California Forest Pest Conditions - 2006

A publication of the California Forest Pest Council

In Memoriam

David E. Schultz
1946-2007

Dave grew up and went to school in upstate New York, receiving a B.S. in 1968 from the State University of New York in Syracuse. Following a brief tour with the Agricultural Research Service, he enlisted in the Army in 1969 and served in Vietnam, earning a Bronze Star and several other medals. Returning to SUNY Syracuse after his military service, where he earned a Ph.D. in forest entomology in 1976.

Dave started his permanent Forest Service career as a staff entomologist in the Region 5 Regional Office in San Francisco. When Forest Health Program service areas were created, Dave came to the Shasta-Trinity National Forest in 1989, spending the rest of his career providing technical assistance to landowners and resource managers to promote the health, productivity and diversity of forests across all ownership boundaries in northern California.

Dave's friends and colleagues came to appreciate him as a master of dry wit, an encyclopedia of knowledge of the West, and an artist of frugality.
He was one of a kind.

California Forest Pest Conditions Report - 2006

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Cover: Top photo: Defoliation caused by the Douglas-fir tussock moth outbreak on Bear Mountain, Shasta-Trinity National Forest. Photo: D. Schultz
Middle photo: Conifer mortality on Mt. Bidwell, Modoc National Forest. Photo: Zachary Heath
Bottom photo: Sudden oak death in western Marin County, photo. Jeff Mai

THE CALIFORNIA FOREST PEST COUNCIL

The California Forest Pest Council, a 501(3)c non-profit organization, was founded in 1951 as the California Forest Pest Control Action Council. Membership is open to public and private forest managers, foresters, silviculturists, entomologists, pathologists, biologists, and others interested in the protection of forests from damage caused by biotic and abiotic agents. The Council's objective is to establish, maintain, and improve communication among individuals who are concerned with these issues. This objective is accomplished by five actions:

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

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

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

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

5. Foster educational work on forest pests and forest health.

The California Board of Forestry 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, ***Forest Pest Conditions in California 2006***, is compiled for public and private forest land managers and other interested parties to keep them informed of conditions on forested land in California, and as a historical record of forest insect and disease trends and occurrences. The report is based largely on information provided by three sources: (1) information generated by Forest Health Protection, Pacific Southwest Region, USDA Forest Service, while making formal detection surveys and biological evaluations, (2) reports and surveys of conditions on private lands provided by personnel of the California Department of Forestry and Fire Protection, and (3) the statewide Cooperative Forest Insect and Disease Survey, in which federal, state, and private foresters and land managers participate.

This report was prepared by Forest Health Protection, USDA Forest Service, Pacific Southwest Region in cooperation with other member organizations of the Council, published by the California Department of Forestry and Fire Protection and distributed by the two agencies. The report is available in color at the following website:

http://www.fs.fed.us/r5/spf/publications/pestconditions/

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FOREST PEST CONDITIONS IN CALIFORNIA 2006

ABSTRACT

This report describes the important forest insect and disease conditions in California in 2006. Included is information on bark beetles, defoliators, dwarf mistletoes, declines and root diseases, foliage, rust and canker diseases, abiotic injury and animal damage. Sections on surveys and evaluations include summaries of the following:

1. Douglas-fir tussock moth pheromone detection cooperative survey
2. White pine blister rust screening program
3. High elevation 5-needle pine white pine blister rust survey
4. Sudden oak death monitoring
5. Intensified ozone monitoring in southern California
6. Aerial detection surveys
7. Detection of vegetation changes using satellite imagery
8. 2006 insect and disease risk map

Key words: California, forest health, forest diseases, forest insects, forest surveys, tree mortality

Conditions in Brief

This report reviews the influence of major biotic agents and abiotic events on tree health in California in 2006. Information was submitted by entomologists, pathologists, botanists and other forest health specialists.

Wet conditions continued for most of California in 2006 (Figure 1). The statewide average snowpack condition in April was 125% of normal. Annual precipitation for the state was 135% of normal, however dry to slight drought conditions returned to the South Coast and Mojave regions of California. The wet conditions contributed to the below average bark beetle caused tree mortality detected in 2006. Approximately 400,000 acres of injury from biotic factors were mapped by survey in 2006, a decrease in the overall injury mapped in 2005 and well below the 13-year average (Figure 1). Injury includes tree mortality, defoliation, foliage discoloration, branch flagging and top kill.

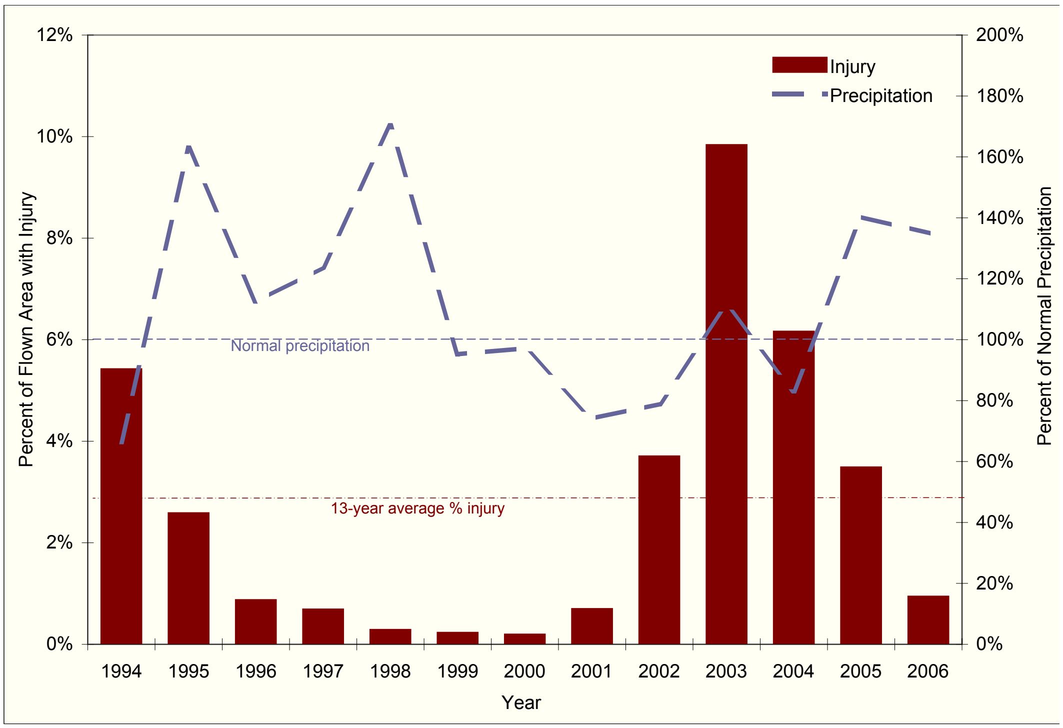


Figure 1. Aerial survey results: Percent of flown area with injury and percent of normal precipitation; 1994-2006.

Jeffrey pine beetle (Figure 2) activity increased on the east side of the Sierra Nevada range in 2006. Jeffrey pine beetle activity is expected to continue to increase in these areas in 2007, especially from Truckee, CA south along the eastern front.

Figure 2. Jeffrey pine beetle pitch tube.

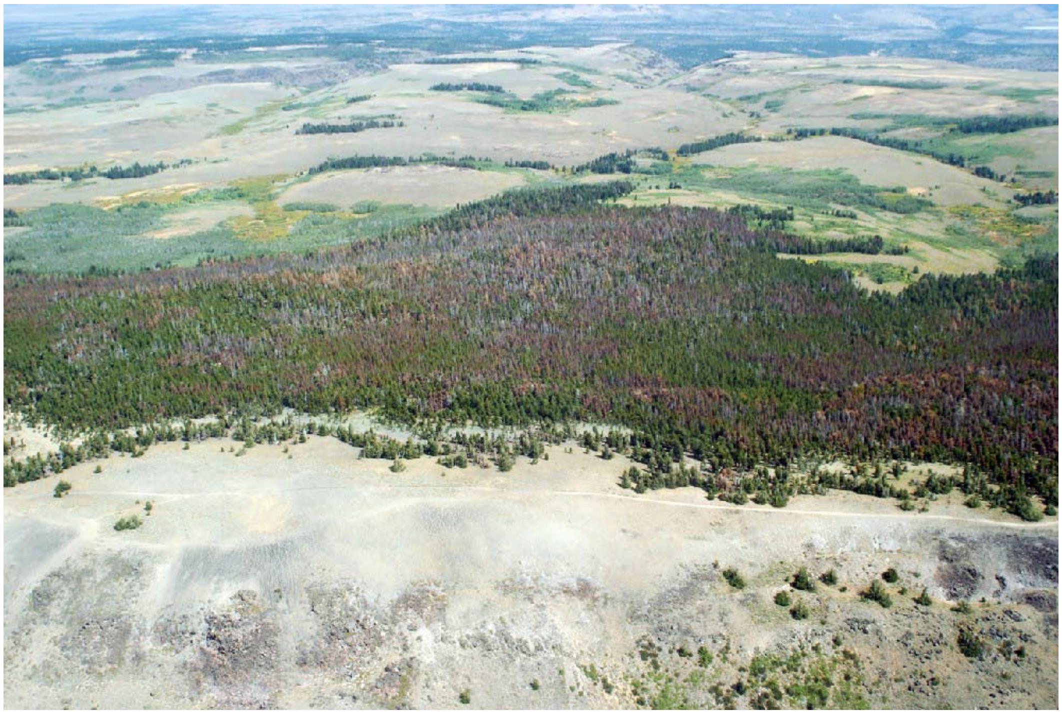
Photo: Sheri Smith

Drought related mortality associated with **mountain and Jeffrey pine beetle** in southern California continued to decline from the high levels observed in 2003. Activity continued at low levels in the San Bernardino, San Jacinto, and San Gabriel Mountains.

Mountain and western pine beetle activity remained low for the rest of the state in 2006, with the exception

Figure 3. Conifer mortality on Mount Bidwell, Modoc National Forest.

Photo: Zack Heath



of the Modoc National Forest where mountain and western beetle-caused mortality was observed on ponderosa, lodgepole and whitebark pine on the Warner Mountain Ranger District (Figure 3).

Most of California experienced low to moderate levels of **fir engraver beetle** activity in 2006. However, fir engraver beetle-caused mortality in conjunction with overstocking, dwarf mistletoe, cytospora canker and annosus root disease continued at the same elevated levels seen in 2005 for few areas California. Elevated fir mortality continued on the Warner Mountain, Big Valley and Doublehead Ranger Districts, Modoc National Forest and throughout the entire red fir belt on the Tahoe National Forest. Fir mortality was also noted at higher elevations throughout the Sierra Nevada range.

Figure 4. The second year of a Douglas-fir tussock moth outbreak caused visible defoliation around the Bear Mountain Lookout east of McCloud, CA.

Photo: Dave Schultz

Defoliation from **Douglas-fir tussock moth** increased in the Sierra and Stanislaus National Forests and Yosemite National Park in 2006. Douglas-fir tussock moth was also detected in several new locations in 2006. There were about 40 acres of white fir defoliated on the Eldorado National Forest near Panther Creek. Defoliation was also detected on white fir and Douglas-fir further north on the Shasta-Trinity National Forest (1,783 acres defoliated) (Figure 4) and on private land near Burney, CA (57 acres defoliated). Egg mass counts in this northern outbreak area indicate that some noticeable defoliation should be expected again in 2007.

An **unknown leaf miner** was observed causing injury in black oak at a few locations on the Plumas and Tahoe National Forests. The highest defoliation levels were along Interstate 80 near Blue Canyon. Investigations to determine the damage causing agent will continue in 2007.

Figure 5. Tanoak mortality caused by *P. ramorum* in western Marin County.

Photo: Jeff Mai

The distribution of **sudden oak death** in California did not change significantly (there were no new counties) but *Phytophthora ramorum*-related mortality in 2006 was at the highest level observed since 2000 (Figure 5). Recent estimates suggest that more than a million overstory trees have been killed in California, with at least another million currently infected. The increased mortality is attributed to above average rainfall and late spring rains in 2005 and 2006, followed by an exceptionally hot summer in 2006.

Port-Orford-cedar root disease was found in Port-Orford-cedar and Pacific yew along Clear Creek in the Siskiyou Wilderness Area; this was the first identification of the exotic root disease in the Wilderness Area and on the Klamath National Forest. Injury from **white pine blister rust** continued to intensify on five-needle pine species throughout the known infestation zone in 2006. **Pitch canker** increased within the Coastal Pitch Canker Zone of Infestation in California in 2006 but did not spread outside of the previously infested areas.

Black stain and annosus root disease continued to be problematic throughout California forests in 2006. A root disease with characteristics similar to black stain was detected in the Ancient Bristlecone Pine Forest, Inyo National Forest. Identification of the pathogen is in progress.

Extensive mortality continued in coast live and Engelmann oak in 2006 in southern San Diego County. The cause for the widespread mortality is undetermined and investigations to determine the damage causing agent will continue in 2007.

Insects

Introduced Insects

Asian Longhorned Beetle

Figure 6. Treatment of senitel trees for the Asian longhorned beetle.

Photo: Tim Larson

Anoplophora glabripennis

California Department of Food and Agriculture (CalFire) and USDA Animal and Plant Health Inspection Service (APHIS) inspectors continued ground surveys for Asian longhorned beetle (ALB) around the 2005 detection site in Sacramento County and the trace forward locations in Los Angeles and San Diego Counties. Forest Service smokejumpers from Redding, CA returned in 2006 to climb trees in Sacramento County to survey for beetle activity. Over 16,000 trees were surveyed as of November, 2006, none of which showed any signs of ALB.

In addition to ground and tree climbing surveys, potted sentinel trees (*Acer mono* (=*pictum*) or *A. truncatum*) were treated with a DEMAND insecticide and placed in the ¼ mile buffer zone of the 2005 detection. Sentinel trees produce an odor which is attractive to ALB. Coupled with contact insecticide treatments, the sentinel trees have been shown to be an effective active trap.The sentinel trees were treated at a nursery then transported to the trapping site (Figure 6). Sacramento County Agricultural Commissioner's Office, CalFireA and APHIS also treated over 200 host trees with the prophylactic systemic insecticide Merit 75 WP (imidacloprid).

Gypsy Moth

Table 1. Gypsy moth detections in traps in California in 2006

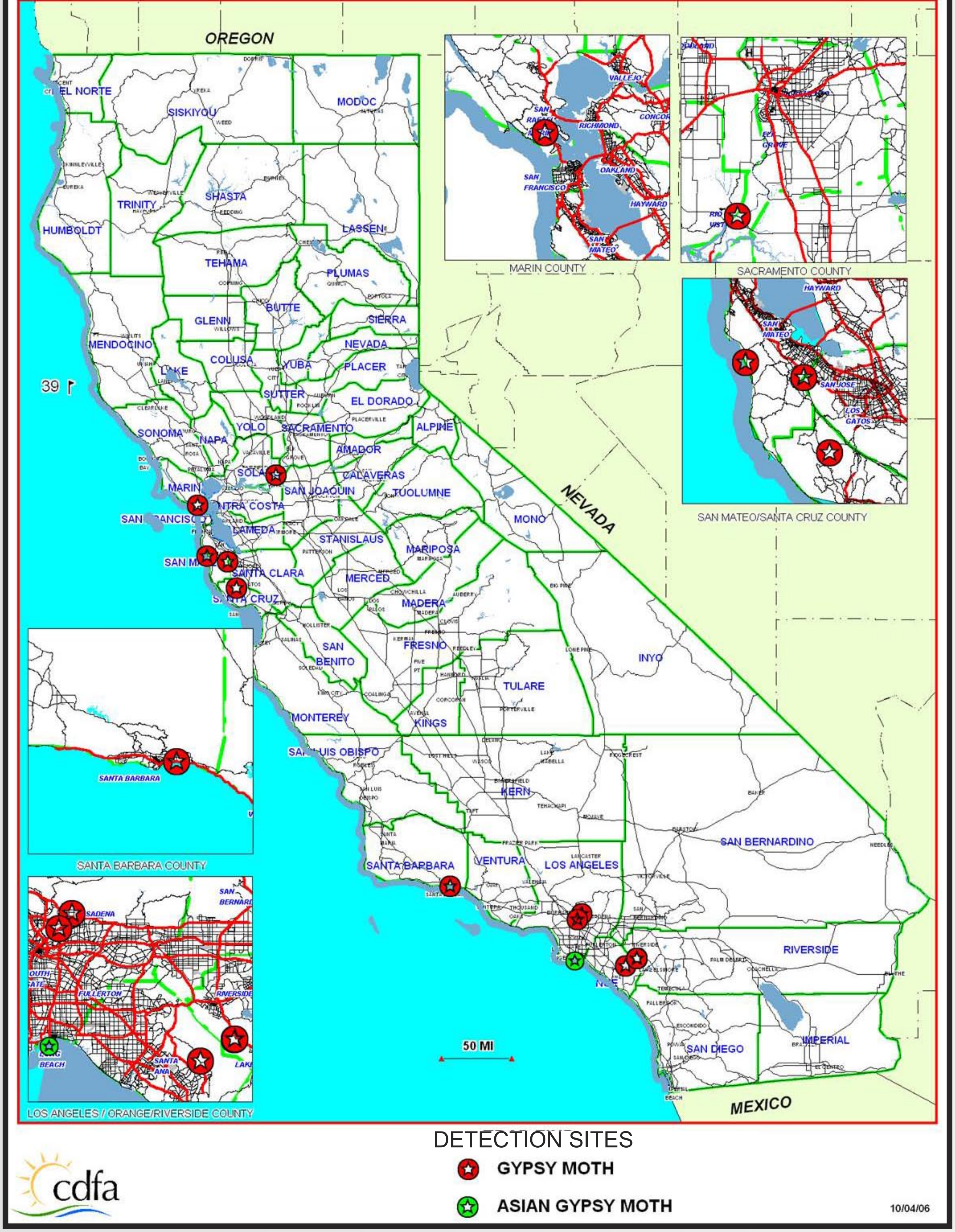
County	City	Adults Trapped
Los Angeles	Highland Park	1
Los Angeles	Pasadena	3
Los Angeles	Long Beach	1(AGM)
Marin	Mill Valley	1
Orange	Silverado	1
Riverside	Corona	3
Sacramento	Ida Island	1
San Mateo	Half Moon Bay	1
San Mateo	Portola Valley	3
Santa Barbara	Montecito	1
Santa Cruz	Boulder Creek	1
TOTAL		**17**

Lymantria dispar

Over 22,000 traps were deployed and monitored as part of California's program to detect and delimit new European gypsy moth (GM), Asian GM (AGM), or Siberian (SGM) infestations in 2006. Trap density in the 19 coastal California counties was three traps per square mile and two traps per square mile in the remaining 39 counties. Ports receiving foreign shipments were trapped at 25 traps per square mile for AGM and SGM. Traps were deployed in urban areas and in rural residential areas of 300 or more homes per square mile. Seventeen moths were trapped at 11 sites in eight counties in 2006 (Table 1), compared to seven moths at seven sites in five counties during 2005.

