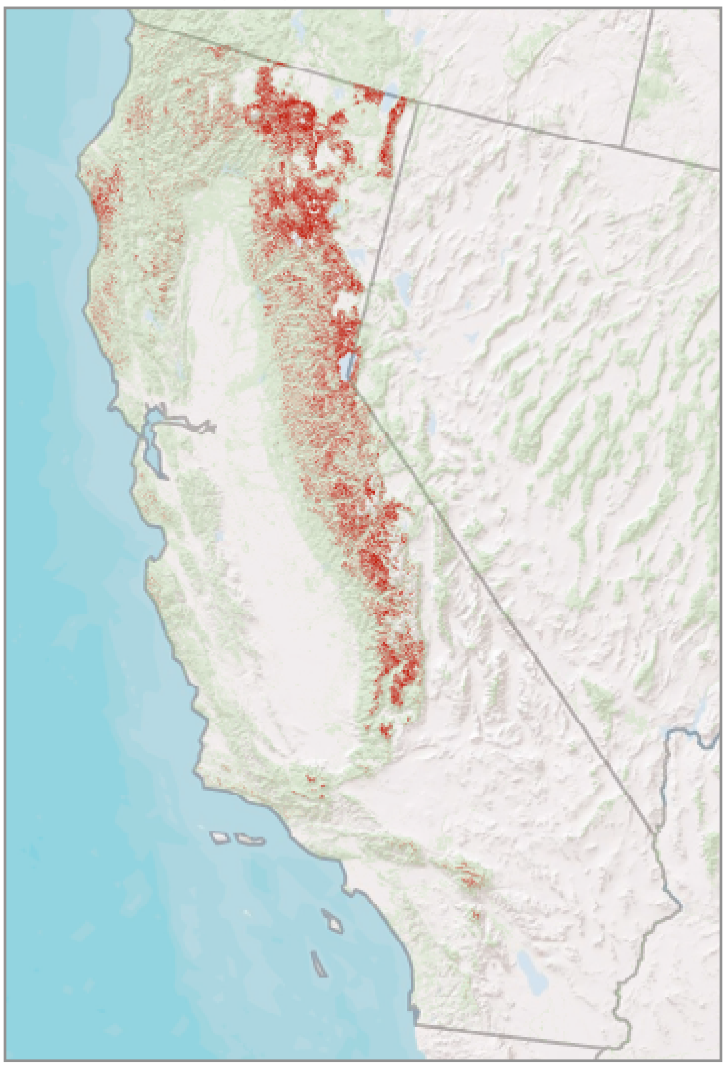
Inspectors in the field are trained to detect suspect AGM egg masses and enforce appropriate actions to stop potential movement beyond the seaport. State and/or county agriculture departments monitor the ports through early detection trapping. CBP maintains a goal of increased AGM compliance through continued communication and outreach with PPQ, including communication with foreign officials and the ocean vessel shipping community.

Insect and Disease Risk Modeling and Mapping

By Meghan Woods

Insect and Disease Risk Modeling was initiated in California 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 National Insect and Disease Risk Map (NIDRM) is updated every 5 to 6 years. The most recent iteration was completed in 2012. Significant improvements include: full coast to coast coverage, more accurate vegetation layers, and vegetation disturbance corrections. The report and data (240m resolution) are available at: http://www.fs.fed.us/foresthealth/technology/nidrm.shtml.

The Forest Health Technology Enterprise Team (FHTET) has facilitated the creation of a 30 m. version of the risk map for California. All models, criteria, and inputs were the same as for the national map, but models were run using 30 m. host layers. The 2012 California Insect and Disease Risk Map (30 m) estimates that 5.8 million acres are at risk* for insects and diseases. Western pine beetle, fir engraver beetle, and Heterobasidion root disease were the primary contributors to risk in the Sierra Nevada, while sudden oak death and fir engraver beetle were primary contributors in the northwest. The finer resolution data can be used in forest plan revisions and district level planning. It is predictive and may be useful in climate change adaptation strategies.



Map 5: 2012 California Insect and Disease Risk Map (30 m).

Photo by: M. Woods

California risk maps are available on the Region 5 USDA Forest Service, Forest Health Monitoring website: http://www.fs.usda.gov/detail/r5/forest-grasslandhealth/?cid=fsbdev3_046705.

* “Risk” is defined as the expectation that, without remediation, 25 percent or more of the standing live basal area (BA) on trees greater than 1 in. diameter will die over the next 15 years due to insects and diseases.

