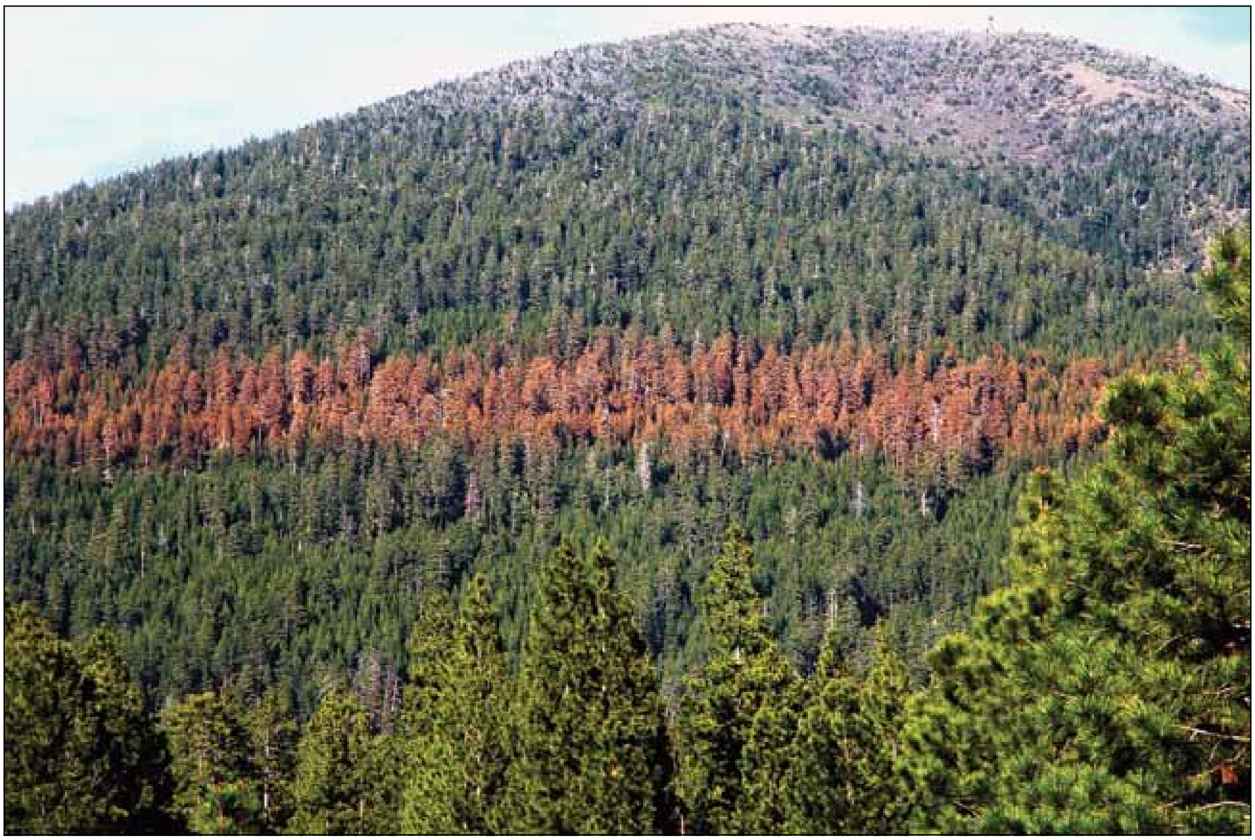
United States
Department of Agriculture

Forest Service
Pacific Northwest Region

Oregon
Department of Forestry

Forest Health Highlights in Oregon—2009



August 2010

Front cover: Red belt winter injury on Black Butte in central Oregon (Oregon Department of Forestry photo).