Eight of the detection sites were single-moth catches and three of the detection sites had multiple moth catches. Sixteen of the moth catches were determined to be European gypsy moth. A single AGM was trapped in Long Beach, Los Angeles County (Map 1). This was the fourth AGM trapped in the state. Delimitation traps were placed for all of these detections. The Long Beach AGM was trapped adjacent to a delimitation response area from a previous AGM find in San Pedro, CA in 2005.

Map 1. Locations of gypsy moth trap detections in 2006.



Icosium tomentosum

Figure 7. Adult *Icosium tomentosum* beetles.

Photo: M. Hoskovec

Five specimens of the exotic longhorned beetle *Icosium tomentosum* were recovered in Orange County in 2006. A visual survey within a 1/4 mile radius of the initial detection failed to detect any evidence of an established infestation.

I. tomentosum is a circummediterrean species represented by two distinct subspecies: *tomentosum* and *atticum*. The subspecies *tomentosum* occurs in southwest Europe and North Africa, whereas spp. *atticum* occurs mainly in the eastern Mediterranean including Turkey, the Balkan Peninsula and reaching south France to the west. Both subspecies develop in various Cupressaceae. Adults are 8-16 mm in length and appear in June through August (Figure 7). Larvae first feed under bark and later enter the wood of recently dead hosts.

Mediterranean Pine Engraver Beetle
Orthotomicus erosus

Figure 8. Adult Mediterranean pine engraver beetle.

Photo: Louis-Michel Nageleisen

Actual Size:

The Mediterranean pine engraver (MPE) (Figure 8), is a exotic bark beetle for North America that was found in May 2004 in baited funnel traps in Fresno, CA by the California Department of Food and Agriculture. Currently, California is the only place where MPE has been detected in North America. It has since been found abundantly throughout California's southern Central Valley (Fresno, Kern, Madera, Merced, and Tulare Counties.) in funnel traps or feeding in the phloem of cut logs of Aleppo and Italian stone pines. A few beetles have also been captured in traps in Monterey, Sacramento, and Salinas Counties, but breeding populations have not been found in these counties yet. Observations in California indicate that this species overwinters as larvae, pupae, and adults beneath the bark. The flight period for MPE in the Central Valley is late February through October-November. There are three generations per year. In 2006, several dead ornamental pines were removed from the Valley Oaks Golf Course in Visalia. Galleries and numerous adult MPE were found throughout the stems.

Red-Haired Pine Bark Beetle
Hylurgus ligniperda

Established populations of the red-haired pine bark beetle (RHBB), were first found in North America in Rochester, New York in 2000. In California, RHBB was first detected by the California Department of Agriculture in July 2003 at two locations in Los Angeles County: Bear Divide Guard Station, Angeles National Forest, and Frank G. Bonelli Regional County Park. These locations are near heavily urbanized areas. In 2005, RHBB was collected in funnel traps in urban and more remote forest lands in Los Angeles, Orange, and San Bernardino Counties. In 2006, RHBB was detected in three more adjacent counties: Riverside, San Diego, and Ventura. In August 2006, RHBB was found at Canyon Crest

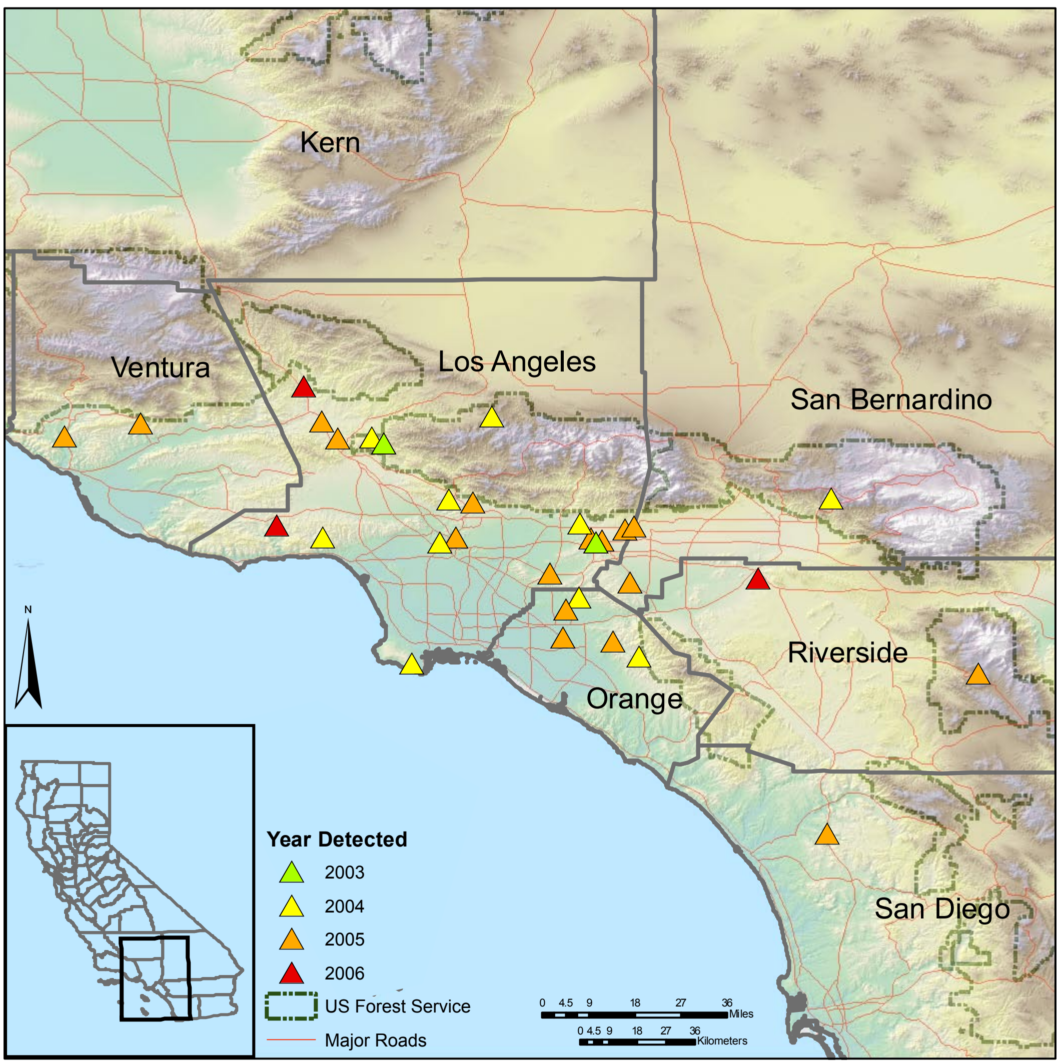
Country Club in Riverside, which is the first time it was collected in urban areas of Riverside County (Map 2).

Adult *H. ligniperda* (Figure 9) are attracted to newly cut stumps, slash and logging debris for breeding. In unhealthy *Pinus* spp., the beetle usually breeds in thick bark near the base of the bole or in large exposed roots. Newly emerged adults may attack seedlings and stressed, pole-sized trees. Adult beetles carry *Leptographium* fungi, which have been implicated in pine root decline. A March 2005 survey in California revealed that RHBB feeds and reproduces in the phloem of large dimensional cut logs of Aleppo and Canary Island pines. Mating pairs of RHBB were also collected from a stump of an Aleppo pine that had broken during a major storm on 27 December 2004. The 2006 trap catch of RHBB in urban Riverside coincided with the dumping of freshly cut pine logs at the site.

Figure 9. Dorsal and lateral view of the red haired pine bark beetle.

Photo: K. Loeffler

Actual Size:



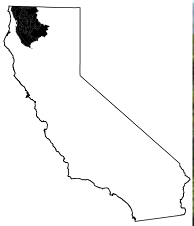
Map 2. Detections of the red-haried pine bark beetle in southern California.

Source: R.L. Penrose, J.C. Lee, D.-G. Liu, and S.J. Seybold, unpublished data

Bark Beetles

Figure 10. Douglas-fir beetle killed isolated trees heavily infested with dwarf mistletoe in the Castle Creek, Scott Camp Creek and upper Sacramento River drainages.

Photo: Dave Schultz

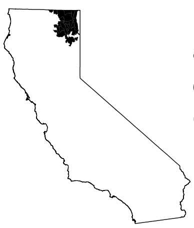


M261A

Cypress Bark Beetle
***Phloeosinus* sp.**
Branch and stem dieback of ornamental cypress was caused by cypress bark beetle at Oak Run, Shasta County.

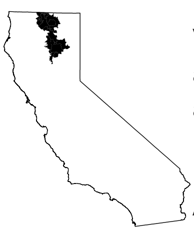
Douglas-fir Beetle
Dendroctonus pseudotsugae
Individual trees that were heavily infested with Douglas-fir dwarf mistletoe were killed by the Douglas-fir beetle in the Castle Creek, Scott Camp Creek and Upper Sacramento River drainages in Siskiyou County (M261A) (Figure 10).

Fir Engraver
Scolytus ventralis
Most of northeastern California experienced low to moderate levels of fir engraver beetle activity in 2006. However, fir engraver beetle-caused mortality continued at the same elevated levels as 2005 in a few areas in conjunction with overstocking, dwarf mistletoe, Cytospora canker and annosus root disease.



M261G

Elevated fir mortality levels continued on the Warner Mountain, Big Valley and Doublehead Ranger Districts, Modoc National Forest. High levels of activity were observed in the Warner Mountains near Cedar Pass, Mount Bidwell, Mount Vida to Buck Mountain, northwest of Boot Lake, and in an area between Pepperdine and Squaw Peak. The Big Valley Ranger District had notable areas of mortality east of Adin near Deer Spring Ridge and also southeast of Adin near Hunsinger Flat (M261G). Mortality also occurred in red and white fir near Medicine Lake on the Doublehead Ranger District (M261D).



M261D

Fir engraver activity was minor throughout most of the Plumas and Lassen National Forests. Areas of elevated activity were southwest of Lake Davis and northeast of Frenchman Lake, Beckwourth District, Plumas National Forest (M261E) and in extremely dense stands on Harvey Mountain and Campbell Mountain, Eagle Lake Ranger District, and Black Mountain, Hat Creek Ranger District, Lassen National Forest (M261G).

M261E

Elevated mortality levels continued throughout the entire red fir belt on the Tahoe National Forest. Red fir infected with dwarf mistletoe and/or annosus root disease were attacked and killed throughout the Alpine Meadows Ski Area, Truckee Ranger District. Fir engraver -caused mortality was also observed on Babbit Peak, Sierraville Ranger District, and near Leviathon Mine in Alpine County. Mortality of red and white fir continued this year on drier, high elevation sites in the vicinity of Interstate 80 from Monumental Ridge north to Yuba Pass and east to the Nevada border, Placer and Nevada Counties (M261E).

Mortality caused by the fir engraver continued at low levels throughout most of the southern Sierra Nevada range. Elevated fir mortality was noted at higher elevations on the Eldorado National Forest. Fir engraver was also found attacking red fir of all size classes in much of the older, decadent stands that are being heavily encroached by lodgepole pine. Most of the high elevation fir mortality in the Eldorado and Stanislaus National Forests was caused by a combination of true fir dwarf mistletoe, fir roundheaded borer and fir engraver. Elevated fir mortality on the Stanislaus National Forest was largely aggregated in the northern section: east of the Emigrant Wilderness along the Summit Level Ridge, and large areas in the Mokelumne and Carson-Iceberg Wilderness. Fir engraver activity in the Sequoia National Forest has subsided to background levels with scattered red fir mortality confined to higher elevations.

The amount of mortality caused by the fir engraver beetle continues to decrease in southern California. Some damage occurred in the San Bernardino Mountains but appears to be approaching the background levels found prior to the recent outbreaks.

Jeffrey Pine Beetle
Dendroctonus jeffreyi

Jeffrey pine beetle activity increased on the east side of the Sierra Nevada range in 2006. Scattered mortality was noted from the northern end of the Carson range down to Coleville, Carson Ranger District, Toiyabe National Forest and from Tahoe City to Sierraville, Sierraville and Truckee Ranger Districts, Tahoe National Forest (Figure 11). Notable areas of Jeffrey pine mortality are Wolf Creek Meadows, the Markleeville area, and south of Chilcoot, CA on the Toiyabe National Forest. Most mortality is in the larger diameter classes (M261E). Jeffrey pine beetle-caused mortality was also noted in large mature trees near Emerald Bay on the south edge of Lake Tahoe. Jeffrey pine beetle activity is expected to increase in these areas in 2007.

Figure 11. Mortality of large diameter Jeffrey pine caused by Jeffrey pine beetle, near Luther Pass; along Hwy. 89 south of Lake Tahoe.

Photo: S.L. Smith

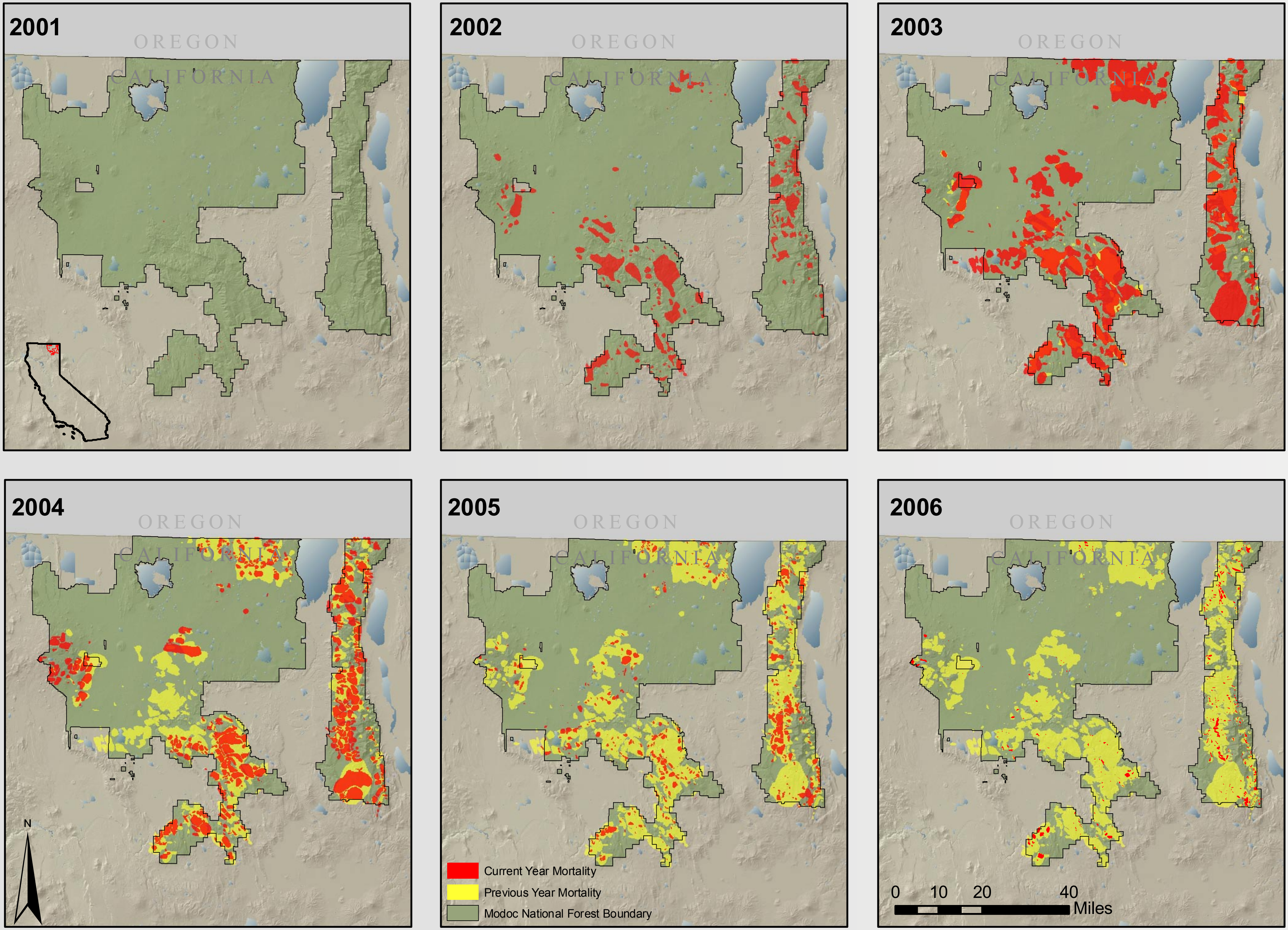
Jeffrey pine beetle was associated with chronic Jeffrey pine mortality in a stand of pine mixed with white and red fir south of Swain Mountain, Plumas Co. The pines show considerable evidence of snow caused injury, including broken, bent, and uprooted trees; nearby fir trees were not injured.

Mountain Pine Beetle
Dendroctonus ponderosae

Mountain pine beetle activity increased in lodgepole pine, western white pine and whitebark pine stands in northeastern California in 2006. Similar to 2005, the highest mortality levels were observed on the Modoc National Forest where mountain pine beetle continued to cause mortality of ponderosa pine, lodgepole pine, whitebark and western white pine. The north end of the Warner Mountain range has some of the highest mortality levels in California, especially on Mount Bidwell, where approximately 75 trees/acre have been killed (Map 3). Other notable areas of mortality in the northern Warner Mountains include Mount Vida, Fandango Valley and Buck Mountain. The lodgepole and whitebark pine mortality is also occurring in the south end of the range near Pepperdine, Squaw Peak, and from Warren Peak to Eagle Peak. In addition, high levels of lodgepole pine mortality occurred on the southeast side of the Warner Mountains near Sworinger Reservoir and Red Rock Mountain, Warner Mountain District (M261G), and near Medicine Lake, Doublehead Ranger District, Modoc National Forest (M261D).

The Tahoe National Forest had elevated lodgepole pine mortality along Prosser Creek, near Boreal Ridge and Interstate 80, along the Truckee River, and southeast of Independence Lake, Truckee Ranger District. Elevated levels of large diameter western white pine mortality were observed near Alpine Meadows (M261E), Truckee Ranger District.

Map 3: Aerial Survey Results: Mortality mapped on the Modoc National Forest (2001-2006)



Mountain pine beetle-caused mortality of white pine blister rust infected sugar pine was observed near La Porte, Feather River Ranger District (M261E) and in the Lake Tahoe Basin Management Unit. Mortality of lodgepole pine was observed southwest of Lake Davis, Beckwourth Ranger District, Plumas National Forest (M261E). Other areas of mountain pine beetle-caused mortality include lodgepole pine in the Thousand Lakes Wilderness, Hat Creek Ranger District, Lassen National Forest (M261D) and western white pine and whitebark pine east of Sonora Pass, Bridgeport District, Toiyabe National Forest (M261E).

Figure 12. Mountain pine beetle and a fluctuating lake level killed a foxtail pine at Washbasin Lake in the Trinity Alps wilderness.

Photo: Dave Schultz

M261E

M261D

M261A

Mountain pine beetle was responsible for the death of widely scattered individual lodgepole pines on the Whaleback, Siskiyou County. The level of mortality was the lowest seen there in the past four years. Mountain pine beetle activity was largely absent from Latour Demonstration State Forest. Mountain pine beetle was also involved in the death of western white pine and foxtail pine near the Young's Valley trailhead to the Siskiyou Wilderness Area, and above Mill Creek Lake in the Trinity Alps Wilderness Area(M261A) (Figure 12).