Aerial Detection Survey

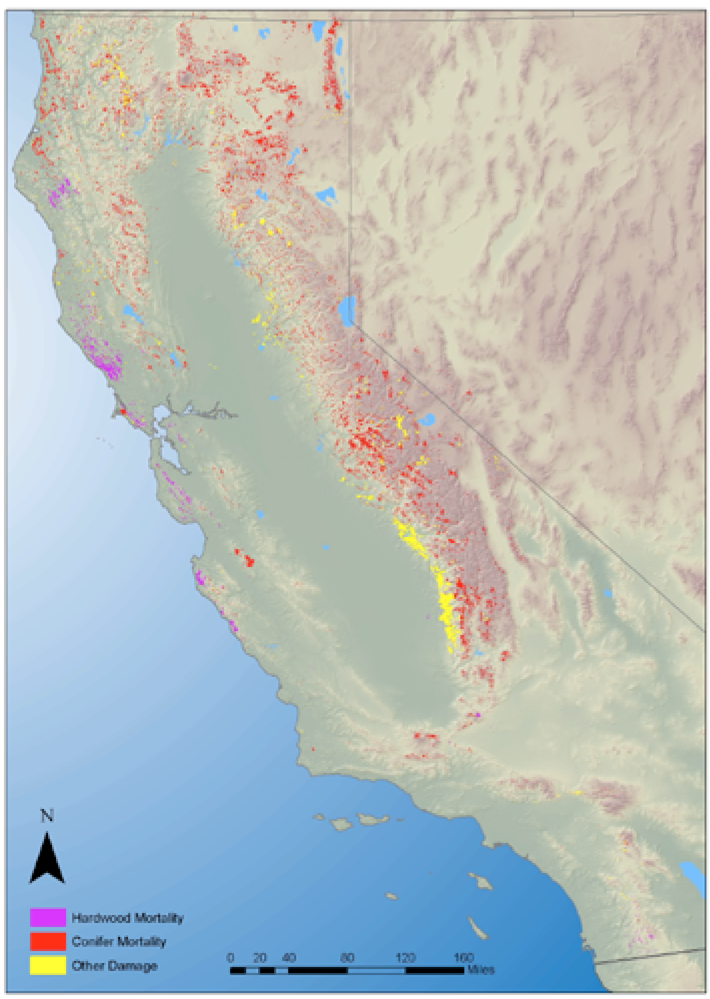
By Zachary Heath

<u>Forest Health Aerial Survey</u>

Overall, mortality was slightly lower than 2012 levels, with about 483,000 acres of elevated mortality mapped over the 48.5 million acres flown in 2013, and an estimated 1.53 million trees killed. Major events included an increase in gray pine mortality as well as smaller increases in Douglas-fir and Jeffrey pine mortality from bark beetles and flat-headed borers. All NFs and forested NPs were surveyed along with state and private lands. The surveys took place from May 14th to September 28th.

<u>Bark Beetles and Wood Borers</u>

- Overall, over 350,000 acres with elevated bark beetle-related mortality were mapped, down from about 50,000 acres in 2012.
- Fir mortality attributed to fir engraver decreased to 129,000 acres in 2013. This is the third year in a row of decline in fir mortality.
- Pine mortality from western and mountain pine beetle decreased slightly in 2013, affecting 129,000 and 136,000 acres respectively. Western pine beetle activity did increase in the southern Sierra Nevada region, especially around the Rim Fire.
- Acres with Jeffrey pine mortality, attributed mostly to Jeffrey pine beetle, pine engraver, and California flat-headed borers, increased to almost 52,800 acres.
- Pockets of Douglas-fir beetle-caused mortality were mapped on the Plumas, Lassen, Shasta-Trinity, and Klamath NFs, totaling about 1,400 acres. Only 15 acres of Douglas-fir beetle were mapped in 2012.
- Flat-headed fir borer affected over 16,000 acres of Douglas-fir this year, more than double the acres mapped in 2012.
- Oak mortality from the goldspotted oak borer (GSOB) in San Diego Co. remained similar to previous years at just over 800 acres. No GSOB-related mortality was observed in Riverside Co.



Map 6: Mortality detected in 2013 via aerial survey.

Photo by: Z. Heath

<u>Diseases</u>

- Oak and tanoak mortality from sudden oak death was slightly lower than last year, affecting 47,500 acres compared to over 54,000 acres mapped in 2012. This is still much higher than 2011 levels, when only 8,000 acres of mortality were observed.

- A survey for Swiss needle cast on the North Coast did not find symptomatic stands of Douglas-fir.
- Damage from western gall rust was bad enough to be visible from the air in the Grass Valley area.
- Other observed diseases included Port-Orford-cedar root disease, pitch canker, maple leaf scorch, Marssonina blight, and Cytospora canker on fir.