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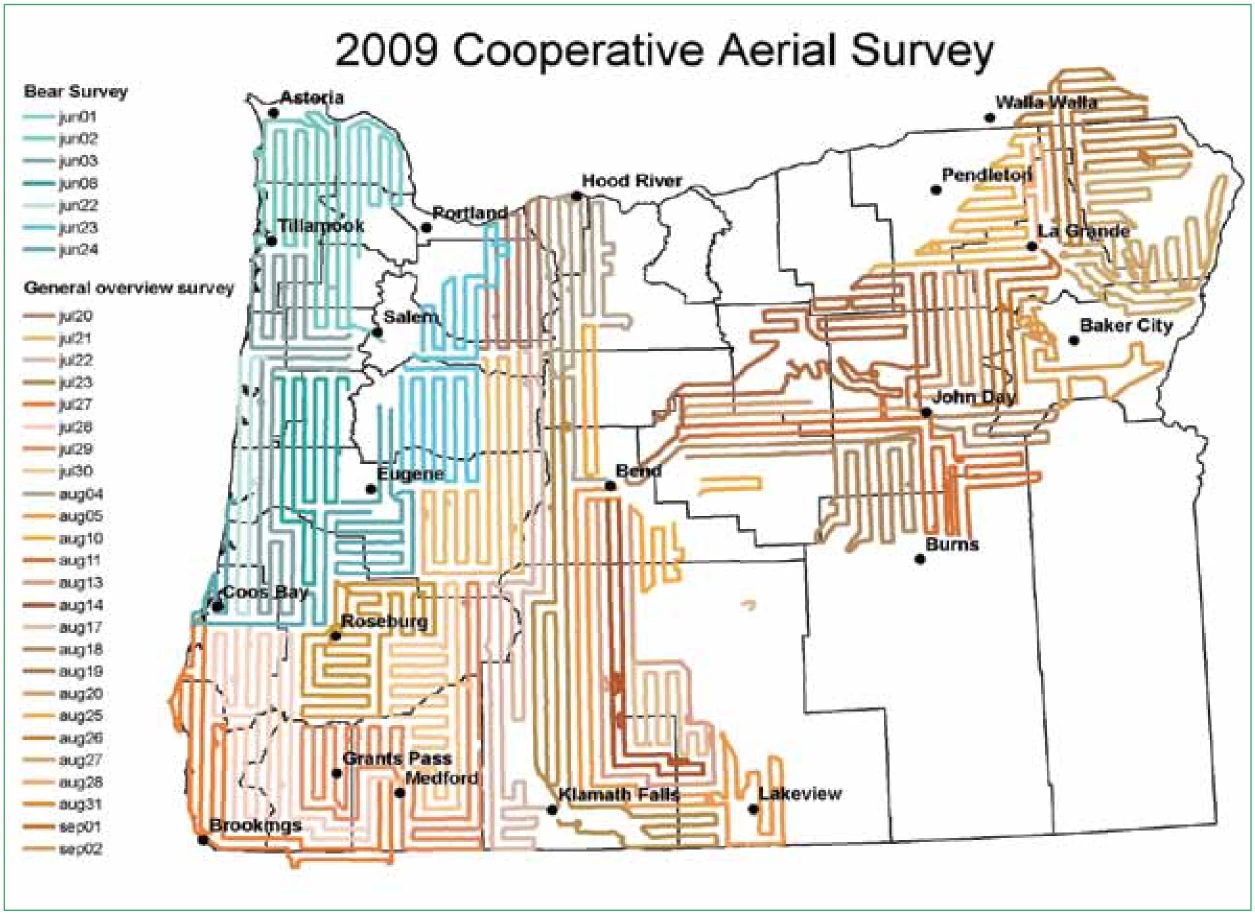

Figure 1: *Coverage area and flight lines for the 2009 statewide aerial survey of Oregon forest lands*

Introduction

Insects, diseases, and other agents cause significant tree mortality, growth loss, and damage over large areas of forest land in Oregon each year. These occurrences affect management strategies of landowners and may contribute to hazardous forest fire conditions. However, these disturbance agents are often a natural and necessary part of forest ecosystems. They contribute to decomposition, nutrient cycling, and create openings which enhance vegetative diversity and wildlife habitat. A healthy forest is one that provides a multitude of benefits but is never free of insects, diseases, and other periodic disturbances.

The Oregon Department of Forestry works cooperatively with the USDA Forest Service to monitor forest health throughout the state. This is done by aerial and ground surveys that focus primarily on insect and disease detection, monitoring, and in some cases overseeing treatment/eradication efforts. This report provides annual information on the status of forest health in Oregon. For additional information, or for specific questions, please contact the specialists listed on the final page of this report.

Forest Resource

The state of Oregon has approximately 28 million acres of forest land, consisting of federal (60%), private (35%), state (3%) and tribal (2%) ownerships. Western Oregon is marked by high rainfall and dense conifer forests along the Pacific coastline, Coast Range, and western slopes of the Cascades, while much of eastern Oregon consists of lower density, semi-arid forests and high desert. Statewide forest cover is dominated by Douglas-fir, true firs, western hemlock, and ponderosa pine, while big leaf maple, red alder, Oregon white oak, and cottonwoods are among the most abundant hardwoods.

The USDA Forest Service Forest Inventory and Analysis (FIA) program measures and monitors change to Oregon's forests through annual ground surveys of a portion of a statewide grid of permanent plots. The latest estimated acreage of forest "types" in Oregon, classified by the dominant tree(s) on each site is shown in Figure 2.

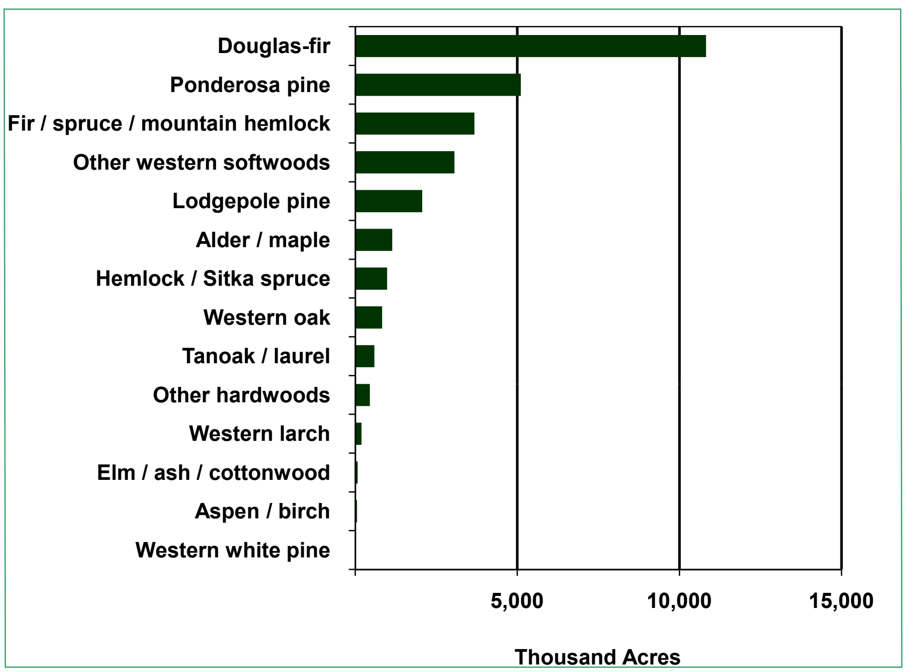

Figure 2: *Estimate of Oregon forest lands by forest type from annualized FIA ground surveys, 2001-2008.*

Aerial Surveys

Aerial surveys are conducted each year to assess forest health in Oregon. They include a statewide survey of forest lands, and separate surveys for Swiss needle cast and sudden oak death (SOD). The surveys use a digital sketch-mapping system that allows for rapid summarizing and reporting of tree damage and mortality.