Mountain pine beetles continued to kill pines in the southern California mountains. The amount of mortality has steadily decreased from previous outbreak years. Levels of mortality appear to be returning background levels. Concerns exist about future root disease due to incomplete treatments of stumps of bark beetle-killed trees.

Red Turpentine Beetle
Dendroctonus valens

Red turpentine beetle activity was observed in sugar pine, ponderosa pine and Jeffrey pine in nearly every prescribed burn and wildfire visited in northeastern California in 2006 (Figure 13). In a spring 2004 prescribed burn near Prattville, Almanor Ranger District, Lassen National Forest, most large diameter ponderosa and sugar pine that had >50 red turpentine beetle attacks are still alive. These trees received very little crown scorch during the burn. Monitoring will continue for the next 3 years (M261E).

Red turpentine beetle caused scattered mortality in a 20-year-old ponderosa pine plantation north of Lake Almanor, Plumas County. The plantation was thinned in the spring of 2004 and most of the attacks appeared to have occurred in 2005, suggesting that a build-up of RTB in cut stumps contributed to the mortality.

Figure 13. Attacks by red turpentine beetles immediately following the Boulder Creek Fire north of Antelope Lake. Mt. Hough Ranger District, Plumas National Forest.

Photo: S.L. Smith

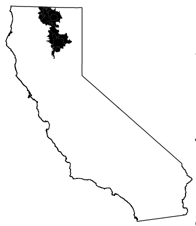
Western Pine Beetle
Dendroctonus brevicomis

Western pine beetle-caused mortality increased slightly in northeastern California in 2006. Western pine beetle-caused mortality of ponderosa pine was most prevalent in the Warner Mountains, Warner Mountain Ranger District, Modoc National Forest. Specific areas include Mount Bidwell from Mount Vida to Buck Mountain, Fandango Valley and Joseph Creek. The Wildhorse Reservoir and Weed Valley areas west of Goose Lake,

M261G

Devils Garden Ranger District, Modoc National Forest had elevated levels of western pine beetle-caused ponderosa pine mortality and Ash Creek had scattered activity on the Big Valley Ranger District, Modoc National Forest (M261G).

Elevated ponderosa pine mortality continued on the Eagle Lake District, Lassen National Forest on the lower northeast side of Campbell Mountain, between Upper and Lower Gooch Valleys and between Hog Flat Reservoir and the Susan River. Pockets of mortality were also found in the area of the Straylor Fire, Hat Creek Ranger District, Lassen National Forest (M261D).



M261D

Scattered ponderosa pine mortality continued in and around Hobo Camp on Bureau of Land Management land near Susanville, Lassen County.

The Plumas National Forest had one area of elevated ponderosa pine mortality near Frenchman Lake on the Beckwourth Ranger District and the Tahoe National Forest had activity near Camp Pendola on the Yuba River Ranger District (M261E).

M261E

Western pine beetle activity was generally low for the remainder of California. An exception was in chronic black stain root disease areas near the eastern end of McCloud Flats (M261D). Scattered mortality of ponderosa pine caused by the western pine beetle was also noted near Black Butte, Shasta County. The site has well-drained, droughty soils and is at the edge of the natural range of ponderosa pine. Western pine beetle was also responsible for the death of scattered ponderosa pine that had been heavily scarred by the Campbellville Fire nearly 20 years ago.

Engraver Beetles

Ips spp.

Engraver beetles continue to cause scattered mortality of shore pine and Bishop pine along the Mendocino coast from Fort Bragg northward to Cleone, CA.

Pine Engraver

Ips pini

Small outbreaks of *Ips pini* killedponderosa pines of various ages in the Camino area of El Dorado County. Trees were growing on poor sites and in overly dense stands.

Figure 14. The amethyst cedar borer was found in Port-Orford Cedar trees dying from Port-Orford Cedar root disease along the Sacramento River in Dunsmuir, and also along Clear Creek in the Siskiyou Wilderness.

Photo: Dave Schultz

Wood Boring Beetles

A neglected Christmas tree plantation located near the Redding Municipal Airport had numerous dying trees. Flatheaded borers were the only biotic organisms detected in the dying trees. The mix of pine species appeared to include Monterey and Scots pines. The plantation had been watered for some length of time after establishment, but had not been watered recently.

Wood boring beetles were found attacking severely burned trees in several early to mid-summer wildfires throughout northeastern California. Fires with high levels of wood borer activity in ponderosa and Jeffrey pine included the Boulder Complex near Antelope Lake, Mt. Hough Ranger District, Plumas National Forest and the Creek Fire that burned near Susanville, CA, Lassen County.

Amethyst cedar borer
Semanotus amethystinus
The amethyst cedar borer infested mature Port-Orford cedars that died along the Sacramento River in Dunsmuir, CA and also along Clear Creek in the Siskiyou Wilderness Area, Siskiyou County (M261A) (Figure 14).

California Flatheaded Borer
Melanophila californica
A flatheaded borer, which appears identical to *Melanophila drummondi*, caused mortality and top-kill of mountain hemlock on the ridge between Little Duck Lake and High Lake in the Russian Wilderness Area (M261A).

Fir Roundheaded Borer
Tetropium abietis
Most of the high elevation fir mortality in the Eldorado and Stanislaus National Forests was due to a combination of true fir dwarf mistletoe, fir roundheaded borer and fir engraver.

Flatheaded Fir Borer
Melanophila drummondi
During 2006, Douglas-fir mortality in interior portions of Santa Cruz, Mendocino, and southern Humboldt Counties increased slightly from levels detected in previous years. Mortality from this beetle was noted on Douglas-fir infected with *Phaeolus schweinitzii* in Santa Cruz County.

Douglas-fir growing on private property near Cedar Creek, west of Round Mountain in Shasta County exhibited varying degrees of resin streaming and branch and top dieback; symptoms that are typical of chronic activity by the flatheaded fir borer on stressed trees.

Defoliators

Douglas-Fir Tussock Moth
Orgyia pseudotsugata

During 2006, defoliation from Douglas-fir tussock moth (DFTM) was detected by aerial surveys in Yosemite National Park (Figure 15) and on the Sierra and Stanislaus National Forests on over 20,605 acres; much higher than that observed in 2005 (12,711 acres) (Map 4). The Sierra National Forest had 10,005 acres of defoliation, Yosemite National Park had 7,157 acres of defoliation and the Stanislaus National Forest recorded 2,275 acres of defoliation. Whole tree mortality may be observed in the defoliated areas, however, top kill may be more common. No DFTM egg masses were found during preliminary surveys (used to predict populations trends) conducted in the fall of 2006 indicating that the DFTM populations in these areas appear to be collapsing.

Figure 15. Defoliation by the Douglas-fir tussock moth in Yosemite National Park, 2006.

Photo: Jeff Mai

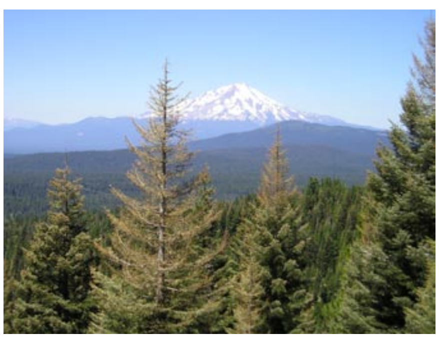


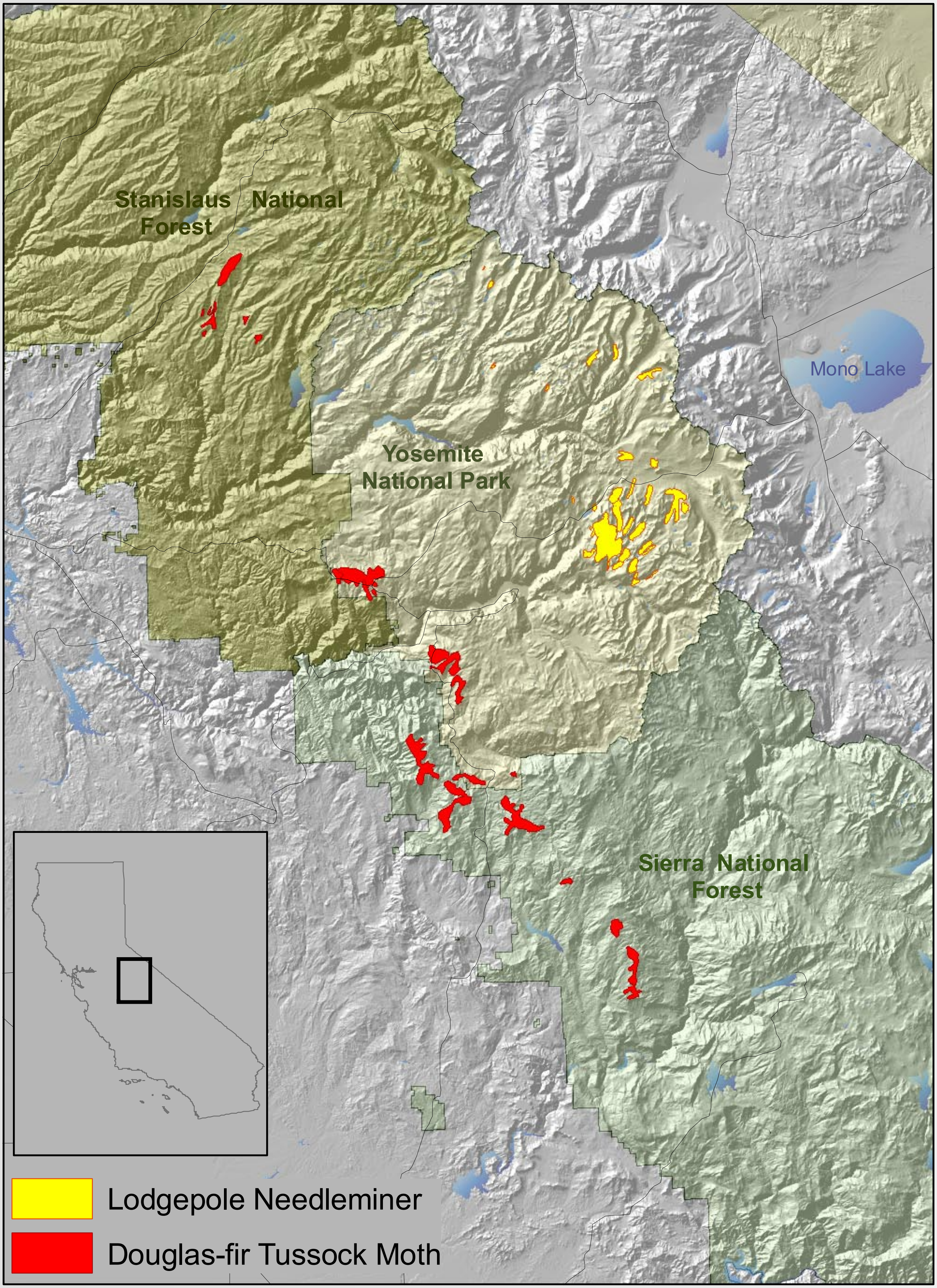
Figure 16. The second year of a Douglas-fir Tussock Moth outbreak caused visible defoliation around the Bear Mountain Lookout east of McCloud.

Photo: Dave Schultz

DFTM defoliated areas were detected in a few new locations in 2006. There were about 40 acres of white fir defoliated on the Eldorado National Forest near Panther Creek. DFTM feeding on white fir and Douglas-fir was also detected further north on the Shasta-Trinity National Forest (1,783 acres) (Figure 16) and on private land near Burney, CA (57 acres). Egg mass counts in the northern DFTM outbreak area indicate that some noticeable defoliation should be expected in 2007.

Traps to monitor for DFTM male moths (used to monitor population levels) were installed in 164 plots (5 traps/plot) in 2006. Plots that exceed 25 moths per trap trigger additional sampling for other life stages to predict defoliation levels. There were 132 (80%) plots with an average of <25 males per trap and 32 plots (20%) that averaged 25 or more moths per trap (Table 2). Only 11% percent of the plots averaged >25 males moths per trap in 2005 indicating an upward trend in overall trap counts in 2006. Plots that averaged >25 moths per trap for 2006 were located on the following Ranger Districts: Placerville (Eldorado National Forest), Almanor (Lassen National Forest), Big Valley (Modoc National Forest), Mt. Hough (Plumas National Forest), Minarets (Sierra National Forest) and Calaveras and Summit (Stanislaus National Forest) and the Yuba River (Tahoe National Forest). In addition to these plots monitored on National Forests, five plots exceeded an average of 25 moths/trap on lands of other ownership. Two of these plots were in Yosemite National

Map 4. Defoliation caused by Lodgepole needleminer and Douglas-fir tussock moth mapped by aerial survey in the southern Sierra Nevada range in 2006.



Year	Total # of Plots	NUMBER OF PLOTS WITH AN AVERAGE MOTH CATCH PER TRAP OF:													
		0<10	10<20	20<25	25<30	30<35	35<40	40<45	45<50	50<55	55<60	60<65	65<70	70<75	75+
1995	158	77	35	13	16	7	7	3	0	0	0	0	0	0	0
	100%	49%	22%	8%	10%	4.5%	4.5%	2%							
1996	149	33	26	16	8	7	12	9	5	8	6	8	5	1	5
	100%	22%	17%	11%	6%	4%	8%	6%	3%	6%	4%	6%	3%	1%	3%
1997	142	88	27	10	9	4	3	0	0	1	0	0	0	0	0
	100%	62%	19%	7%	6%	3%	2%			<1%					
1998	159	81	22	11	9	6	3	10	7	5	2	1	1	1	0
	100%	51%	14%	7%	6%	3%	2%	6%	4%	3%	<1%	<1%	<1%	<1%	
1999	159	126	20	5	3	2	2	0	0	0	1	0	0	0	0
	100%	79%	13%	3%	2%	1%	1%				1%				
2000	185	154	15	4	4	0	1	2	2	2	0	0	1	0	0
	100%	83%	8%	2%	2%		<1%	1%	1%	1%			<1%		
2001	183	95	57	13	10	6	0	1	1	0	0	0	0	0	0
	100%	52%	31%	7%	5%	3%		<1%	<1%						
2002	168	126	31	5	3	3	0	0	0	0	0	0	0	0	0
	100%	75%	18%	3%	2%	2%									
2003	163	53	42	11	11	10	14	13	3	1	4	0	1	0	0
	100%	32%	26%	7%	7%	6%	8%	8%	2%	1%	2%		1%		
2004	174	68	43	6	16	11	6	5	3	0	2	1	1	0	0
	* 93%	39%	25%	3%	9%	6%	3%	3%	2%		1%	<1%	<1%		
2005	195	139	15	11	7	4	3	2	3	1	0	0	0	1	1
	*95%	71%	8%	5%	4%	2%	2%	1%	2%	<1%				<1%	<1%
2006	164	98	26	8	8	5	3	4	3	4	2	0	1	1	1
	100%	60%	16%	5%	5%	3%	2%	2%	2%	2%	<1%		<1%	<1%	<1%

* Some plots were not collected due to weather.

Table 2. Number of Douglas-fir tussock moth pheromone detection survey plots by trap catch for California, 1995-2006.

Park and the remaining three were on private land monitored by CalFire. (2 plots in Shasta County and 1 plot in Modoc County).

Fall Webworm
Hyphantria cunea
Infestations of fall webworm were noted in Tuolumne, Amador, Calavaras, and Eldorado Counties. Light defoliation was noted along the highway 49 corridor and south on Highway 108. Most of the affected trees occurred in groups along streambeds or by roadsides (Figure 17).

Figure 17. Fall webworm webs on various oak species along Highway 49 in Calavaras County.

Photo: Beverly Bulaon

Fruittree Leafroller
Archips argyrospilus
Black oaks had some feeding by fruit tree leafroller in early June near Cedar Camp on the Mendocino National Forest (M261B).

M261B

Jeffrey Pine Needleminer
Coleotechnites* sp*. near milleri
The Jeffrey pine needleminer infestation continued this year near Truckee, Placer County, but at a lower intensity. Approximately 200 acres were affected, which is about the same as last year. The affected area is still entirely to the south of Interstate 80 (M261E).

Lodgepole Pine Needleminer
Coleotechnites milleri
Lodgepole needleminer defoliated nearly 14,000 acres of lodgepole pine on the eastside of Yosemite National Park (Figure 18). This is considerably lower than previous years. Over 30,000 acres of defoliation have been detected anually since 2003. Most of the defoliation was concentrated between Tenaya Lake and Cathedral Ridge in Tuolumne Meadows (Map 4). Feeding appears to have tapered off in currently infested areas, and no lodgepole pine mortality was identified.

Figure 18. Defoliation caused by lodgepole needleminer around May Lake in Yosemite National Park.

Photo: Beverly Bulaon

Pandora Moth

Coloradia pandora

Pandora moth populations increased in El Dorado County in the Lake Tahoe Basin Management Unit, however very little defoliation occurred.

Ponderosa Pine Tip Moth

Rhyacionia zozana

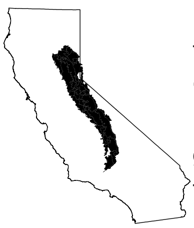
Ponderosa pine tip moth caused significant injury to ponderosa pine plantations near Goose Valley, Shasta County and north of Lookout, Modoc County. Western pineshoot borer is also infesting trees at these sites.

M261A

Sawflies

***Neodiprion* sp.**

Understory ponderosa pine trees were defoliated by sawflies during the spring in Yreka, Siskiyou Co. (M261A).



M261E

Unknown Oak Leaf Miner

(Reported as unknown oak leaf skeletonizer in 2005)

Leaf miner injury was observed in black oak (*Quercus kelloggii*) at a few locations on the Plumas and Tahoe National Forests. The largest area, along Interstate 80 near Blue Canyon, Tahoe National Forest, had the highest defoliation levels. The foliage was attacked in early summer resulting in complete or nearly complete browning of leaves. Some re-growth occurred on a few trees later in the summer. This is the second year in a row for this insect activity. This same type of defoliation was also observed on Bloomer Hill near Berry Creek and Schneider Creek, Plumas National Forest and on Kimshew Point, Butte County (M261E) (Figure 19).

Figure 19. Injury caused by an unknown oak leafminer on black oak around Blue Canyon along Interstate 80.

Photos: William Woodruff and Jeff Mai

Other Insects

Black Pineleaf Scale
Nuculaspis californica

Figure 20. Black pineleaf needle scale damage on ponderosa pine, Modoc National Forest.

Photo: Danny Cluck

Black pineleaf scale was observed infesting ponderosa pine plantations and mature stands on and adjacent to Timber Mountain, Doublehead Ranger District, Modoc National Forest (Figure 20). This is the same general area where one of California's largest outbreaks of black pineleaf scale occurred in 1992. In 2006, plantations on Timber Mountain had many pockets with severe defoliation and stunted growth due to chronic and heavy scale infestations. Healthier plantation trees, with good leader growth and needle retention, have chlorotic foliage from lighter infestations. Several larger trees within and adjacent to the plantations are also infested and exhibited poor needle retention. One natural stand of ponderosa pine (~20 acres), surrounding a nearby pumice plant, is severely infested with scales. Approximately 50% of the trees in this stand have died over the past few years and the surviving trees have very little foliage. In this stand, dust from the pumice plant is likely playing a role in reducing the ability of the predators and parasites to find the scales.