Defoliators and Other Events

- Defoliation from Douglas-fir tussock moth was observed on the Plumas NF affecting about 6,000 acres.
- Other defoliator activity included pinyon scale, lodgepole needleminer, satin moth, and fruit-tree leafroller.
- Nearly 25,000 acres with elevated mortality of gray pine were mapped, compared to about 2,000 in 2012 and less than 400 in 2011. Much of the mortality occurred in the southern Sierra Nevada and coastal ranges.
- About 140,000 acres of early color change and leaf drop in blue oak were mapped in early July in the southern Sierra Nevada foothills. Although typical in drought years, this event was much earlier and more severe than normal.

List of Common and Scientific Names

Insects

Common Name	Scientific Name
Invasive Insects	
Asian gypsy moth	*Lymantria dispar*
Balsam woolly adelgid	*Adelges piceae*
European gypsy moth	*Lymantria dispar*
Goldspotted oak borer	*Agrilus auroguttatus*
Polyphagous shot hole borer	*Euwallacea* sp.
Bark Beetles	
California fivespined Ips	*Ips paraconfusus*
Douglas-fir beetle	*Dendroctonus pseudotsugae*
Emarginate ips	*Ips emarginatus*
Fir engraver	*Scolytus ventralis*
Gray pine bark beetle	*Orthotomicus sabiniana*
Jeffrey pine beetle	*Dendroctonus jeffreyi*
Mountain pine beetle	*Dendroctonus ponderosae*
Pine engraver beetle	*Ips pini* & *Ips* spp.
Pinyon Ips	*Ips confusus*
Red turpentine beetle	*Dendroctonus valens*
Western pine beetle	*Dendroctonus brevicomis*
Defoliators	
Black oak leaf miner	*Eriocraniella aurosparsella*
California oakworm	*Phyrganidia californica*
Douglas-fir tussock moth	*Orgyia pseudotsugata*
Fruittree leaf roller	*Archyps argyrospila*
Pandora moth	*Coloradia pandora*
Satin moth	*Leucoma salicis*
White fir sawfly	*Neodiprion abietis*
Other Insects	
Alder flea beetle	*Macrohaltica ambiens (= Altica ambiens)*
Black pineleaf scale	*Nuculaspis californica*
California flatheaded borer	*Phaenops californica*
Cicada	family Cicadidae
Citrus thrips	*Scirtothrips citri*
Flatheaded fir borer	*Melanophila drummondi* & *Phaenops drummondi*
Flatheaded wood borer	*Chrysobothris* sp.
Gouty pitch midge	*Cecidomyia piniinopis*
Jeffrey pine needleminer	*Coleotechnites* sp. near *milleri*
Oak lecanium scale	*Parthenolecanium quercifex*
Oak pit scale	*Asterodiapsis* spp.
Oak twig girdler	*Agrilus angelicus*
Pine reproduction weevil	*Cylindrocoptorus eatoni*
Pinyon needle scale	*Matsucoccus acalyptus*
Ponderosa pine bark borer	*Acanthocinus princeps*
Ponderosa pine twig scale	*Matsucoccus bisetosus*
Red gum lerp psyllid	*Glycaspis brimblecombei*
Sequoia pitch moth	*Synanthedon sequoiae*
Spotted pine sawyer	*Monochamus clamator*

Tea shot hole borer	*Euwallacea fornicatus*
Twig beetle on pines	*Pityophthorus boysei* & *Pityophthorus* sp.
Woodboring beetles	Families Cerambycidae & Buprestidae