The annual statewide aerial survey covered approximately 28 million acres in 2009 (Figure 1). To document damage from Swiss needle cast (SNC), a foliage disease of Douglas-fir, a separate survey of 2 million acres in western Oregon has been completed annually since 1996. Maps and data summaries of all surveys are distributed annually to cooperators and other interested parties, and are made available at the following USDA Forest Service and Oregon Department of Forestry websites: http://www.fs.fed.us/r6/nr/fid/data.shtml; http://www.oregon.gov/odf/privateforests/fh.shtml

Special aerial surveys to detect tanoaks killed by sudden oak death (SOD) have been conducted in Curry County since 2001. Fixed-wing and helicopter flights are used to precisely record the location of all dead and dying tanoak trees (Figure 3). All trees identified in the survey are then visited by ground crews, checked for the cause of mortality, and sampled for the SOD pathogen, *Phytophthora ramorum*. In 2009, SOD aerial surveys were conducted in March, May, July, and October, covering a cumulative area of 1.3 million acres.

Figure 3: *Special aerial surveys are used to detect tanoaks that may be infected by* Phytophthora ramorum.

Insects

Forest insect outbreaks are regulated by a number of factors that can lead to significant annual variation in damage. In the 2009 statewide aerial survey, insect damage was observed on 762,000 acres of forest land. Of the total area affected, bark beetles accounted for the majority of damage (72%), followed by sap-feeding insects (20%) and defoliators (8%). Declining bark beetle infestations in many areas, combined with reduced detections of some defoliators, resulted in a 16% decline in overall damage relative to 2008.

While mountain pine beetle continued to account for the majority of tree mortality in Oregon, an overall decline was observed for the first time in the last decade. There also was reduced statewide detection of other damaging bark beetles, including Douglas-fir beetle, fir engraver, and western pine beetle. The majority of insect defoliation observed this year appeared to be from western spruce budworm, larch casebearer, and balsam woolly adelgid, while more localized damage by fall webworm, conifer sawflies, and the rarely documented pine butterfly also was observed.

Mountain Pine Beetle *(Dendroctonus ponderosae)*

The mountain pine beetle continues to cause widespread mortality of mature lodgepole pine stands in eastern Oregon as well as more localized damage to areas of ponderosa and 5-needle pines (western white, sugar, and whitebark). However, the total estimated area affected by this beetle declined by over 95,000 acres this year, representing the first overall decline observed within the last decade (Figure 4). Remaining outbreaks are concentrated along the eastern slopes of the Cascades from Crater Lake to Mt. Hood and over large areas of Klamath and Lake Counties. Damage trends were not consistent across geographic areas, with declines observed in central and northeast Oregon, while increases continued to occur in southcentral Oregon.

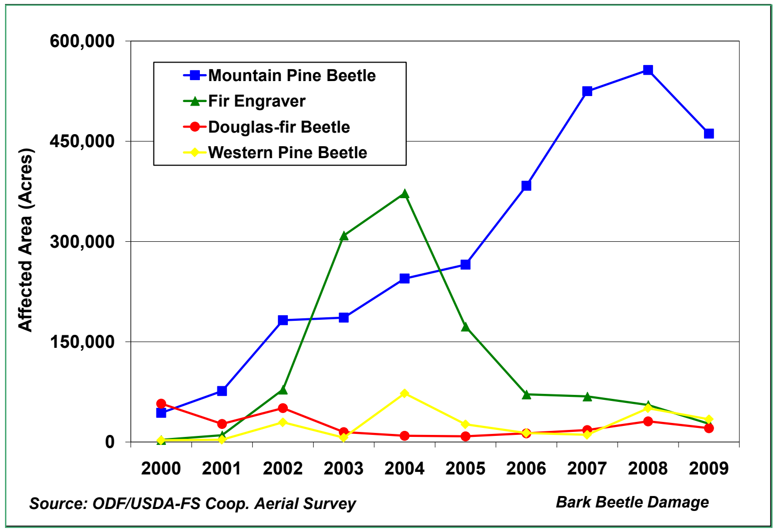

Figure 4: *Ten-year damage trend for the major bark beetles affecting Oregon forests.*

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Outbreak "spill-over" effects were again noted in the hardest hit areas and appear to be the result of large beetle populations overwhelming normally more resistant hosts. This was most evident in young, ponderosa pine plantations, but also occurred in larger-diameter ponderosa pines near outbreaks (Figure 5). Historically, outbreaks of mountain pine beetle have not been sustained once the majority of mature lodgepole stands are exhausted, and the overall decline this year may be due to the depletion of this host in some areas (Figure 6). Overall damage is expected to continue to decline; however, many highly susceptible areas continue to exist near

Figure 5: *Bark beetle damage to ponderosa pine adjacent to mountain pine beetle outbreaks in southcentral Oregon.*

Figure 6: *Mountain pine beetle outbreaks often subside once the majority of mature lodgepole pine stands are exhausted.*

outbreaks and will continue to be affected. Current management efforts are focused on salvage to reduce potential safety and fire hazards as well as thinning areas of overly dense, younger ponderosa pine to provide increased vigor and resistance.