Scales were also abundant on the foliage of several large ponderosa pines growing near a dirt surfaced residential road near Janesville, CA, Lassen County (M261E).

Sugar pine suffering from an outbreak of black pineleaf scale north of Dead Horse Summit, Siskiyou County, had healthier foliage this year. Trees within the infested area (roughly 1500-to-2000 acres) had greener and fuller crowns than were seen in 2005.

California Tortoise-Shell
Nymphalis californica

Large acres of *Ceanothus* sp. bushes were being severely defoliated by California tortoise-shell larvae in several locations around the Groveland Ranger District, Stanislaus National Forest. In late-July to early August, swarms of adults were congregating in the middle of roadways on the Stanislaus National Forest, and also along Highway 120 through Yosemite National Park.

Gouty Pitch Midge
Cecidomyia piniinopsis
A small group of trees in Tuolumne County had high leves of gouty pitch midge. The probable cause was major site disturbance from housing developments.

Pine Needle Scale
Chionaspis pinifoliae
About five acres of ponderosa and sugar pines in a mixed conifer stand on the Groveland Ranger District, Stanislaus National Forest had a chronic infestation of pine needle scale. Mature pines had been suffering slow needle loss for a number of years, however no mortality was attributed directly to the scale.

Pine Needle Sheathminer

Zelleria haimbachi

A thinning operation in the Pondosa Burn plantation, Siskiyou County, provided the opportunity to inspect the tops of cut, 22-year-old ponderosa pine for infestation by the pine needle sheathminer in an area that had experienced sheathminer outbreaks during the 1990s. No appreciable injury was present, but 59% of shoots from top whorls and terminals were infested with one or more sheathminer larvae. In contrast, 30% of shoots from the lower crowns of nearby uncut trees were infested with one or more larvae. Regardless of position within the tree, the majority of shoots had one larva, but occasionally 2 or 3 were found. These results translate in to an average of less than one larva per shoot. Infestation levels this low go unnoticed since each larvae destroys only 6-to-10 needle fascicles before pupating.

M261A

Plantations of ponderosa pine were heavily infested by the pine needle sheathminer in China Flat, Groveland Ranger District, Stanislaus National Forest. The infestation was scattered over 15 acres Some trees had nearly 50% loss of current and older foliage. Trees (<10 feet tall) displayed stunted terminal growth or "bottlebrush" shorter leaders, however no mortality was detected.

Figure 21. Pit-making scales were abundant enough on tanoak and huckeberry oak in the Clear Creek drainage in the Siskiyou Wilderness Area to kill trees (Klamath National Forest).

Photo: Dave Schultz

Pit Scale

***Asterolecanium* sp.**

Understory tanoak and huckleberry oak were killed by a pit scale in the Clear Creek drainage in the Siskiyou Wilderness Area (M261A) (Figure 21).

Spruce Aphid

Elatobium abietinum

Fewer reports were received this year about declining Sitka spruce in Humboldt County compared to previous years. Chronically infested Sitka spruce along Highway 101 between Fortuna, CA and Eureka, CA in Humboldt County looked slightly better this year than in past years.

Thrips

Unknown species

Needle damage was caused by thrips on Douglas-fir Christmas trees near Camino, El Dorado County.

Western Pineshoot Borer

Eucosma sonomana

The western pineshoot borer continued to damage plantation ponderosa pine near Pondosa, CA, Siskiyou and Shasta Counties and north of Lookout, Modoc County. Damage, in the form of stunted terminals, varies widely across the plantations. Some stands are receiving pheromone-based treatments to reduce damage.

Figure 22. Willow blister gall was found in Whiskeytown National Recreation Area. (Shasta County).

Photo: Jennifer Gibson.

Willow blister gall midge

Oligotrophus salicifolius

Galls on willows caused by this cecidomyiid were common in the Whiskeytown National Recreation Area in late summer (M261A) (Figure 22).

Diseases

Introduced Diseases

Pitch Canker
Fusarium circinatum
Pitch canker disease was first identified in California on Monterey pine in the Santa Cruz area in 1986. It now exists in the coastal and adjacent areas of the state from San Diego to Mendocino Counties. The disease tends to be most serious on planted Monterey and Bishop pines but is a major concern in the limited natural ranges of Monterey pine in California. Pitch canker also affects Coulter, gray, knobcone, shore, torrey, aleppo, canary island, and Italian stone pines as well as Douglas-fir in California. Laboratory tests show that most native pines in the state could potentially be infected. The spread of the disease in California is thought to be primarily by insects, mostly bark, twig and cone beetles, that carry the fungus on their bodies and act as vectors. Humans may also spread the disease by moving infested material from one area to another.

Pitch canker disease has increased within the Coastal Pitch Canker Zone of Infestation in California during 2006. It has not spread outside of the previously infested areas but has intensified within this zone. In areas where the infestation has existed for a long period of time, the disease has moved up higher in elevation.

Douglas-fir seed orchard trees in the Camino area of El Dorado County in the Sierra Nevada range were found to be infected in previous years. All of the infected trees were destroyed. Since then, no new infections have been found in the seed orchard and the disease has not been discovered during extensive surveys of wild land forests, Christmas tree plantations, or landscape plantings in the area.

Recent research on pitch canker disease has found that the fungus easily forms spores on Douglas-fir in experiments conducted in coastal areas. However, experiments in the inland areas did not show that spore production could readily occur on Douglas-fir away from the coast.

Figure 23. Pitch canker infection on a Monterey pine seedling at Point Reyes National Seashore.

Photo: Jack Marshall

Aleppo pines in the Legoland area of San Diego County were killed by *F. circinatum* in the past. The affected trees have since died. Spore traps are being monitored in the area to determine whether there continues to be any potential infection pressure in the area. Surveys of the surrounding areas have not uncovered any significant outbreaks of pitch canker in susceptible landscape plantings.

In 2005, infections were found in large, planted Monterey pines in a private campground in Olema and in a mature Monterey pine plantation (Figure 23) and adjacent native Bishop pines in the Drakes Estero portion of Point Reyes National Seashore. Recent reports are of flagging north of those areas in late 2006, have not been surveyed. These infections mark the most northern coastal sites in Marin County wherein symptoms have been reported or sampled.

Phytophthora Root Rot

Phytophthora cinnamomi

Figure 24.
P. cinnamomi-caused mortality of Ione manzanita along SR88, south of Ione, CA.

Photo: Ted Swiecki

Figure 25.

P. cinnamomi-caused mortality of pallid manzanita in the Oakland Hills.

Photo: Ted Swiecki

Mortality due to *Phytophthora cinnamomi* continues to affect the endangered Ione manzanita (*Arctostaphylos myrtifolia)* in at least two sections of its limited range in Amador County (Figure 24). Ione manzanita occurs on Ione formation soils in this area, which are highly acidic. The common whiteleaf manzanita (*A. viscida*) is also killed by *P. cinnamomi* in the infested areas. Both manzanitas are commonly killed in upland sites and along slopes that dry out by late spring. Other species, including scrub oak (*Q. berberidifolia*) are affected in low lying areas such as drainages that remain wet later in the season. DNA microsatellite analyses by the Garbelotto lab (UC Berkeley) have shown that the larger infested area, located between Ione and Buena Vista, has apparently resulted from several independent introductions of the pathogen into the area, whereas only a single genotype has been associated with mortality in the Carbondale Road area. However, *P. cambivora* was also associated with diseased manzanita in one portion of the affected Carbondale Road area.

P. cinnamomi was also associated with native plant mortality in the Oakland Hills on a steep slope below residences and upslope from the Huckleberry Botanic Regional Preserve. Movement of the pathogen downslope into the Preserve is likely. Affected species included the endangered pallid manzanita (*A. pallida*) (Figure 25), brittleleaf manzanita (*A. tomentosa* ssp. *crustacea*), giant chinquapin (*Chrysolepis chrysophylla* var. *chrysophylla)*, and huckleberry (*Vaccinium ovatum*). Chinquapin appeared to be the most sensitive of the species present in the affected area.

P. cinnamomi was also associated with mortality of madrone and California bay on a hill overlooking the Miwok Meadows area of China Camp State Park. This area is also severely affected by sudden oak death (caused by *P. ramorum*), and includes an area containing long-term Sudden Oak Death (SOD) research plots. Dead madrone and manzanita plants, most likely killed by *P. cinnamomi,* were noted within the area when the SOD research plots were established in 2000. Wilting and mortality of mature madrone observed in the 2006 plot evaluations prompted investigation that led to the isolation of *P. cinnamomi.*

P. cinnamomi was found killing incense cedar trees in Shasta and El Dorado Counties where streams have flooded the trees during the past rainy season. The pathogen has also killed Douglas-fir Christmas trees in plantations in Sacramento and Placer Counties when irrigated with infested water sources. Shade trees are sickened and killed in many parts of the Central Valley of California especially affecting oaks and sycamores in the Sacramento Valley.

These *P. cinnamomi* root disease occurances are notable in that they are affecting native vegetation in relatively dry areas on slopes. All of the sites also have relatively poor soils with low levels of organic matter. *P. cinnamomi* may be more common than previously suspected in sites such as these in many parts of California.

Port-Orford-Cedar Root Disease
Phytophthora lateralis

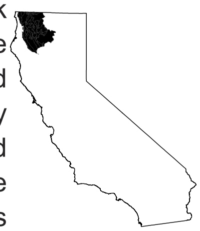
Figure 26. Port-Orford-cedar mortality due to Port-Orford-cedar root disease along Clear Creek in the Siskiyou Wilderness Area (Siskiyou County).

Photo by Dave Schultz

Port-Orford-cedar (POC) is found on approximately 35,000 acres in California; primarily on the Six Rivers, Shasta-Trinity and Klamath National Forests. The species has a narrow geographic range, but a wide ecological amplitude. POC is found at elevations from sea level to 6,400 feet and among a variety of species with differing ecological requirements, from coast redwood to mountain hemlock.

Phytophthora lateralis, an exotic root pathogen, was introduced to the native range of POC in the early 1950s. It is almost always fatal to trees. *P. lateralis* spores are spread via infested water or soil. A typical long distance spread scenario involves infested soil being transported into an uninfested area from mud on vehicles or equipment or in infested water. The infested soil falls off of the vehicle or spores are delivered via water. The pathogen first infects POC near the site of introduction then is washed downhill in surface water which infects additional hosts. This is especially lethal along drainages and creeks where infested water is channeled and flows near concentrations of healthy POC. About 8% of the POC acres in California are infested with the disease.

Port-Orford-cedar root disease was identified in POC and Pacific yew along Clear Creek in the Siskiyou Wilderness Area (M261A) (Figure 26). This was the first identification of the exotic root disease in the Wilderness Area and ont he Klamath National Forest. Scattered pockets of mortality were identified and confirmed to be caused by *P. lateralis* approximately one mile south of Young's Valley (6.3 miles from the Young's Valley Trailhead) and continuing approximately nine miles further down Clear Creek (to approximately ½-mile above the junction of Clear Creek and the West Fork of Clear Creek). Additional pockets of dead and dying POC were observed from that point to the Clear Creek Trailhead, but because they were located well below the Clear Creek Trail, pathogen confirmations were not completed.



M261A

Port-Orford-cedar root disease was also present along the main stem of the Sacramento River from Dunsmuir to Shotgun Creek (M261A). Monitoring of the POC eradication treatments at Scott Camp Creek in the upper part of the Sacramento River drainage (M261A) revealed no new infestations of POC root disease.

Fourteen years after POC root disease was eradicated from Cedar Rustic Camp, both the host tree and the disease organism have reinvaded due to a lack of maintenance. All infected and uninfected POC have since been removed from the campground (Del Norte Co., M261A).

The Trinity River drainage (M261A) continues to be the only major uninfested river drainage within the range of POC.

Sudden Oak Death
Phytophthora ramorum

Significant *Phytophthora ramorum*-related oak and tanoak mortality over the past ten years has resulted in substantial concerns for the forests of California where this exotic pathogen is found. Commonly called "sudden oak death" (SOD) when affecting oaks and tanoaks, *P. ramorum* also causes a foliar disease known as *ramorum* blight, which affects 100 known plant species. Foliar hosts can be found in infested forests as well as the nursery industry, and while these plants rarely die if infected by *P. ramorum,* many facilitate pathogen spread. *Phytophthora ramorum* is an exotic pest, and recent findings strongly suggest it was introduced inadvertently to California through nursery stock (Ivors and others, 2006). Regulations to limit the spread of this invasive pest are in place at the federal and State levels, including a federal order to regulate interstate shipments for all nurseries in California, Oregon and Washington with host plants on site.

During 2006, *P. ramorum*-related mortality was at the highest level observed since 2000 (Figure 27). Recent estimates suggest that more than a million overstory trees have been killed in California, with at least another million currently infected. The increased mortality is attributed to above average rainfall and late spring rains in 2005 and 2006, followed by an exceptionally hot summer in 2006. Tanoak mortality was widespread in Sonoma County from Forestville west to Fort Ross. The Russian River area (Guerneville) is of particular concern due to the number of residences in the area. SOD mortality was spotted for the first time north of Cloverdale and was scattered in several locations along the Mendocino/Sonoma County line. In Humboldt County, tanoak mortality was more apparent in the Garberville area. Mortality also flared up in areas infested with the pathogen since the late 1990s, including parts of Marin, Santa Cruz and Monterey Counties. Maps of *P. ramorum* confirmations and other mortality estimates are available online at the California Oak Mortality Task Force (COMTF) website, www.suddenoakdeath.org.

Figure 27. Tanoak mortality in Marin County.

Photo: Janet Klein, Marin Municipal Water District.

New hosts. Twenty new hosts were confirmed and added to the USDA Animal and Plant Health Inspection Service (APHIS) *P. ramorum* regulated list in 2006. While many of these new hosts were detected in nursery settings outside of the U.S., new additions of particular importance for California forests were *Abies magnifica* (red fir), *Ceanothus thyrsiflorus* (blueblossom), and *Eucalyptus haemastoma* Sm. (Myrtaceae – Myrtle family). The current list of hosts, including over 100 plant species in more than 60 genera, can be found on the COMTF website, www.suddenoakdeath.org.

***P. ramorum* in nurseries.** To date in 2006, eleven states have had *P. ramorum* detected in nurseries: Alabama (1), California (26), Connecticut (1), Florida (2), Georgia (1), Indiana (1), Maine (1), Mississippi (1), Oregon (13), Pennsylvania (1), and Washington (10). Since 2004, when 20 states and more than 170 nursery-related detections were made, the number of such detections has continued to decline each year as a result of implementing the current USDA APHIS federal regulations. In California specifically, there were 26 confirmations at nurseries as of August 2006, down from the 53 confirmations in the state in July 2005.

New research findings. Previous to 2006, pathologists had thought that this pathogen infected only above ground plant parts of forest hosts. However, this year the pathogen was isolated from asymptomatic root tissue of infected tanoak seedlings (Parke and others, 2006a) (Figure 28). Researchers also found that sapflow and specific conductivity were significantly reduced in infected tanoak trees, suggesting that interference with water conductance may be a factor in tree mortality (Parke and others, 2006b). Other studies revealed the importance of spore survival in soil and water, especially in nurseries, which has implications for sanitation and spread in these environments (Linderman and Davis, 2006; Wamishe et al., 2006). Also within the nursery setting, pathologists discovered a third lineage of *P. ramorum*, distinct from the A1 and A2 lines previously known from North American forests and European gardens and nurseries (Ivors and others, 2006).

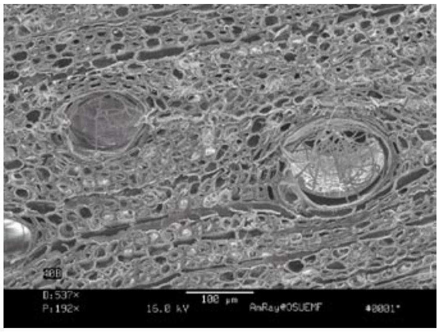


Figure 28. *P. ramorum* hyphae growing in water vessels of an infected tanoak.

Photo: Jennifer Parke, Oregon State University.

Surveys and monitoring. The USDA Forest Service (USFS) and Cal Poly San Luis Obispo completed their 2006 SOD aerial and targeted ground survey of high-risk forest areas, covering 6,667 miles and 9,000,000 acres in 11 counties. Approximately 20,000 acres of tanoak and oak mortality were mapped with nine new infestations detected in southern Mendocino County and one in Willow Creek, Monterey County. Watershed monitoring continued in streams outside of known infested areas, with no new finds made outside of the 14 quarantined counties (Maps 5 and 6). The California Department of Forestry and Fire Protection (CalFire) also conducted the California National *P. ramorum* Survey of Forest Environments in cooperation with the USFS, and found no new areas of infection.

As part of the 2006 National *Phytophthora ramorum* wildland survey, detection surveys were conducted in the Sierra Nevada foothills of Butte, Yuba, Nevada, Placer, and El Dorado Counties. Two types of surveys were conducted: 1) a road survey combined with vegetation transects to record hosts of *P. ramorum* and sample symptomatic host tissue, and 2) a stream survey that utilized Rhododendron leaves as bait for *Phytophthora* spp. in stream water. A total of 32 vegetation transects were surveyed and 23 streams were baited. Several hundred miles of roadside vegetation were scanned while driving through areas identified as being moderate to high risk for sudden oak death. Four vegetation samples were collected for lab diagnosis. *P. ramorum* was not detected by any of the survey methods. A commonly encountered Phytophthora, *P. gonapodyides* was recovered from seven streams.

Big Sur Adaptive Management Project. Started in 2005, the Big Sur project brings together UC Berkeley, UC Davis, Cal Poly San Luis Obispo, Big Sur Land Trust, Los Padres National Forest, and others to address landscape-level tree mortality. Work already underway includes an estimate of tree mortality in the region, treatments for high-risk tanoaks, and lowering inoculum levels through selective removal of California bay laurel trees. Future projects will include large stand manipulations and treatments, with the objective of supplying land managers with recommendations for landscape level management.

Tanoak resistance study. This cooperative effort is being carried out by UC Berkeley, USDA Forest Service, Mid-Peninsula Open Space District, and Pt. Reyes National Seashore. Acorn collections are being made at five locations from Big Sur to Southern Oregon for evaluation of tanoak resistance, genetic make-up, and genetic variation in growth characteristics, along with other traits.

Figure 29. *P. ramorum* suppression efforts in Humboldt County.