Diseases and Causal Pathogens

Common Name	Scientific Name
Introduced Diseases	
Dutch elm disease	*Ophiostoma novo-ulmi*
Fusarium dieback	*Fusarium euwallaceae*
Phytophthora root rot	*Phytophthora cinnamomi*
Port-Orford-cedar root disease	*Phytophthora lateralis*
Seiridium canker	*Seiridium cardinale* & *S. unicorne*
Sudden oak death	*Phytophthora ramorum*
White pine blister rust	*Cronartium ribicola*
Blights and Cankers	
Bacterial leaf scorch	*Xylella fastidiosa*
Botryosphaeria canker	*Botryosphaeria* sp.
Cytospora canker	*Cytospora abietis*
Dothistroma needle blight	*Mycosphaerella pini*
Elytroderma needle blight	*Elytroderma deformans*
Fireblight	*Erwinia amylovora*
Maple leaf scorch	unknown cause
Marssonina leaf blight	*Marssonina populi*
Red ring rot	*Porodaedalea* (*Phellinus*) *pini*
Mistletoes	
Big leaf mistletoe	*Phoradendron macrophyllum*
Grey pine dwarf mistletoe	*Arceuthobium occidentale*
Western dwarf mistletoe	*Arceuthobium campylopodum*
White fir dwarf mistletoe	*Arceuthobium abietinum* f.sp. *concoloris*
Root Diseases	
Armillaria root disease	*Armillaria mellea*, *Armillaria* sp.
Black stain root disease	*Leptographium wageneri*
Heterobasidion root disease	*Heterobasidion irregulare* *Heterobasidion occidentale*
Phytophthora cambivora root disease	*Phytophthora cambivora*
Foliage Diseases	
Foliar blight of madrone	*Mycosphaerella* sp. & *Monochaetia* sp.
Leaf spot on oak	*Tubakia* sp.
Oak anthracnose	*Cryptocline cinerescens*
Oak leaf blister	*Taphrina caerulescens*
Oak leaf blotch	*Gnomoniopsis* sp.
Sycamore anthracnose	*Apiognomonia veneta* (*Discula platani*)
True fir needle cast	*Lirula abietis-concoloris*
Rusts	
Western gall rust	*Endocronartium harknessii* = *Peridermium harknessii*

Trees

Common Name	Scientific Name
Conifers	
Pines	*Pinus* spp.
Coulter pine	*Pinus coulteri*
Four-needle pinyon pine	*Pinus quadrifolia*
Foxtail pine	*Pinus balfouriana*
Gray pine	*Pinus sabiniana*
Jeffrey pine	*Pinus jeffreyi*
Knobcone pine	*Pinus attenuata*
Lodgepole pine	*Pinus contorta* var. *murrayana*
Ponderosa pine	*Pinus ponderosa*
Singleleaf pinyon	*Pinus monophylla*
Sugar pine	*Pinus lambertiana*
Washoe pine	*Pinus washoensis*
Western white pine	*Pinus monticola*
Whitebark pine	*Pinus albicaulis*
True firs	*Abies* spp.
Grand fir	*Abies grandis*
Red fir	*Abies magnifica*
White fir	*Abies concolor*
Others	
Coast redwood	*Sequoia sempervirens*
Deodar cedar	*Cedrus deodara*
Douglas-fir	*Pseudotsuga menziesii*
Giant sequoia	*Sequoia giganteum*
Incense cedar	*Calocedrus decurrens*
Leyland cypress	*Cupressocyparis leylandii*
Monterey cypress	*Cupressus macrocarpa*
Port-Orford-cedar	*Chamaecyparis lawsoniana*
Hardwoods	
Oaks	*Quercus* spp.
Blue oak	*Quercus douglasii*
California black oak	*Quercus kelloggii*
Canyon live oak	*Quercus chrysolepis*
Coast live oak	*Quercus agrifolia*
Engelmann oak	*Quercus engelmannii*
English oak	*Quercus robur*
Interior live oak	*Quercus wislizeni*
Oregon white oak	*Quercus garryana*
Valley oak	*Quercus lobata*
Other	
Alder	*Alnus* spp.
Ash	*Fraxinus* spp.
Aspen	*Populus tremuloides*
Avocado	*Persea americana*
Big-leaf maple	*Acer macrophyllum*
Birch	*Betula* sp.
Blue palo verde	*Parkinsonia florida*
Box elder	*Acer negundo*
California bay laurel	*Umbellularia californica*
California sycamore	*Platanus racemosa*

Castorbean	*Ricinus communis*
Coral	*Erythrina corallodendon*
Cottonwoods	*Populus* sect. *Aigeiros* spp.
Elms	*Ulmus* spp.
Eucalyptus	*Eucalyptus* spp.
Evergreen huckleberry	*Vaccinium ovatum*
Golden (giant) chinquapin (chinkapin)	*Chrysolepis chrysophylla*
Goldenrain	*Koelreuteria paniculata*
Japanese maple	*Acer palmatum*
Madrone	*Arbutus menziesii*
Maple	*Acer* spp.
Manzanita	*Arctostaphylos* spp.
Olive	*Olea europaea*
Palo verde	*Cercidium floridium*
Persimmon	*Diospyros* sp.
Red willow	*Salix laevigata*
Silk	*Albizia julibrissin*
Sweetgum	*Liquidambar styraciflua*
Tanoak	*Lithocarpus densiflorus*
Tortuosa	*Salix matsudana*
White alder	*Alnus rhombifolia*
Weeping willow	*Salix babylonica*

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Appendix A

CDFA Noxious weed ratings (for complete descriptions go to: www.cdfa.ca.gov/phpps/ipc/encycloweedia/winfo_weedratings.htm) include:
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, are 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.