Fir Engraver *(Scolytus ventralis)*

Historically, fir engraver outbreaks have caused high levels of mortality in Oregon. Increased damage by this beetle is usually closely associated with climatic conditions, particularly below-average moisture and drought. In recent years, overall damage has remained at endemic or background levels due to normal to above-average annual precipitation (Figure 4). In 2009, damage was estimated at over 27,000 acres, representing a decline of 50% relative to the previous year. While little damage was detected in western Oregon, significant damage was again observed in some areas of northeast Oregon. The typical pattern observed at endemic population levels is for attacks to occur on trees under stress from defoliators, diseases, or drought. With western spruce budworm defoliation increases and prolonged below-average moisture in eastern Oregon, increased damage from fir engraver is expected in the near term.

Douglas-fir Beetle *(Dendroctonus pseudotsugae)*

Overall damage attributed to Douglas-fir beetle declined by approximately 33% to approximately 20,000 acres in 2009 (Figure 4). While the overall trend appeared to be driven by declines in northeast Oregon, several northwest Counties, which had recently sustained severe storm damage, showed significant increases. Beetle outbreaks often follow storm events that cause blowdown or breakage of larger diameter Douglas-fir. High levels of down materials allow small, endemic beetle populations to rapidly build to levels that may cause mortality in standing trees in 2-3 years (Figure 7). The severe winter storms of 2006 and 2007 that caused widespread damage in western Oregon appear to have contributed to the rise in westside damage observed this year. Treatment strategies for large areas of blowdown rely primarily on salvage, but in high-value sites or more inaccessible areas, the potential for damage can also be reduced through the application of an anti-aggregant pheromone (MCH). Additional information on this product can be found at:
http://www.fs.fed.us/r1-r4/spf/fhp/publications/MCH_brochure/MCH_online.pdf.

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Figure 7: *Outbreaks of Douglas-fir beetle may occur 2-3 years following significant winter storm damage in western Oregon.*

Western Pine Beetle *(Dendroctonus brevicomis)*

Above-average damage was attributed to western pine beetle in 2008; however, survey results this year showed a relative decline of 33% (Figure 4). These beetles usually breed in and kill individual, mature ponderosa pine, particularly those affected by root disease, sustained drought, or fire damage. Group-killing of young, high-density ponderosa pine plantations was again observed in many areas this year, but much of this damage appeared to be in close proximity to mountain pine beetle outbreaks. Management efforts where damage by western pine beetle occurred were focused on mitigation and thinning strategies similar to those of other pine bark beetles. Slash management is also used to reduce fuels and the potential for damage from closely associated bark beetles (*Ips* spp.).

Western Spruce Budworm *(Choristoneura occidentalis)*

Over the last decade, damage from western spruce budworm has occurred in only a few areas of central Oregon, and has been highly variable. Damage steadily increased from 2001-2007, then appeared to dramatically decline in 2008. In 2009, a three-fold relative increase was observed, estimated at over 40,000 acres (Figure 8). While it was initially speculated that these fluctuations were due to natural regulation, field observations have since suggested that this trend was largely due to variation in the appearance of the aerial damage "signature." Ground surveys, in the Ochoco and Malheur National Forests, during the fall of 2008 indicated that the extent of budworm defoliation was much greater than observed during initial flights, and appeared to be more closely aligned with the extent of the damage recorded this year.

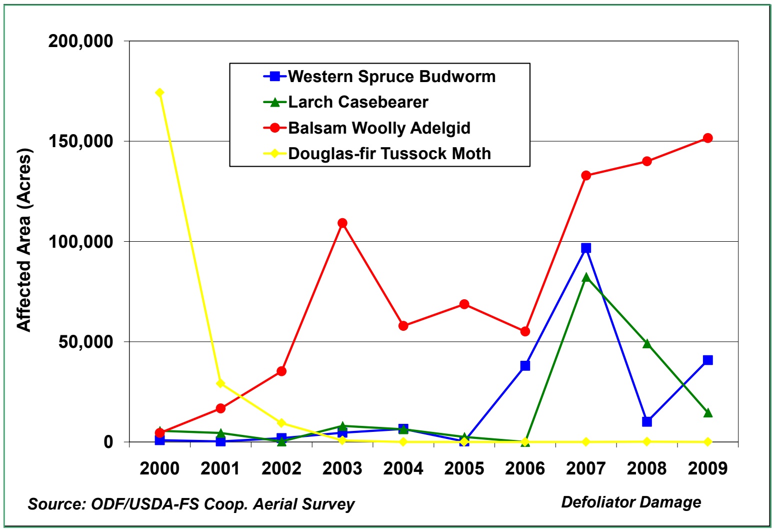

Figure 8: *Ten-year damage trend for the major defoliators affecting Oregon forests.*

In affected areas, defoliation intensity continued to be low-to-moderate and was restricted to the upper crowns of large trees and to diffuse damage in the understory (Figure 9). Thinning stands to improve vigor and increase species diversity during the time between outbreaks is the best long-term strategy, and has shown some benefit even at low-to-moderate infestations. Given the continued proliferation of highly preferred hosts in eastern Oregon, damage levels are expected to continue to rise.