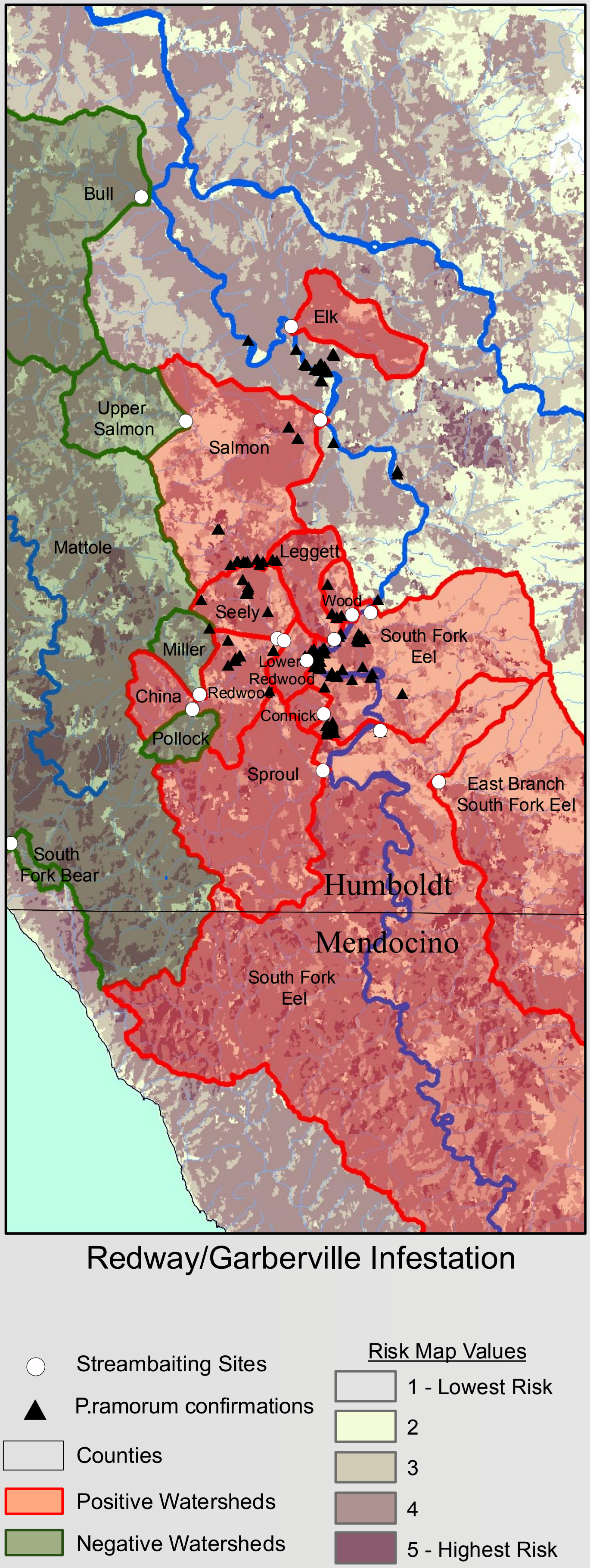
Photo: Yana Valachovic, UC Cooperative Extension, Humboldt and Del Norte Counties.

Humboldt County monitoring and management. Between late fall 2005 and mid-summer 2006, tanoak mortality increased dramatically in Humboldt County, primarily in these areas: Connick Creek canyon and ridge top separating that area from Briceland; to the north of Redway (at the edges of open stands upslope of Highway 101); along the South Fork Eel River between Miranda and Myers Flat; along major riparian corridors to the east of Garberville and Redway, especially Dean Creek and Bear Canyon; a small drainage immediately east of Phillipsville; and near Briceland to the west. Additionally, scattered mortality was visible throughout the Salmon Creek watershed. *P. ramorum* inoculum was detected for the first time in China Creek near Briceland, in the East Branch of the South Fork Eel River near Benbow, and in Elk Creek between Miranda and Myers Flat.

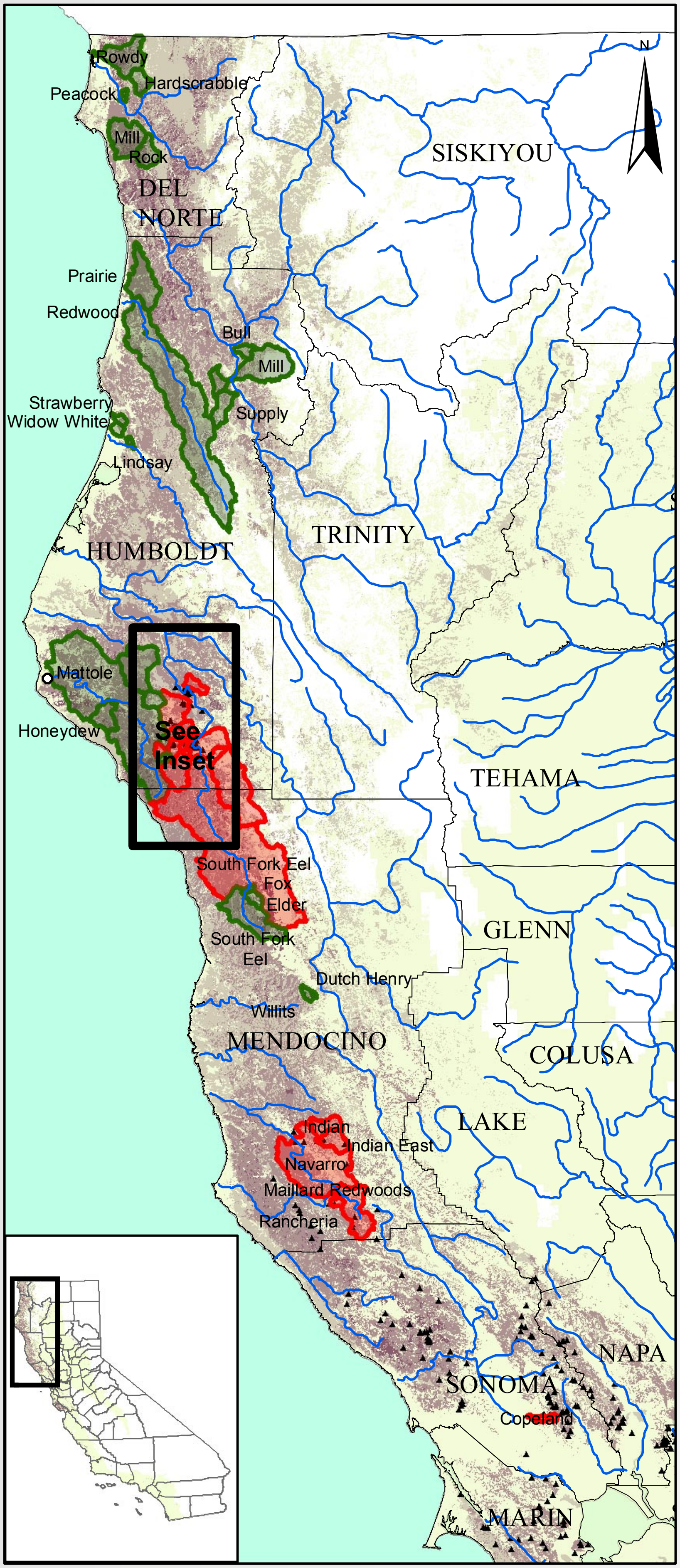
Near Miranda, a suppression project aims to reduce the spore load of *P. ramorum* in the North Coast and limit pathogen spread. Treatments include the removal of infected tanoak, California bay laurel, and madrone trees in a 50- acre area. Pile burning and underburning are taking place in fall 2006 (Figure 29).

Sonoma County treatment and management. Land owners and managers in remote western Sonoma County have voiced concern over SOD for a number of years, but increased mortality in urban corridors around the Russian River in recent years has dramatically raised the concern over the disease in the County. A new county-wide task force has formed to draft a response plan to SOD and increased fire dangers in urban-wildland zones. An educational outreach plan is a large component of the program. Management and research efforts continue with the Kashia Band of Pomo Indians to treat sacred tanoak trees in an effort to maintain tree health as well as acorn crop production around Stewart's Point.

Map 5. 2006 Watershed monitoring for *Phytophthora ramorum* in northern California.

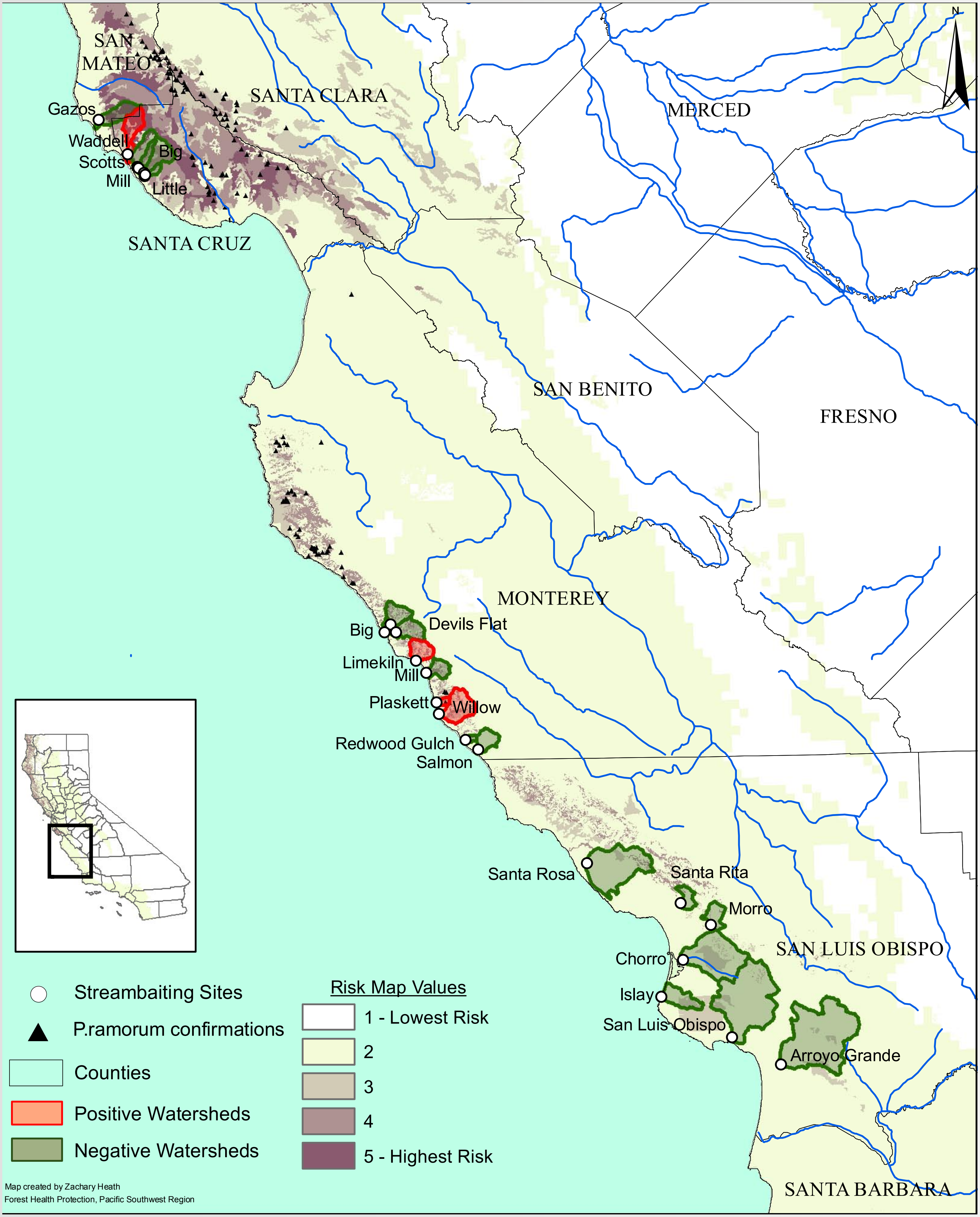


Redway/Garberville Infestation



Map created by Zachary Heath
Forest Health Protection, Pacific Southwest Region

Map 6. 2006 Watershed monitoring for *Phytophthora ramorum* in the Central Coast.



White Pine Blister Rust

Cronartium ribicola

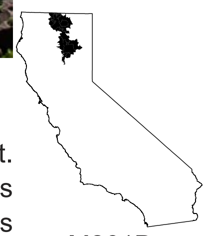
White pine blister rust (WPBR) is the most destructive disease on five-needle pines (such as sugar pine, western white pine, and whitebark pine) in California. The pathogen is native to Asia, although it was actually introduced on pine seedlings from Europe in the early 1900s.

Figure 30. White pine blister rust was common in western white pine at higher elevations in Siskiyou and Del Norte Counties.

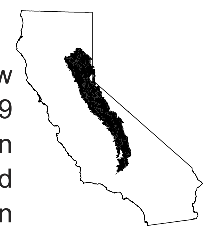
Photo: Dave Schultz

WPBR was present on western white pine along the Pacific Crest Trail west of the intersection with the Soapstone Trail (M261A), and along the Pacific Crest Trail west of Scott Mountain Summit (M261A). The disease is also present on western white pine on Black Butte (southwest of Mount Shasta, M261D), and on western white pine at Washbasin Lake in the Trinity Alps Wilderness Area (M261A). WPBR was found present on western white pine in the Alpine Meadows Ski Area on the Truckee River District, Tahoe National Forest (M261E).

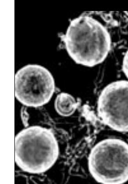
M261A



M261D



M261E



Levels of blister rust appear to be increasing in the Lake Tahoe Basin Management Unit. Most of the trees infected are old growth sugar pines, although western white pine trees were also infected. Injury was primarily that of dead branches although some of the trees are also dying from a combination of WPBR and attack by mountain pine beetles.

2006 White Pine Blister Rust Resistance Screening Program

During 2006 the rust resistance program screened 799 sugar pine families from new candidate trees suspected of carrying major gene resistance (MGR) to blister rust; 49 families proved to be from MGR seed-parent trees. This brings the total number of proven resistant trees to 1625 in the Pacific Southwest Region, including other federal, state and private lands. In addition, 378 families had one or more MGR seedlings due to an unknown MGR pollen parent (MGR-PR). Most MGR and MGR-PR seedlings were transferred to the Happy Camp field site for slow rust resistance screening, although some MGR-PR seedlings with northern California parents were retained and planted in the local breeding arboretum near Placerville.

The Spring 2006 sowing included seed from 730 sugar pine families, of which many were from the northern (29%) and southern California forests (43%). The Regional Genetic Resources Program has been focusing efforts on the northern forests (Klamath, Mendocino, Shasta-Trinity, Six Rivers, Modoc, and Lassen National Forests) due to the difficulty in finding MGR trees in that part of the State. In light of that, the Program has supported cone collections and grown additional seedlings from that area for testing. While some seedlings go through the typical testing process at Placerville and Happy Camp, additional siblings of the same families go directly to Happy Camp, thereby speeding up the rate at which rust resistant seedlings, i.e., slow rust resistant (SRR; also called partial rust resistance), are found for the northern forests. The 300-plus sugar pine families from the southern forests (Los Padres, Angeles, and San Bernardino National Forests) represent the first major operational testing of material from that area by the Genetic Resources Program. Seed from another 570 southern forest trees are being stored for rust resistance testing in upcoming years. Cone collections from MGR candidate trees in southern California will continue when the next cone crop is large enough to warrant this effort. In Fall 2006, cone collections are expected to come from about 210 trees from the northern forests and 130 from cooperators. In addition, a small crop of cones were collected from MGR sugar pine trees (5 bushels) at the Foresthill seed orchard on the Tahoe National Forest, as some trees are in the initial stages of producing cones. Working together with the Regional Natural Resources and National Forest staffs, efforts are underway to increase the number of proven MGR trees represented in the Regional seed bank. Currently, 38% of the sugar pine seed in the bank is MGR.

Activities at the Happy Camp outplanting site on the Klamath National Forest included the planting of 1,711 MGR sugar pine seedlings, shipped from Placerville, for slow rust resistance testing. Another 7,824 sugar pine seedlings were established for a study that will examine slow rusting heritability and efficacy. Additional activities included the selection of 44 trees with slow rust resistance traits from 1,959 evaluated, and the collection and shipment of scion from these selects for clone bank and seed orchard establishment, and from 29 other trees for North Zone MGR orchards. As part of a continuing effort to monitor the frequency and spread of the two virulent rust strains, vCr1 (sugar pine) and vCr2 (western white pine), in northern California, *Ribes sanguinium* leaves infected with blister rust in the telial stage were collected from seven key locations.

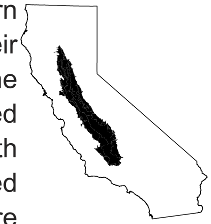
Seed orchards are being developed by the USFS and Sierra Pacific Industries to supply rust resistant sugar pine seed for reforestation and fire restoration. Cuttings from parent trees possessing MGR or both MGR+SRR are being collected by these and additional cooperators throughout the state. To date, more than 700 unrelated parents have been established in five separate orchards from Sierra Nevada native forests. Additional sites are being used as “clone banks” to preserve resistant sugar pine grafts from other parts of California, where seed needs are not as high or in anticipation of seed orchard development in the future. Last fall, 44 MGR parents were collected from wild stands and an additional 44 with both MGR+SRR which represented much of the state. More will be established each year to both conserve and use the genetic diversity of this species.

Figure 31. White pine blister rust was found in a whitebark pine growing on Black Butte, west of Mt. Shasta (Siskiyou County).

Photo: Dave Schultz

High Elevation Five-needle Pine Survey

The 2004-2005 survey of white pine blister rust (WPBR) on high-elevation white pines in California continued for a third-year with the establishment of a few plots and attention to analyses and reporting on the data. Approximately 120 plots were established and spread out across the species' ranges in California, with about 75% of those being in western white and whitebark pine. In the Sierra Nevada Range, plots were paired west and east of the Pacific crest to capture climatic and landscape differences. The data revealed that WPBR was not present in plots of limber, Great Basin bristlecone, and southern foxtail pine. In contrast, WPBR was found in plots with western white, whitebark (Figure 31), and northern foxtail pines. Mean rust levels were relatively low within species (12-15%), but plot-to-plot variation was high (northern foxtail, 0-33%; western white, 0-92%; whitebark, 0-71%). Data indicate that WPBR levels were higher west of the Pacific Crest of the Sierra Nevada Range, although the Crest does not appear to be a strong barrier given the presence of WPBR in Lake Tahoe Basin. Western white and whitebark pine were affected by rust in the northern and central portions of their California ranges, but less so in the southern portions. WPBR was found on whitebark pine at about 11,000 feet on the Sierra National Forest, further south than previously reported in whitebark. Activity of another biotic factor, mountain pine beetle, was found in plots with whitebark (62%), western white (54%) or northern foxtail pine (43%), but was not observed in plots with limber, Great Basin bristlecone, or southern foxtail pine. Data analyses are ongoing and more detailed information is forthcoming.



262a

Canker Diseases

Cankers
Cause Unknown
A fungal canker disease (pathogen unknown) is causing dieback of ponderosa pine in one of the seed orchards at the Chico Tree Improvement Center (262Aa) (Figure 32). Winter fog and summer heat are suspected to play a role in the infection and mortality.

Figure 32. Dieback of ponderosa pine in one of the seed orchards at the Chico Tree Improvement Center.

Photo: Pete Angwin

M261A

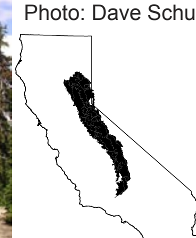
Another fungal canker disease (pathogen unknown) is causing dieback of branches in ponderosa pine within four feet of the ground in a fog pocket northwest of Bear Mountain near Slagger and Hambone. Cold air and fog are suspected of playing major roles in the infection and dieback.