Q–Rated - An organism suspected to be of economic or environmental detriment, but whose status is uncertain because of incomplete identification or inadequate information.

Cal-IPC ratings (for complete descriptions go to www.cal-ipc.org/ip/inventory/index.php#categories) include:
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 indicates a significant potential for invading new ecosystems, an Alert designation is used so that land managers may watch for range expansions.

I. FIELD INFORMATION (See instructions on reverse)		
1. County:	**2. Forest (FS only):**	**3. District (FS only):**
4. Legal Description: T. R. Section (s) **5. Date:**	**6. Location:** UTM:	**7. Landownership:** National Forest ☐ Other Federal ☐ State ☐ Private ☐
8. Suspected Cause of Injury: 1. Insect ☐ 2. Disease ☐ 3. Animal ☐ 4. Weather ☐ 5. Chemical ☐ 6. Mechanical ☐ 7. Weed ☐ 8. Unknown ☐	**9. Size of Trees Affected:** 1. Seedling ☐ 2. Sapling ☐ 3. Pole ☐ 4. Sawtimber ☐ 5. Overmature ☐	**10. Part(s) of Tree Affected:** 1. Root ☐ 2. Branch ☐ 3. Leader ☐ 4. Bole ☐ 5. Twig ☐ 6. Foliage ☐ 7. Bud ☐ 8. Cone ☐
11. Species Affected:	**12. Number Affected:**	**13. Acres Affected:**

14. Injury Distribution: 1. Scattered ○ 2. Grouped ○	**15. Status of Injury:** 1. Decreasing ○ 2. Static ○ 3. Increasing ○	**16. Elevation:**
17. Plantation? 1. Yes ○ 2. No ○	**18. Stand Composition (species):**	**19. Stand Age and Site Class:** Age: Class:

20. Stand Density:	**21. Site Quality:**

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

23. Sample Forwarded: 1. Yes ○ 2. No ○	**24. Action Requested:** 1. Information only ☐ 2. Lab Identification ☐ 3. Field Evaluation ☐	**25. Reporter's Name:**	**26. Reporter's Agency:**

27. Reporter's Address, email and Phone Number:

email: ______________________________ phone: ______________

Address 1: ______________________________

Address 2: ______________________________

City: ______________ State: ______________ Zip: ________

II. Reply (Pest Management Use)

28. Response:

29. Report Number:	**30. Date:**	**31. Examiner's Signature:**

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

Completing the Detection Report Form

Heading (Blocks 1-7): Enter all information requested. In Block 6, **LOCATION**, provide sufficient information for the injury center to be relocated. If possible, attach a location map to this form.

Injury Description (Blocks 8-15): Check as many boxes as are applicable, and fill in the requested information as completely as possible.

Stand Description (Blocks 16-21): This information will aid the examiner in determining how the stand conditions contributed to the pest situation. In Block 18 indicate the major tree species in the overstory and understory. In Block 19, indicate the stand age in years and/or the size class (seedling-sapling; pole; young sawtimber; mature sawtimber; overmature or decadent).

Pest Names (Block 22): Write a detailed description of the pest or pests, the injury symptoms, and any contributing factors.

Action Requested (Block 24): Mark “Field Evaluation” only if you consider the injury serious enough to warrant a professional site evaluation. Mark “Information Only” if you a reporting a condition that does not require further attention. All reports will be acknowledged and questions answered on the lower part of this form.

Reply (Section II): Make no entries in this block; for examining personnel only. A copy of this report will be returned to you with the information requested.

Handling Samples: Please submit injury samples with each detection report. If possible, send several specimens illustrating the stages of injury and decline. Keep samples cool and ship them immediately after collection. Send them in a sturdy container, and enclose a completed copy of the detection report.

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

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

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

USDA Forest Service State and Private Forestry Forest Health Protection 1323 Club Drive Vallejo, CA 94592	Forest Health Protection Shasta-Trinity National Forest 3644 Avtech Parkway Redding, CA 96002	Forest Health Protection Stanislaus National Forest 19777 Greenley Road Sonora, CA 95370

Forest Health Protection Lassen National Forest 2550 Riverside Drive Susanville, CA 96130	Forest Health Protection San Bernardino National Forest 602 Tippecanoe Avenue San Bernardino, CA 92408-2677

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

Forest Pest Management CA Dept of Forestry & Fire Protection 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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