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Figure 9: *Current defoliation by the western spruce budworm appears to be primarily restricted to the upper crowns of large trees.*

Larch Casebearer *(Coleophora laricella)*

Detection of damage due to the non-native larch casebearer moth declined in 2009, down 70% relative to the previous year, to an estimated 14,000 acres (Figure 8). Similar to western spruce budworm, aerial damage detection of damage can easily be affected by survey timing as well as its co-occurrence with two larch foliage diseases. While western larch is generally considered resistant to defoliation, successive years of damage can result in increased susceptibility to other agents. In 2009, scattered, low-to-moderate intensity defoliation was observed over the range of larch on the Mt. Hood, Wallowa-Whitman, and Umatilla National Forests as well as adjacent private lands. It remains unknown what impact parasitic wasps, released decades ago for biological control of larch casebearer, are having here, but research suggests that similar efforts in other states may be contributing to some population regulation.

A commonly associated foliage disease, larch needle cast (*Meria laricis*), was much more prevalent in 2009 than in recent years, particularly along riparian areas of the Elkhorn Mountains in northeast Oregon (Figure 10).

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Figure 10: *Larch needle cast was prevalent along many riparian areas in northeast Oregon.*

Balsam Woolly Adelgid *(Adelges piceae)*

Damage by the sap-feeding balsam woolly adelgid has been on the rise in eastern Oregon since 2001. Surveys in 2009 indicated an increase of 8% relative to the previous year, with damage detected on over 151,000 acres (Figure 8). Tree decline and mortality continue to be most severe in high-elevation stands of Pacific silver and subalpine fir. Scattered damage was again observed throughout the Cascades from Mt. Hood south to the Rogue River, while greater intensity damage and increased mortality appeared to be occurring in the Wallowa-Whitman and Umatilla National Forests, as well as the Hells Canyon National Recreation Area (Figure 11).

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Figure 11: *Subalpine fir decline and mortality due to the balsam woolly adelgid continues to occur in many areas of central and northeast*

Expansion of existing infestations appears to be occurring unchecked and may significantly alter future stand conditions and species composition. Infestations of this non-native insect largely eliminated grand fir from low elevation areas of western Oregon in the 1950’s-60’s, but it is unknown if similar impacts will occur in eastern Oregon. Management is impractical in most settings, but silvicultural treatments and systemic chemical controls can be used on a small scale to preserve high-value stands.

Pine Butterfly *(Neophasia menapia)*

Defoliation of ponderosa pine by pine butterfly (Figure 12) was observed on approximately 4,000 ac in 2009, representing the first detected outbreak in Oregon since 1982. Damage was scattered across multiple ownerships including the Malheur National Forest, Bureau of Land Management (BLM) and private lands (Figure 13). Previous outbreaks at wide intervals have been documented on the Payette (1921-23) and Boise (1953-54) National Forests in Idaho, as well in the Bitterroot National Forest (1973-74) in Montana. Ground surveys indicated defoliation was severe in many areas, and some tree mortality is expected.

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Figure 12: *Pine butterfly (a) adults are white with black wing markings, and can be seen in large numbers in tree canopies during outbreaks, (b) larvae are green with white stripes.*

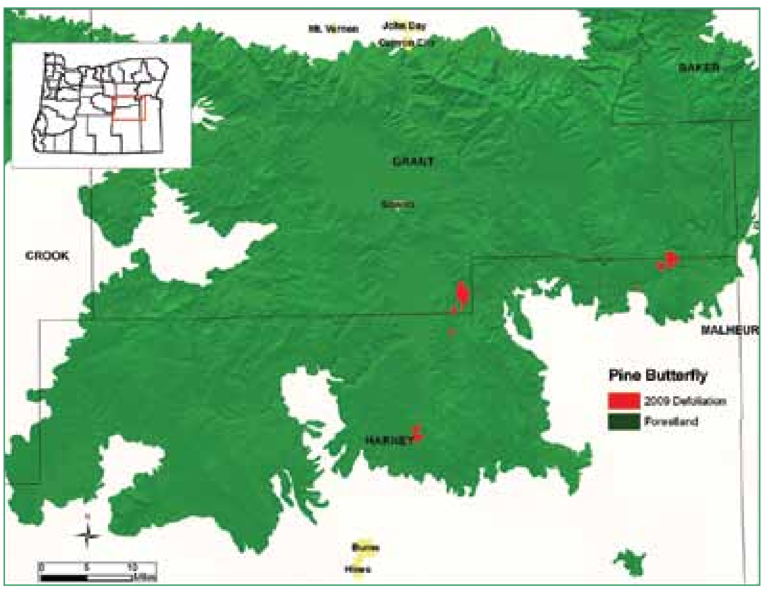

Figure 13: *Locations affected by the pine butterfly in 2009. Defoliation by pine sawfly was also observed within and adjacent to these areas.*

Additional impact may occur due to co-occurrence of damage by a pine sawfly (*Neodiprion* sp.) (Figure 14), within and adjacent to areas affected by pine butterfly. While these defoliators normally cause only minor damage, due in part to larval preference for older needles, during outbreaks current year foliage may be consumed as well and lead to mortality

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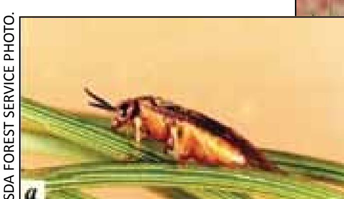

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Figure 14: *Pine sawfly (a) adults are small, copper colored, and bee-like, while (b) larvae are green and similar to moth and butterfly caterpillars.*

(Figure 15). Follow-up ground surveys are planned to more closely examine the extent and duration of this outbreak and may provide insight on the factors that contributed to this occurrence.