Cytospora Canker of True Fir
Cytospora abietis
Cytospora canker is severe on red fir along the Pacific Crest trail west of Scott Mountain summit and along the clear Creek Trail in the Siskiyou Wilderness Area near the Young's Valley trailhead (M261A) (Figure 33). Branch dieback was also noted on true firs at Ward's Fork Gap, Siskiyou County.

Figure 33. Branch flagging due to Cytospora canker in red fir was common west of Scott Mountain Summit in the Trinity Alps and also in the Duck Lakes basin in the Russian Wilderness. (Siskiyou County).

Photo: Dave Schultz

Cytospora canker continues to infect red fir branches near Robinson Flat Campground and in scattered areas of the American River Ranger District, Tahoe National Forest. (M261E) *C. abietis* was identified in red fir in the Alpine Meadows Ski Area on the Truckee River Ranger District, Tahoe National Forest. (M261E)



M261E

Cytospora Canker of Willow
Cytospora chrysosperma
Cytospora canker was detected in willow species this year at lower elevations on the eastside of the northern Sierra Nevada and southern Cascade ranges. Scattered willow dieback was detected in nearly all stands (342B).

342b

Diplodia Blight of Pines

***Sphaeropsis sapinea* (*Diplodia pinea*)**

M261E

Shoot dieback caused by *S. sapinea* was observed again in 2006 on ponderosa pines in the Sacramento River Canyon, principally between Shasta Lake and Dunsmuir, Shasta and Siskiyou Counties. Repeated infections on some trees are leading to crown dieback and occasionally mortality. Diseased ponderosa pines were also noted in the upper Trinity River drainage, Trinity County and in Whitmore, Shasta County. Although the yearly percentage of diseased pines is relatively small, some areas have experienced a chronic occurrence of Diplodia blight since the mid-1990s.

Diplodia blight continued to kill ponderosa pine branches along the North Yuba River in the Goodyears Bar and Downieville area of Sierra County (M261E). Some of the infected trees have died since 2005, probably as a result of moisture stress in combination with Diplodia blight. Branch dieback was also noted on ponderosa pine in the Nevada City and Grass Valley area in Nevada County.

M261A

Seiridium Canker

Seiridium cardinale

Seiridium canker was observed on scattered 12-year-old Port-Orford-cedar in the Provenance Test Site near the Stuart's Fork Arm of Trinity Lake (M261A). It was also found on Port-Orford-cedar at the Provenance Test Site at the Humboldt Nursery in McKinleyville (Humboldt County, 263a) and in the old range-wide planting at the Chico Genetic Resource Center.

263a

Foliage Diseases

Foliar Blight

Figure 34. Foliar blight and topkill of Port-Orford-cedar at the Humboldt Nursery near McKinleyville, CA (Humboldt County).

Photo: Pete Angwin

Species Unidentified

A foliar blight of Port-Orford-cedar (possibly *Stigmina thujina*) is widespread in the Provenance Test Planting at the Humboldt Nursery near McKinleyville (Humboldt County, 263Ae) (Figure 34).

Oak Anthracnose

Apiognomonia quercina

High levels of infection by oak anthracnose occurred throughout the foothills of the Sierra Nevada range and in urban areas of the Sacramento Valley. Some oaks defoliated early due to the disease. The high incidence of the disease was likely due to the late spring and early summer rains, which favors infection by the fungus.

Powdery Mildew of Blue Oak

Species Unidentified

Powdery mildew was common on blue oak in foothill areas along the west side of the Sacramento Valley, including Nevada, Yuba, and Placer Counties. Abundant soil moisture late in the season allowed many trees to produce a second flush of leaves which was particularly susceptible to infection.

Tanoak tip blight

Discula quercina

In late 2005 and again in 2006, many tanoaks of all sizes had extensive branch tip blight. Blighted trees were observed from southern Mendocino County north through the southern half of Humboldt County. This disease made detection of sudden oak death puzzling, as symptoms of *D. quercina* were similar to tip blight caused by *P. ramorum* in tanoaks.

Root Diseases

Annosus Root Disease
Heterobasidion annosum

Root diseases are a growing concern in southern California after the cutting of numerous bark beetle killed trees. The potential for spread of annosus root disease will be a possibility for decades to come where freshly cut stumps were not properly treated. Specifically there is concern in the mountains of southern California where dead tree removal projects have been underway since the extreme conifer mortality events between 2002-2004.

H. annosum continues to cause scattered pockets of mortality in ponderosa pine on McCloud Flats on the Shasta-Trinity National Forest (M261D). Mortality is impacting management in the Pilgrim Sale Area.

Annosus root disease was identified from laminated decay and the presence of fruiting bodies in scattered white fir stumps near Little Grass Valley Reservoir on the Plumas National Forest (M261E) (Figures 35, 36). Based on stunted growth and crown dieback, many young and old white fir trees in the area appear to be infected with root disease.

Black Stain Root Disease
Leptographium wageneri

Because precipitation levels were again near normal in most of northwestern California during the winter of 2005-2006, ponderosa pine mortality due to a combination of drought, high stocking, black stain root disease and western pine beetle at McCloud Flats (McCloud Ranger District, Shasta-Trinity National Forest) has decreased (M261D) (Figure 38). However, conspicuous concentrations of mortality around black stain root disease centers were evident at the Mud Flow Research Natural Area, Elk Flat, Ash Creek Sink, Algoma and Harris Mountain.

Black stain root disease also caused scattered mortality of Douglas-fir trees throughout Butte and Plumas Counties. The trees were primarily large, older trees in stands that have been repeatedly

Figure 35. *Annosus* root disease on a white fir stump near Little Grass Valley Reservoir on the Plumas National Forest.

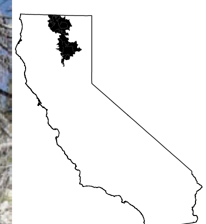
Photo: William Woodruff

Figure 36. Blowdown exposed *Annosus* root disease on the Plumas National Forest

Photo: William Woodruff

Figure 37. Bristlecone pines infected with black stain root disease, Ancient Bristlecone Pine Forest, Inyo National Forest.

Photo: Beverly Bulaon



M261D

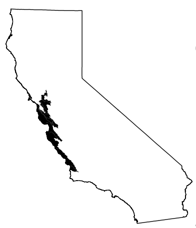
Figure 38. Ponderosa pine mortality continued in black stain root disease centers east of McCloud (Siskiyou County, Shasta-Trinity National Forest).

Photo: Dave Schultz

thinned.

Black Stain Root Disease
Species unknown
A root disease with characteristics similar to *L. wageneri* was detected on bristlecone pines in the Ancient Bristlecone Pine Forest, Inyo National Forest (Figure 37). Identification of the pathogen is in progress. Black stain root disease has been killing pinyon pines at the lower elevations of the White Mountains for a number of years. Monitoring the extent and severity of the root disease in bristlecone pine will initiate in 2007.

Brown Cubical Butt Rot
Phaeolus schweinitzii



M261A

Brown cubical butt rot was observed affecting scattered Douglas-fir in Hayden Flat Campground on the Trinity Resource Management Unit of the Shasta-Trinity National Forest (M261A).

Brown cubical butt rot infected large Douglas-firs on Soquel Demonstration State Forest (SDSF) and along Highland Dr. south of Santa Cruz. Sporophores were visible in mid-September. Infected standing trees were killed by the flatheaded fir borer. Several sporophores and one large, windthrown Douglas-fir were also noted near camp sites closed to the public at Hendy Woods State Park in Mendocino County. Sporophores were apparent in early October.

Rust Diseases

Cedar Apple Rust
Gymnosporangia juniperi-virginianae
Erratum
The 2005 report of cedar apple rust in young incense-cedar in Calaveras County was incorrect. The pathogen causing the damage was incense-cedar rust. Cedar apple rust has not been found in California and is regulated by the California Department of Food and Agriculture.

Incense-cedar Rust
Gymnosporangium libocedri
Incense-cedar rust was reported occurring near Nevada City, Nevada County.

Willow Rust
***Melampsora* sp.**
An unidentified species of rust is infecting various willow species in the town of Soquel along Soquel Creek in Santa Cruz County. Infection is on the underside of the leaves and does not appear to be causing any significant injury to the willows at this time. Infection is mostly on trees in fields and slopes above the creek as opposed to those trees growing right along the creek. The rust has been initially identified as a species in the genus *Melampsora*. Molecular work is being conducted to determine the specific species. Surveys will be conducted in 2007 to determine the extent of the infestation and to look for any potential alternate hosts in the area.

Miscellaneous Diseases

Oak Mortality – Southern California

Cause unknown

Extensive mortality in coast live and Engelmann oak continued in 2006 in southern San Diego County. The mortality occurred around Descanso, Pine Valley, and in areas south of Interstate 8, including Horsethief Canyon, along Campo Road near Dutchman Canyon, and Lake Morena County Park. The cause for the widespread mortality is undetermined, and investigations are continuing.

Sugar Pine Sudden Death

Cause Unknown

Sugar pines in a seed orchard in the Camino area of El Dorado County are suddenly dying from an unknown cause. The trees are scattered throughout the orchard and do not form any typical disease pattern. They suddenly dry out and turn to a straw color. So far no insect or pathogen problem has been identified as the causal agent.

Dogwood Canker and Death

Cause Unknown

Pacific dogwoods in the area of Alta in Placer County are dying from a cankering disease around the base of the trunks. The trees develop numerous sprouts near the base that die back after which the disease enters the trunk and girdles it. The exact cause has not been determined as of yet.

Declines

Incense Cedar Decline

Cause Unknown

Incense cedar trees in the San Bernardino Mountains of San Bernardino County are declining and dying due to some unknown cause. Trees of all ages are affected with most of the death among younger seedlings and saplings. No known insect or disease has been identified, but enduring drought effects are the likely suspect. Symptomatic trees can be found throughout northern California and the Sierra Nevada Range. Symptoms include foliage dieback and whole tree mortality. Seedlings and saplings appear to be the most affected but some large diameter tree mortality is occurring.

Aspen Decline

Cause Unknown

Affected aspen stands are scattered throughout the east side of the northern Sierra Nevada range. Some specific areas are in the Sweetwater Mountains north of Bridgeport, near Twin Lakes and near Heenan Lake, Alpine County.

Rots

Bole Decay

True fir trees that sustained considerable bole injury during wildfires continue to fail with full green crowns four to seven years post-fire. Boles are almost entirely decayed except in small areas of post-fire sapwood growth. This type of injury and failure is found primarily in trees that had very little crown kill and that burned in areas with high annual precipitation. Specific areas include the Storrie Fire, Almanor Ranger District, Lassen National Forest and the Bucks Fire, Feather River Ranger District, Plumas National Forest.

Mistletoe

True Mistletoe
***Phoradendron* spp.**

True mistletoe has caused increased mortality in black oaks on the Sawmill and Liebre Ridges, Angeles National Forest.

Figure 39. Black oak infected with true mistletoe on the Angeles National Forest.

M261A

Figure 40. Douglas-fir engraver and fir flatheaded borers slowly killed Douglas-firs that were heavily infected with dwarf mistletoe on Black Butte (Mt. Shasta in background, Siskiyou County).

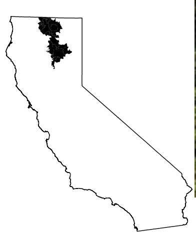
Photo: Dave Schultz

Douglas-fir Dwarf Mistletoe
Arceuthobium douglasii

Douglas-fir dwarf mistletoe is slowly killing Douglas-fir on Black Butte (southwest of Mount Shasta, M261D), and along Castle Crags Creek and the upper Sacramento River drainages (M261A) (Figure 40).

Gray Pine Dwarf Mistletoe
Arceuthobium occidentale

Dwarf mistletoe was observed causing branch dieback and some whole tree mortality of mature gray pines off of Highway 89 near the Hat Creek Work Center, Hat Creek District, Lassen National Forest. (M261D)



M261D

Limber Pine Dwarf Mistletoe
Arceuthobium cyanocarpum

Limber pine dwarf mistletoe is causing flagging on whitebark pine on the ridge between Little Duck Lake and High Lake (M261A)(Figure 41).

Lodgepole Pine Dwarf Mistletoe
Arceuthobium americanum
Lodgepole pine dwarf mistletoe was observed on lodgepole pine near Little Grass Valley Reservoir on the Plumas National Forest (M261E)

Mountain Hemlock Dwarf Mistletoe
Arceuthobium tsugense **subsp.** ***mertensianae***
An infestation of mountain hemlock dwarf mistletoe severe enough to cause mortality is present on the ridge between Little Duck Lake and High Lake in the Russian Wilderness Area (M261A)(Figure 43).

Mountain hemlock dwarf mistletoe was observed on western white pine in the Alpine Meadows Ski Area on the Truckee River Ranger District, Tahoe National Forest (M261E).

Red Fir Dwarf Mistletoe
Arceuthobium abietinum **f.sp.** ***magnificae***
Incidence and impact of red fir dwarf mistletoe continues to be heavy at South Fork Mountain on the Hayfork Ranger District, Shasta-Trinity National Forest (M261B).

White Fir Dwarf Mistletoe
Arceuthobium abietinum **f.sp.** ***concoloris***
Incidence and impact of white fir dwarf mistletoe continues to be heavy at South Fork Mountain on the Hayfork Ranger District, Shasta-Trinity National Forest (M261B).

Figure 41. Limber pine dwarf mistletoe caused branch flagging in whitebark pine on the ridge between Little Duck Lake and High Lake in the Russian Wilderness Area(Siskiyou County).

Photo: Dave Schultz

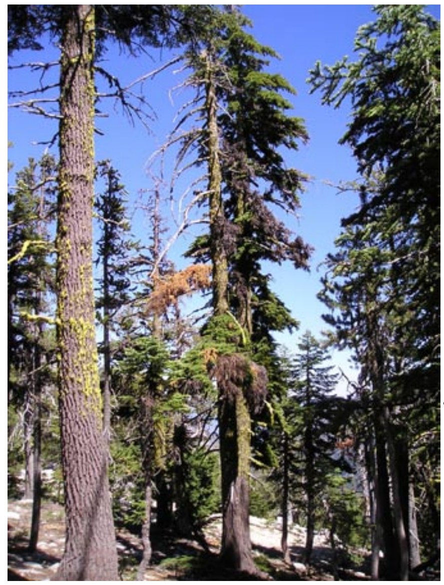
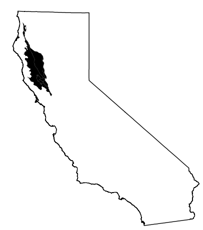


Figure 42. Mountain hemlock dwarf mistletoe and a flatheaded borer are slowly killing mountain hemlock trees in the Duck Lakes Botanical Area, Russian Wilderness Area, Klamath National Forest (Siskiyou County).

Photo: Dave Schultz

M261E



M261B

Diseases

Abiotic Injury

Weather

Information from two sources illustrates meteorological conditions in California over the past few years: the Palmer Drought Indices and data collected by the California Department of Water Resources. The Palmer Drought Index is an indicator of drought or moisture excess and ranges from -6 to +6, with the negative values denoting degree of drought. Wet conditions continued for most of California in 2006. The statewide average snowpack condition in April was 125% of normal. Overall precipitation for the state was at 135% of normal in 2006, however dry to slight drought conditions returned to the South Coast and Mojave regions (Figure 43).

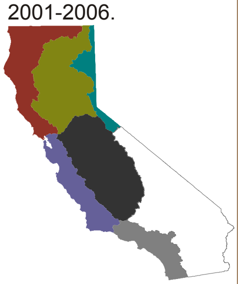


Figure 43. Palmer drought indices for the seven hydrologic zones in California, 2001-2006.

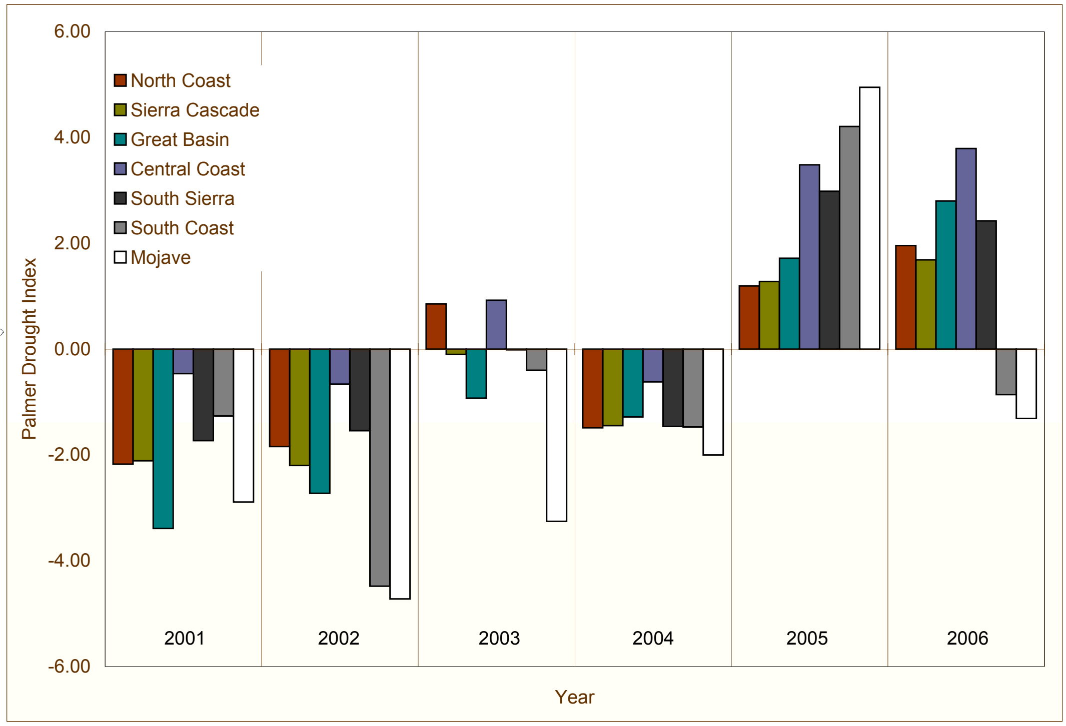


Figure 44. Several consecutive days of temperatures over 115 degrees F, combined with windy conditions in the northern end of the Sacramento Valley caused a scorched appearance on many ornamental plants (Shasta County).

Photo: Dave Schultz

Heat

Oak trees in the central Sierra Nevada foothills (Nevada, Placer, El Dorado, Shasta and Amador Counties and surrounding areas) have suffered from dieback due to the extreme extended heat that occurred in the month of July. Trees are showing signs of branch dieback and early defoliation (Figure 44). No insect or biotic disease problems have been noted.

The excessive heat wave in July may have been associated with the browning of chemise in Mendocino County. The heat may have led to the rapid death of stem-infected tanoaks across SOD regions, as *P. ramorum* may also be acting as a wilt pathogen in tanoak. Several consecutive days of temperatures over 115 degrees F, combined with windy conditions in the northern end of the Sacramento Valley caused a scorched appearance on many ornamental plants in Shasta County (M261C).

Wind

On the morning of December 31, 2005 strong winds swept across Humboldt, Del Norte and Western Trinity Counties. Wind speeds up to 97 mph were recorded around Humboldt Bay. The winds caused tree injury (2-3 foot diameter trees snapped) near Cape Mendocino to north of Trinidad and as far inland as Salyer with other minor injury reported further north.

Wildfire Activity

The 2006 fire season in California was more intense and longer than 2005. A total of 80 large fires (>300 acres) burned 736,022 acres. Several wildfires were significant in 2006; among them were the Day Wildland Fire on the Los Padres National Forest (162,702 acres) and the Bar Complex Wildland Fire on the Shasta-Trinity National Forest (100,164 acres).

Changes in Fire Regimes

Huckleberry and live oaks in the Lake Tahoe basin are dying in areas of poor site quality. No insect or disease incidence was observed. The trees are old for the species in the area. The areas would normally burn on a regular basis and it is felt that the changes in fire return regimes have allowed the trees to live longer than would historically have occurred. The trees may be dying of old age as well as from extreme competition due to the dense vegetation left by the lack of wildfires clearing underbrush species.

Fire Injury

In the community of Campbellville, Tehama County, a variety of conifers have wounds from a fire that swept through the area in the late 1980s. Ponderosa pine is the principal species affected, but Douglas-fir, white fir, and sugar pine are also damaged. Wounds are apparent on the lower bole, root collar, and upper roots and vary in size and degree of healing. Most scars have been covered by callus and bark, but some trees still have large, open scars that reveal exposed, decayed wood beneath. Chronic, low-level tree mortality has been ongoing for many years.

Ozone Injury

Intensified Ozone Monitoring in Southern California

Tropospheric ozone is a phytotoxic gaseous air pollutant formed by photolysis from air pollution generated by large metropolitan areas, during transport over long distances to rural areas. Ozone, together with drought and bark beetles, is one of the key stressors affecting forest trees adjacent to urban areas. Recently passive samplers have been used to measure ambient ozone concentrations. Passive samplers (Figure 45) allow O_3 distribution to be characterized at forest stand and landscape scales. An extensive network of 37 passive ozone samplers were established in the southern California mountains, foothills and desert. Samplers were changed every 2 weeks during between May and September 2005 and 2006. Several active ozone monitors were installed to provide calibration of passive samplers on-site. In addition, foliar injury was evaluated at 14 monitoring sites established during the 1960s and 1970s. Mortality was also measured at 14 long-term sites in the San

Figure 45. Passive ozone samplers in southern California.

Photo: Mike Arbaugh

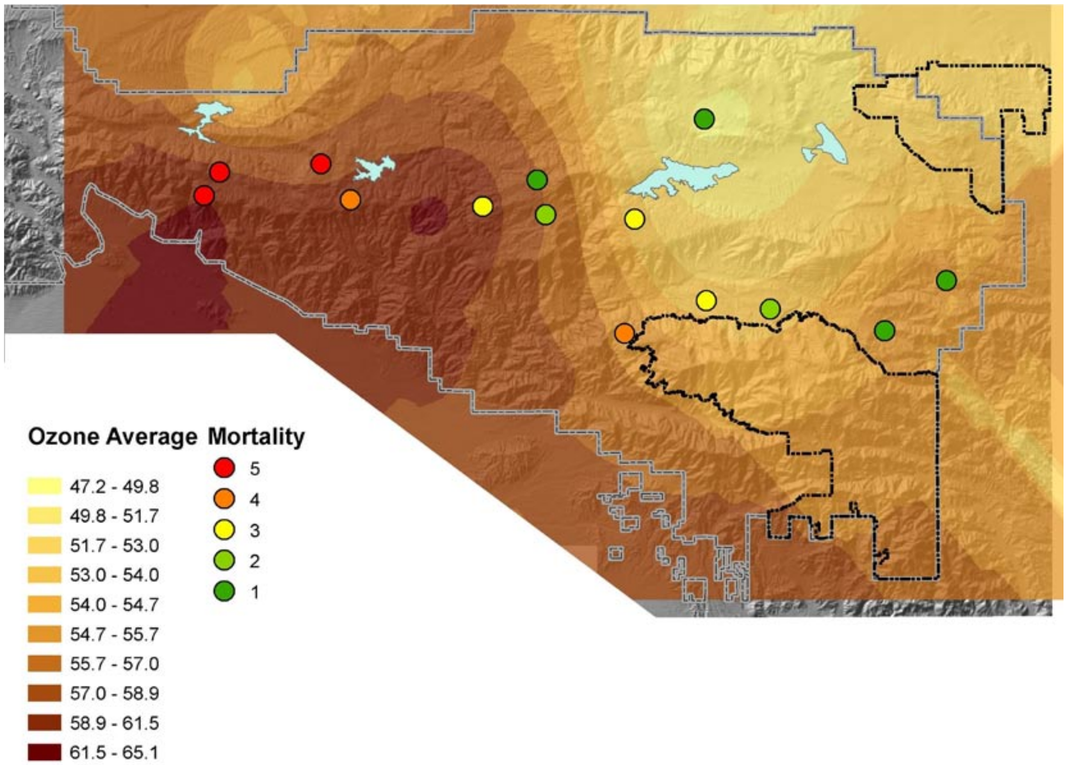
Abiotic

Bernardino Mountains.

Mortality and Air Pollution in the San Bernardino Mountains

During the 1960s and 1970s a series of sites were established in the southern California Mountains by Paul Miller. Many of these sites have been lost, but 18 sites in the San Bernardino Mountains have been maintained. Mortality was assessed at 14 of these long-term study sites between 2005-2006. Preliminary results below show a good correspondence between ambient ozone distribution (using 2006 data) and mortality levels (Map 7). At several sites in western San Bernardino mountains all pines in study plots died during the drought of 2001-2004. In contrast, few pines died in low air pollution areas,

Map 7. 2006 Ambient ozone distribution and mortality levels in the San Bernardino mountians.



despite these areas having less precipitation than high air pollution sites.

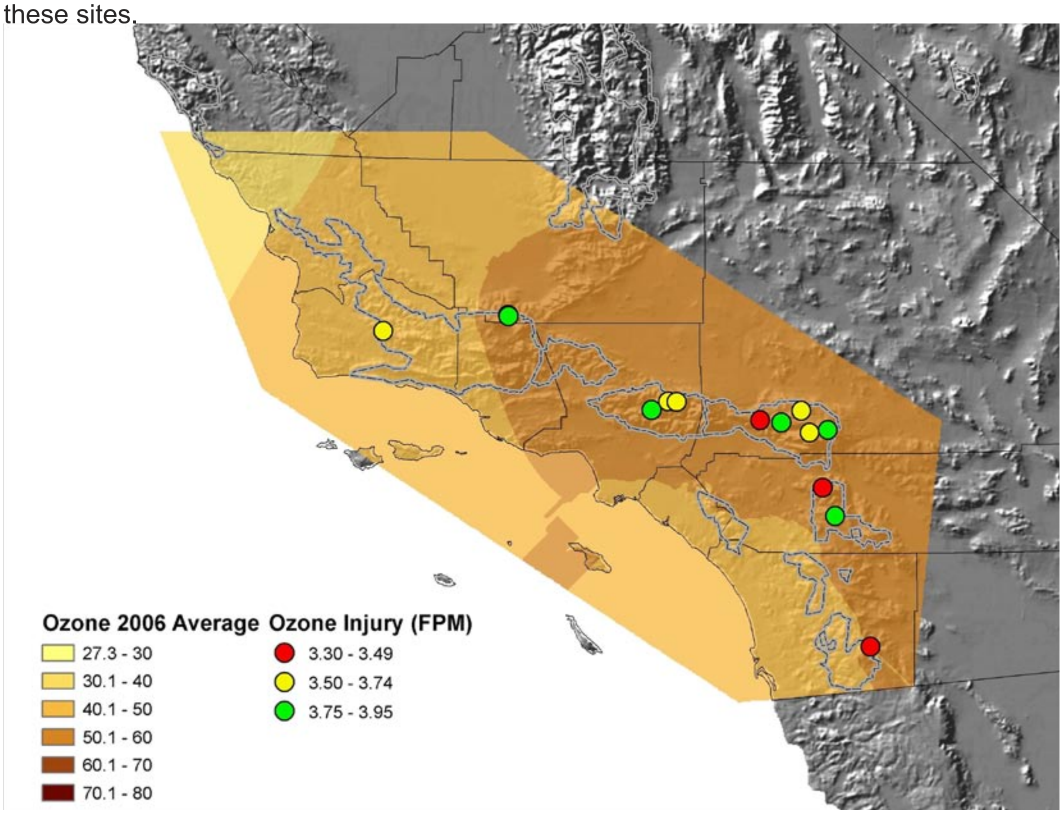
Foliar Injury and Ambient Ozone Distribution in Southern California Mountains

Foliar injury from ozone was evaluated at 14 sites in southern California mountains in 2006 using a Forest Health Protection protocol developed by John Pronos during the 1970s. This protocol is called the Forest Pest Management (FPM) protocol. Three branches from the lower 1/3 crown of each tree were evaluated using the criteria in Table 3, then averaged to determine a single tree value.

Table 3. Forest Pest Management evaluation criteria for foliar injury from ozone.

FPM Score	Youngest needles with chlorotic mottle	Injury Severity
0	Current Year	Very Severe
1	One year old	Severe
2	Two year old	Moderate
3	Three year old	slight
4	Four year or older	No injury

The results indicate that foliar injury in Southern California is generally 'slight' (Map 8). The most severe injury was observed in western San Bernardino, San Jacinto, and Laguna Mountains. Equally and more severe injury was observed at long term sites in the Southern Sierra Nevada range using the same evaluation protocol. These results differ greatly from past work. In past studies, sites in the western San Bernardino Mountains had more severe injury than other sites in California. Many of the most severely impacted sites in the San Bernardino Mountains were not evaluated in 2006, because few or no pines remained at these sites.



Map 8. Foliar injury and ambient ozone distribution in the southern California mountains in 2006.

Forest Inventory and Analysis Ozone Biomonitoring

The USDA Forest Service's Forest Inventory and Analysis (FIA) uses biomonitoring to monitor the potential impact of tropospheric ozone on forests. Bioindicators are plants that exhibit a visible response to ozone pollution.

Seventy-two ozone biosites were visited in 2006 in California; ozone injury was present on 31 percent of them. Of the 22 positive sites, almost half were in the San Joaquin Valley and Mountain Counties air basins. There were three biosites where injury had not been detected previously (one each in the Mohave, NE Plateau, and Sacramento Valley air basins). Indicator species with validated injury were ponderosa pine, Jeffrey pine, and blue elderberry.

Additional analysis of ozone injury detected by the FIA program will be reported in the upcoming FIA 5-Year Report for California as well as a Pacific Northwest General Technical Report. The FIA ozone database (Access) for California, Oregon, and Washington for 2000-2005 is currently available from Sally Campbell, scampbell01@fs.fed.us.

Animal Damage

Black Bear
Ursa americanus
Bear damage continues to be the most common plight of conifers on industrial and small private lands from the Klamath River northward to the Smith River. 20- to 40-year-old Douglas-fir was commonly damaged, but occasionally redwood was also damaged and killed.

Invasive Plants

Japanese Dodder
Cuscuta japonica
Japanese dodder is an exotic, potentially invasive parasitic vine recently introduced to California. Native of Asia, Japanese dodder's occurrence in California is probably linked to its use as an herbal remedy among immigrants, since most known infestations occur in or very near to Asian residences. Japanese dodder's facultative perenniality, broad host range, vegetative reproduction, rapid growth rate and seed longevity makes eradication challenging. A handful of previous introductions have occurred and been successfully eradicated in the southeastern U.S and Houston, TX. Japanese dodder control is primarily by mechanical removal of the dodder vegetation, the infected parts of host plants, or the entire host plant, taking care not to spread any dodder propagules in the removal process. As in most invasive species, a combination of methods should be employed to ensure effective control and eradication.

Dodder infests many native California tree species (willows, California live oak, and buckeye, etc.). Japanese dodder also creates a tangle of dense plant material that may impede birds and other wildlife from using the native host plant.

Japanese dodder has been detected in at least eight California counties. During 2006, Eradication activity of Japanese dodder occurred in Alemeda, Los Angeles, Fresno, Sacramento Yuba, and Yolo Counties. Monitoring will continue in 2007.

Figure 46. Japanese dodder infested tree in Sacramento County.

Photo: B. Dowell

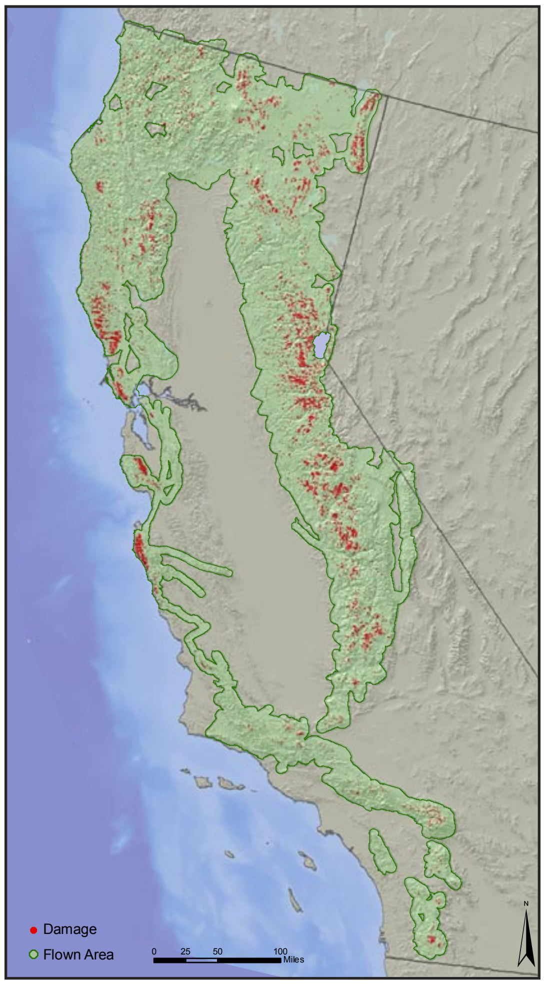
Monitoring

Aerial Survey

The USDA Forest Service Forest Health Protection program conducts aerial detection surveys nationally. Surveys have been conducted in the Pacific Southwest Region annually since 1994. Data is collected using a digital aerial sketch mapping system following national protocols in order to provide standardized information on biotic and abiotic injury to California's forested ecosystems.

Highlights for 2006…

The area flown in California increased from approximately 28 million acres during 2005 to approximately 43 million acres in 2006 to include additional State, private, and other Federal lands (Map 9).



Map 9. Area flown and injury detected statewide in 2006.

Approximately 727,000 acres with mortality were observed and mapped in California, including nearly 400,000 acres caused by biotic agents such as bark beetles and diseases.

High levels of mortality caused by black stain root disease, mountain pine beetle and western pine beetle continued to be observed in the northeast portion of the state (Klamath, Modoc, and Shasta-Trinity National Forests).

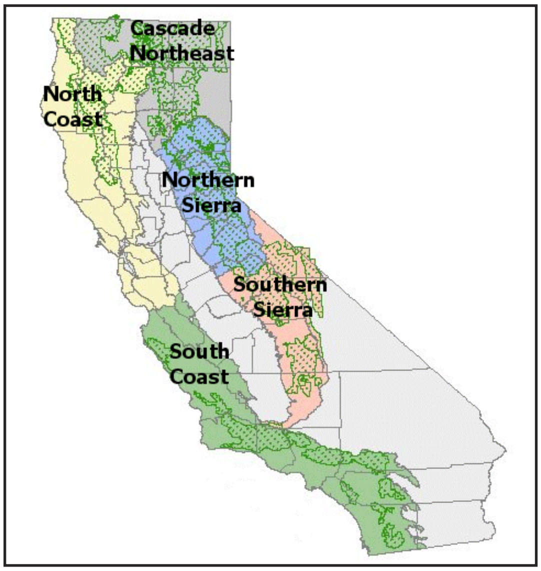
High levels of defoliation caused by the douglas-fir tussock moth (DFTM) continued in many areas of California, increasing over the past year. Approximately 22,000 acres of defoliation were mapped (Sierra, Stanislaus, and the Shasta-Trinity National Forests and Yosemite National Park).

Hardwood mortality related to sudden oak death continues to advance within currently infested counties.

The 2006 Aerial Survey Report contains maps and tables summarizing acres of mortality and injury mapped by National Forest, National Park and County. To download the 2006 Aerial Survey Report, view standards, metadata, maps and data, visit: www.fs.fed.us/r5/spf/fhp.

Detecting Vegetation Cover Changes in California Using Satellite Imagery

California Land Cover Mapping and Monitoring Program (LCMMP)

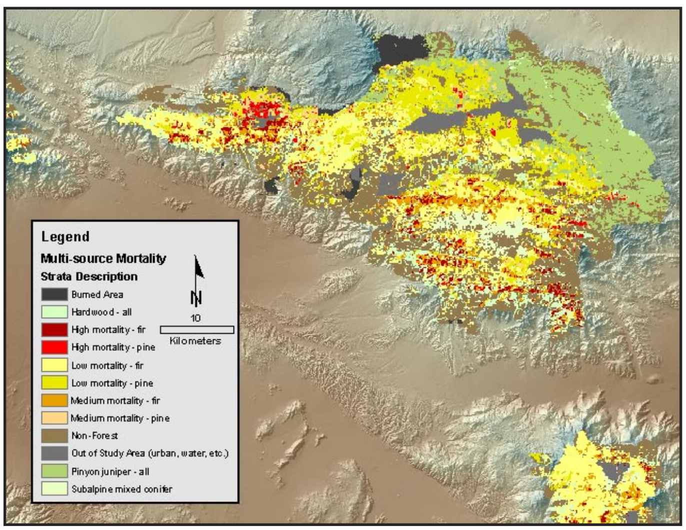


Map 10. Land cover project areas.

This program uses Landsat Thematic Mapper (TM) satellite imagery to map vegetation and derive land cover change (losses and gains) within five-year time periods for different project areas (Map 10). The LCMMP's collaborative approach to land cover mapping and monitoring includes the coordinated acquisition of resource photography, satellite imagery, and geo-processing on a five-year cycle . Baseline vegetation maps and inventory plots, change detection, cause determination, and map updates serve as the basis for assessing the State's vegetation resources.

During FY 2006 the cooperative LCMMP completed the Southern California and Northern California Project Areas and the development of a ten year assessment.