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***Figure 15: S**evere defoliation of ponderosa pine in an area affected by both pine butterfly and pine sawfly, as it appears on (a) the ground and (b) in the aerial survey.*

Fall webworm *(Hyphantria cunea)*

Fall webworm is one of the most commonly observed hardwood defoliators in Oregon (Figure 16). Larvae feed gregariously within and in close proximity to large silk webs, causing "skeletonized" leaves and localized defoliation (Figure 17). Field reports from southwest Oregon indicated increased damage levels in many areas in 2009. While damage was most apparent on Pacific madrone, several other hardwoods were also affected. While increases in fall webworm can be alarming, outbreaks are generally short-lived, do not spread over large areas, and cause only minor damage.

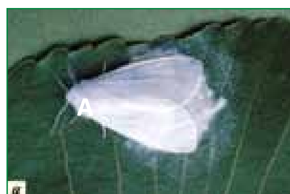

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***Figure 16:** Fall webworm (a) adults are small, white moths; (b) larvae have long white hairs extending from orange spots.*

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***Figure 17:** Silk webbing and defoliation associated with fall webworm on Pacific madrone in southwest Oregon.*

Gypsy Moth *(Lymantria dispar)*

Approximately 12,000 gypsy moth pheromone traps were placed by the Oregon Department of Agriculture in 2009, with a total of 6 male moths captured at three new sites. All moths were determined to be the European (or North American) strain. Three moths were found in the Portland area, with 3 additional moths captured near the cities of Aurora and Clackamas. Detection sites included a park near Jantzen Beach, along the I-205 corridor, and at an industrial area near the Columbia River. Additional surveys at these sites have not found any evidence of breeding gypsy moth populations. There also have been no additional moths found at three recent eradication sites in western Oregon: St. Helens (Asian gypsy moth strain), Shady Cove, and Eugene.

Diseases

Sudden Oak Death (SOD)

Sudden Oak Death (SOD), caused by the non-native pathogen *Phytophthora ramorum*, is a relatively new disease in Oregon. It was first discovered in July 2001 at five sites on the southwest coast near the town of Brookings. Aerial photos of the area indicate that the pathogen was present at one of the sites since 1997 or 1998. Outside of Oregon, *P. ramorum* is known to occur in forests only in California (14 counties) and in two European countries. The origin of the pathogen is unknown.

P. ramorum can kill highly susceptible tree species such as tanoak, coast live oak, and California black oak by causing lesions on the main stem (Figure 18). Tanoak is by far the most susceptible species in Oregon, and the disease seriously threatens the future of this species. *P. ramorum* also causes leaf blight or shoot dieback on a number of other hosts including rhododendron, evergreen huckleberry, Douglas-fir, and Oregon myrtle. If *P. ramorum* is allowed to spread unchecked in Oregon, it would seriously affect the ecology of southwest Oregon forests, and the resulting quarantine regulations would disrupt domestic and international trade of many forest and agricultural commodities. It poses a substantial threat to many forest ecosystems in North America and elsewhere around the world.

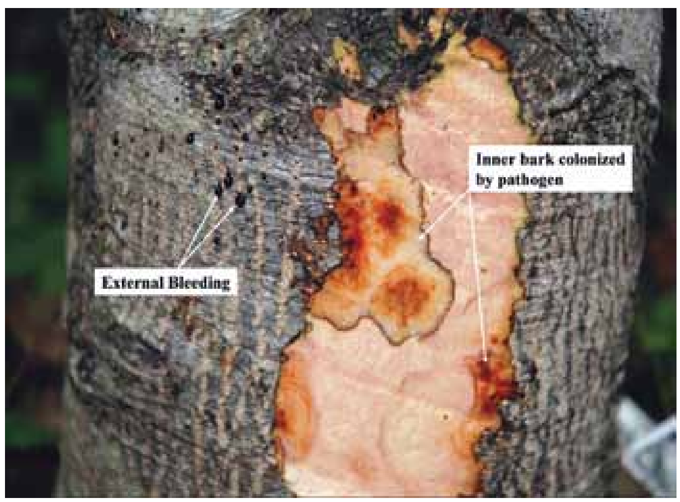

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Figure 18: *Stem lesion, inner bark of tanoak* (Lithocarpus densiflorus) *caused by* Phytophthora ramorum.

P. ramorum spreads during rainy periods when spores produced on infected leaves or twigs are released into the air and either are washed downward or transported in air currents (Figure 19). *P. ramorum* also has a tough resting spore stage, called a chlamydospore, which allows the pathogen to survive harsh conditions for months or years in soil or plant parts.

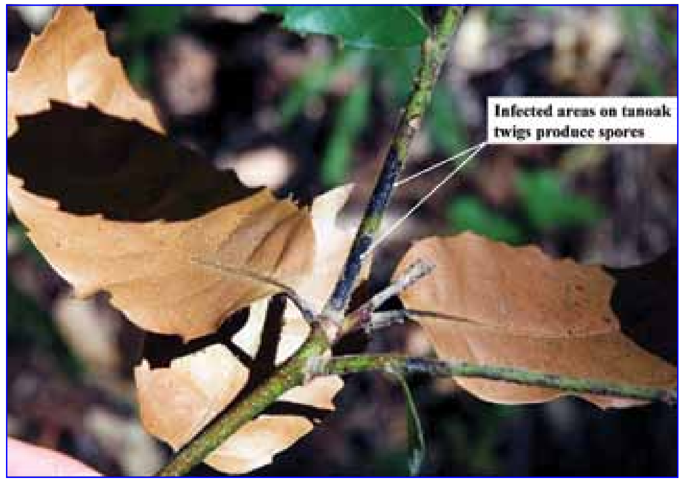

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Figure 19: *Infected leaves and twigs of tanoak* (Lithocarpus densiflorus) *caused by* Phytophthora ramorum.

Since fall of 2001, state and federal agencies have been attempting to eradicate *P. ramorum* from infested sites in Oregon by cutting and burning all infected host plants and adjacent, apparently uninfected, plants (Figures 20, 21). Between 2001 and the end of 2009 we completed (or partially completed) eradication treatments on approximately 2,900 acres of forest at an estimated cost of $5 million. Despite this effort, the disease continues to expand slowly; from 2007 to 2009 we have found approximately 60 new infested sites each year (Figure 22). Delays in completing treatments, latency of the pathogen, and consecutive years of an unusually wet spring and early summer weather contributed to disease spread.

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Figure 20: *Sudden Oak Death site piled and ready for burning, BLM land, Curry County, Oregon.*

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Figure 21: *Sudden Oak Death eradication site following cutting, piling, and burning tanoak in a mixed tanoak-red alder stand, Curry County, Oregon.*

The infested sites discovered in 2009 were small and consisted of very few infected plants, suggesting relatively early detection. The majority were located in the center of the quarantine zone and close to infected sites from previous years. The distribution of new sites followed the historic northward pattern of spread. The greatest distance between a new infested site and an infested site from a previous year was two miles. All sites are well-within the existing 162 mi^2 quarantine area established in early 2008 (Figure 23).

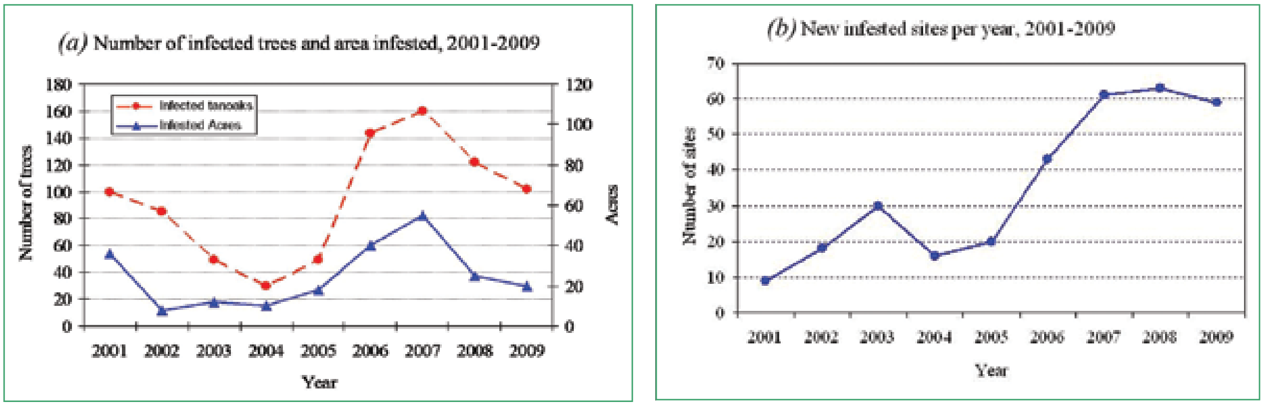

***Figure 22 (a and b):** Sudden Oak Death trends in southern Curry County, Oregon, 2001-2009: (a) number of new infected trees and infested area discovered each year; (b) number of new infested sites per year.*

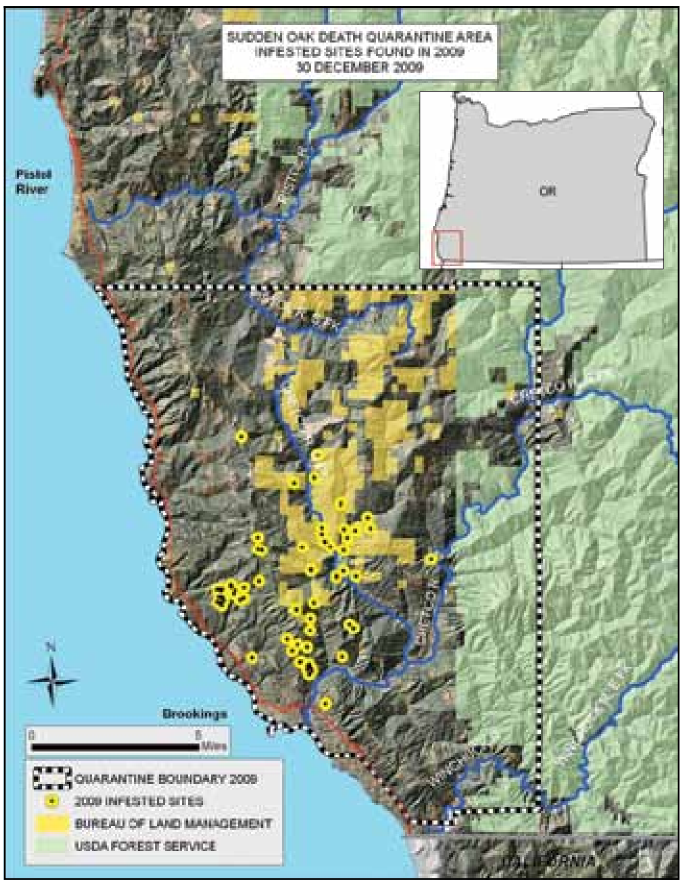

***Figure 23:** Location of areas infested with* Phytophthora ramorum *in southwest Oregon, December 2009. Sites enlarged by yellow 1000 ft buffer zone for visibility.*