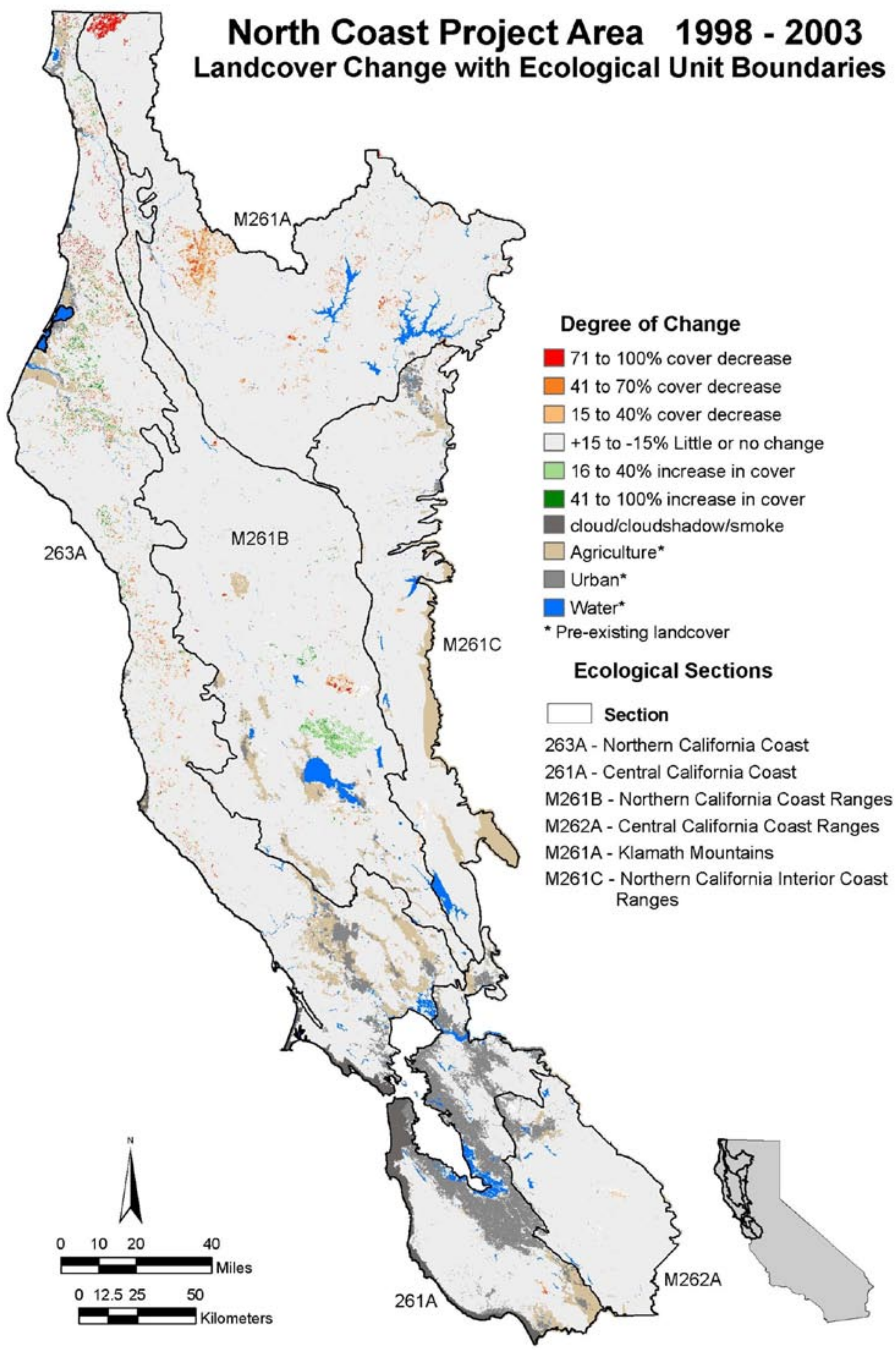
Southern California:



Map 11. Cumulative, multi-source mortality layer for the San Bernardino National Forest and surrounding areas.

Severe tree mortality events caused by epidemic levels of *Dendroctonus, Scolytus* and *Ips* beetle species were exacerbated by several successive years of drought during 2001-2003. In order to identify and track mortality on and adjacent to the San Bernardino National Forest (BDF), change detection data from Cycle II (1997-2002) for the South Coast project area, change detection data from 2001-2003 (CalFire-FRAP and FHP cooperative study), and aerial survey data were combined to develop a cumulative mortality layer for the entire project area (Map 11). The mortality layer was used to stratify plot location by level of mortality and vegetation type for re-measurement of the plots (Figure 49). Volume estimates were calculated for dead trees and used to aide CalFire in prioritizing their resources for harvesting. Within the project extent, approximately 13% of all conifer trees died between 2001 and 2004. This estimate represents approximately 21% (~127 million cubic feet) of the total conifer forest biomass with larger trees (DBH ≥ 21 inches) accounting for about 80% of the total dead biomass. The total volume loss for all tree species is estimated to be 137 million cubic feet. Plot re-measurement revealed that Coulter and Ponderosa pine (*Pinus coulteri* and *P. ponderosa*) were the most heavily impacted conifer species, particularly in size classes ≥ 21 inches DBH.

North Coast:
Conditions in the North Coast Project Area in the time period 1998 to 2003 resulted in a change in canopy cover over 3% or 447,629 acres. Fire and harvest/plantation activity was the primary cause for both increase and decrease in vegetation and is summarized below. Development, pests, agricultural conversion and unidentified causes accounted for the remainder of the change detected. Approximately 94% of the change area was labeled with a cause type, only 6% of the overall change was due to unidentified causes (Map 12).



Map 12. Land cover change for the North Coast project area, 1998-2003.

Ten year assessment: Since inception of the LCMMP, analysts have completed processing ten years of Landsat imagery spanning California, with the exception of the Central Valley (monitored by the U.S. Bureau of Reclamation) and the Mojave bioregions. Collectively, the LCMMP project areas cover approximately 65 million acres of land in a single cycle. To date, two cycles have been completed statewide and a third cycle has just been completed for the southern California project area. Project areas range from nine to 17 million acres and are the basis for organizing mapping and monitoring work. A total of 147 million acres have been monitored over a ten-year period. Monitored lands include Federal, State and private ownerships throughout California.

Statewide Statistics for 10 years of monitoring land cover changes in California

- The California change detection project encompassed approximately 65 million acres divided into five project areas.
- Project areas range from nine to 17 million acres and are the basis for organizing mapping and monitoring work.
- A total of 147 million acres have been monitored over a ten-year period.
- Monitored lands include Federal, State and private ownerships throughout California.
- Change in canopy cover (both increase and decrease) was detected on over 5 million acres of land over 10 years of monitoring.
- Fire accounted for 20% of the change, affecting over 1 million acres
- Harvest accounted for 10% of the change, affecting approximately 487,000 acres
- These data provide important information about permananet and non-permanent changes that are critical for resource management and land use planning. In addition, changes detected over time across these large landscapes can be important components for further investigation into climate change models and theories.

Insect and Disease Risk Map

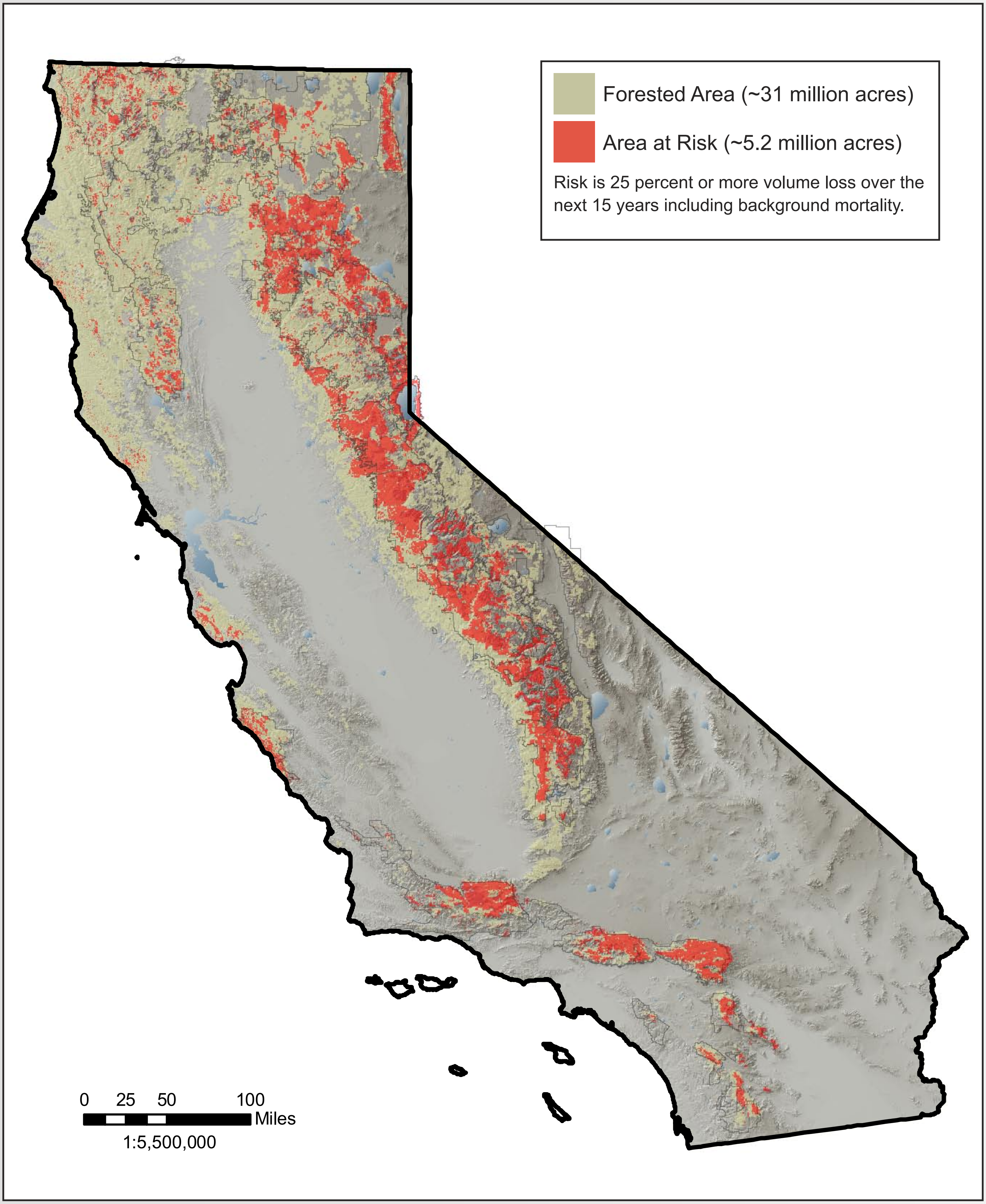
The risk mapping effort, a National Program, was initiated in 1995 with the formation of an interdisciplinary team of specialists to model and predict potential risk of tree mortality due to insect and diseases. Risk, in this context, is defined as a 25 percent or more volume loss over the next 15 years including background mortality. Two products have tangentially evolved out of the initial efforts of the Risk Map team over the course of the past 10 years, a regional and national risk map for California.

The National Risk Map is based on standardized national data sets that have been modeled from Forest Inventory and Analysis (FIA) plots for basal area, quadratic mean diameter, stand density index, and canopy cover at a spatial resolution of one kilometer. A multi-criterion framework was established to facilitate a standardized modeling approach across all forest health regions to create a seamless final product. The latest iteration of the national map will be available at: http://fhm.fs.fed.us/. The planned update schedule for the national map is every 5 years.

The California Risk Map (Map 13) uses EVEG (USDA Forest Service, Region 5, Remote Sensing Laboratory, Existing Vegetation Data) and CA-GAP data sets for the vegetation base layers for host type at a spatial resolution of 30 meters. Scientific literature, professional knowledge, and statistical data form the basis for the development of the host specific models. Model criteria and parameters vary across the landscape for each host type due to the ecological and biological complexity that exists in California. 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 regional models are currently being migrated to a multi-criteria modeling approach to better identify areas at high risk. This approach will help facilitate the prioritization of identifying and protecting biologically significant stands. The California risk map and data are available online at: www.fs.fed.us/r5/spf/fhp/fhm/risk/.

The risk models, both regionally and nationally, are constantly evolving as new data becomes available and more scientific literature relating to forest health is published. The regional map will be updated as regional vegetation data layers are updated.

Map 13: California Insect and Disease Risk Map



LIST OF COMMON AND SCIENTIFIC NAMES

INSECTS

Common Name	Scientific Name
Bark Beetles and Wood Borers	
Ambrosia beetles	*Monarthrum* spp.
Asian Longhorned Beetle	*Anoplophora glabripennis*
California fivespined ips	*Ips paraconfusus*
California flatheaded borer	*Melanophila californica*
Cedar bark beetle	*Phloeosinus* sp.
Douglas-fir beetle	*Dendroctonus pseudotsugae*
Fir engraver	*Scolytus ventralis*
Fir roundheaded borer	*Tetropium abietis*
Flatheaded fir borer	*Melanophila drummondi*
Jeffrey pine beetle	*Dendroctonus jeffreyi*
Monterey pine ips	*Ips mexicanus*
Mountain pine beetle	*Dendroctonus ponderosae*
Oak bark beetles	*Pseudopityophthorus* spp.
Pine engraver	*Ips pini*
Pine engravers	*Ips* spp.
Pinyon ips	*Ips confusus*
Red turpentine beetle	*Dendroctonus valens*
Western oak bark beetle	*Pseudopityophthorus pubipennis*
Western pine beetle	*Dendroctonus brevicomis*
Wood borers	*Semanotus* sp.
Yellow Phoracantha	*Phoracantha recurva*
Defoliators	
California oakworm	*Phryganidia californica*
Douglas-fir tussock moth	*Orgyia pseudotsugata*
Fall webworm	*Hyphantria cunea*
Fruittree leafroller	*Archyps argyrosphila*
Gypsy moth	*Lymantria dispar*
Lodgepole pine needleminer	*Coleotechnites milleri*
Pandora moth	*Coloradia pandora*
Pine catkin sawflies	*Xyela* spp.
Other Insects	
Aspen gall wasp	unknown
Cooley spruce gall aphid	*Adelges cooleyi*
Douglas-fir twig weevil	*Cylindrocopturus furniss*
Jeffrey pine needleminer	*Coleotechnites* sp. near *milleri*
Needleminers	*Coleotechnites* spp.
Pine reproduction weevil	*Cylindrocopturus eatoni*
Ponderosa pine twig scale	*Matsucoccus bisetosus*
Red gum lerp psyllid	*Glycaspis brimblecombei*
Scales	*Physokermes* sp.
Sequoia pitch moth	*Vespamima sequoiae*
Spruce aphid	*Elatobium abietinum*
The obtuse sawyer	*Monochamus obtusus*
Tip moth	*Rhyacionia zosana*
Western pineshoot borer	*Eucosma sonomana*

Recent Introductions

Asian gypsy moth	*Lymantria dispar*
Asian longhorned beetle	*Anoplophora glabripennis*
Banded elm bark beetle	*Scolytus schevyrewi*
Mediterranean pine engraver	*Orthotomicus erosus*
Red-haired pine bark beetle	*Hylurgus ligniperda*

DISEASES AND THEIR CAUSAL PATHOGENS

Common Name of the Disease	Scientific Name of the Pathogen
Cankers	
Chinkapin canker	Unknown
Cytospora canker of true fir	*Cytospora abietis*
Diplodia blight of pines	*Sphaeropsis sapinea*
Douglas-fir canker	Unknown
Madrone canker	*Nattrassia mangiferae* and *Botryosphaeria dothidea*
Phomopsis canker	*Phomopsis lokoyae*
Pitch canker	*Fusarium circinatum*
Declines	
Incense-cedar decline	Unknown
Sudden oak death	*Phytophthora ramorum*
Dwarf Mistletoes	
Douglas-fir dwarf mistletoe	*Arceuthobium douglasii*
Gray pine dwarf mistletoe	*Arceuthobium occidentale*
Mountain hemlock dwarf mistletoe	*Arceuthobium tsugense* subsp. *mertensianae*
Pinyon pine dwarf mistletoe	*Arceuthobium divaricatum*
Red fir dwarf mistletoe	*Arceuthobium abietinum* f. sp. *magnificae*
Sugar pine dwarf mistletoe	*Arceuthobium californicum*
Western dwarf mistletoe	*Arceuthobium campylopodum*
White fir dwarf mistletoe	*Arceuthobium abietinum* f. sp. *concoloris*
Foliage Diseases	
Elytroderma disease	*Elytroderma deformans*
Sugar pine needle cast	*Lophodermella arcuata*
Root Diseases	
Annosus root disease	*Heterobasidion annosum*
Armillaria root disease	*Armillaria mellea*, *Armillaria* sp.
Black stain root disease	*Leptographium wageneri*
Port-Orford-cedar root disease	*Phytophthora lateralis*
Phytophthora root rot	*Phytophthora cinnamomi*
Schweinitzii root disease	*Phaeolus schweinitzii*
Rusts	
Western gall rust	*Endocronartium harknessii*
White pine blister rust	*Cronartium ribicola*
True Mistletoes	
True mistletoe	*Phoradendron* spp.

TREES

Common Name	Scientific Name
Conifers	
Pines	
Aleppo pine	*Pinus halepensis*
Bishop pine	*Pinus muricata*
Coulter pine	*Pinus coulteri*
Foxtail pine	*Pinus balfouriana*
Gray pine	*Pinus sabiniana*
Italian stone pine	*Pinus pinea*
Jeffrey pine	*Pinus jeffreyi*
Knobcone pine	*Pinus attenuata*
Lodgepole pine	*Pinus contorta* var. *murrayana*
Monterey pine	*Pinus radiata*
Ponderosa pine	*Pinus ponderosa*
Singleleaf pinyon	*Pinus monophylla*
Sugar pine	*Pinus lambertiana*
Torrey pine	*Pinus torreyana*
Western white pine	*Pinus monticola*
Whitebark pine	*Pinus albicaulis*
True firs	
Red fir	*Abies magnifica*
White fir	*Abies concolor*
Others	
Brewer spruce	*Picea breweriana*
Douglas-fir	*Pseudotsuga menziesii*
Engelmann spruce	*Picea engelmannii*
Giant sequoia	*Sequoia giganteum*
Incense-cedar	*Calocedrus decurrens*
Mountain hemlock	*Tsuga mertensiana*
Port-Orford-cedar	*Chamaecyparis lawsoniana*
Coast redwood	*Sequoia sempervirens*
Sitka spruce	*Picea sitchensis*
Hardwoods	
Oaks	
Oaks	*Quercus* spp.
California black oak	*Quercus kelloggii*
Coast live oak	*Quercus agrifolia*
Other	
Aspen	*Populus tremuloides*
Big-leaf maple	*Acer macrophyllum*
California bay laurel	*Umbellularia californica*
California sycamore	*Platanus racemosa*
Camphor	*Cinnamomum camphora*
Chinkapin	*Castanopsis chrysophylla*
Eucalyptus	*Eucalyptus* spp.
Mountain mahogany	*Cercocarpus* sp.
Pacific madrone	*Arbutus menziesii*
Poison oak	*Toxicodendron diversilobum*
Poplar	*Populus* spp.
Tanoak	*Lithocarpus densiflorus*
Willow	*Salix* spp.

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FOREST PEST DETECTION REPORT

I. FIELD INFORMATION (See instructions on reverse)

1. County:

2. Forest (FS only):

3. District (FS only):

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

5. Date:

6. Location:

UTM:

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

8. Suspected Cause of Injury:
1. Insect ☐
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 Bernadino National Forest 602 Tippecanoe Avenue San Bernardino, CA 92408-2677	

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

Forest Pest Management CA Dept. of Forestry & Fire Protection P.O. Box 944246 Sacramento, CA 94244-2460	Forest Pest Management CA Dept. of Forestry & Fire Protection 6105 Airport Road Redding, CA 96002	Forest Pest Management CA Dept. of Forestry & Fire Protection 17501 N. Highway 101 Willits, CA 95490

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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