In 2009 we sampled 119 eradication sites that had been treated between 2001 and 2007 to determine if the pathogen was still present on the sites. We recovered *P. ramorum* in soil or vegetation from 41% of the plots sampled; 31% of the plots yielded cultures of *P. ramorum* from soils only, 7% from soils and vegetation, and 3% from vegetation only. All positive vegetation samples were tanoak sprouts or seedlings. No *P. ramorum* was recovered from plots on sites treated in 2002; all other treatment years yielded some *P. ramorum*. Most of the *P. ramorum*-positive plots were associated with more recent treatment years, 2006 and 2007.

Despite the new occurrences of *P. ramorum* in 2009, distribution of the pathogen in Oregon forests remains limited to a very small area near Brookings, suggesting that the eradication effort has at least slowed the spread of the pathogen. Four aerial surveys, numerous ground-based surveys, and year-round stream baiting (58 drainages) have failed to detect the pathogen in forests beyond this general area of infestation.

The 2009 detection and eradication program cost was approximately $1.3 million, but at this funding level we were unable to complete all of the eradication treatments on non-federal lands. With overall program funding of approximately $2 million/year we expect continued success at slowing the spread, but it is unlikely that we will completely stop disease spread or eradicate the pathogen.

A complete P. ramorum host list can be found at: http://www.aphis.usda.gov/ppq/ispm/pramorum/pdf_files/usdaprlist.pdf
For more information on Sudden Oak Death, visit:
http://nature.berkeley.edu/comtf/

Swiss Needle Cast

Swiss needle cast (SNC) is a disease of Douglas-fir foliage caused by the native fungus *Phaeocryptopus gaeumannii*. It causes needles to turn yellow and fall prematurely from tree, ultimately reducing tree growth and survival (Figure 24). Tree mortality is rare, occurring only after many years of defoliation. Since the late 1980's, the disease has become particularly damaging to Douglas-fir forests on the west slopes of the Oregon Coast range.

Growth loss as a result of Swiss needle cast correlates with foliage retention. High foliage retention (3 or 4 annual compliments) means less damage and better tree growth; low foliage retention (1 or 2 annual compliments) means more severe damage and reduced tree growth (Figure 25). Growth loss due to Swiss needle cast in the Oregon Coast range is estimated at more than 100 million board feet per year. In addition to growth loss and some mortality, Swiss needle cast reduces stand management options, hinders the development of stand structures and wildlife habitat, and may increase the risk of catastrophic fire.

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Figure 24: *Swiss needle cast causes needle yellowing and sparse crowns in Douglas-fir (right) compared to healthy trees (left) in western Oregon.*

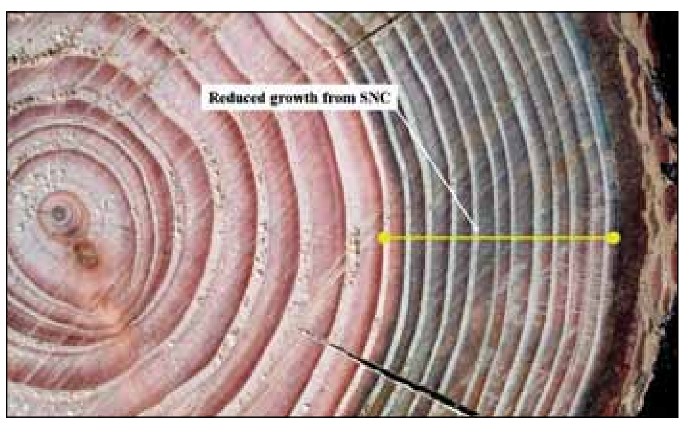

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Figure 25: *Reduction in recent radial growth increment of Douglas-fir caused by Swiss needle cast near Tillamook, Oregon.*

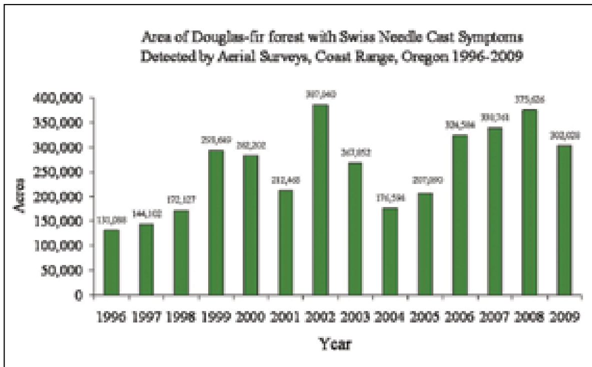

Figure 26: *Trend in area of Douglas-fir forest in western Oregon with symptoms of Swiss needle cast as detected during aerial surveys in April and May, 1996-2009. Results for 2008 were estimated by extrapolating from 3 sample survey blocks.*

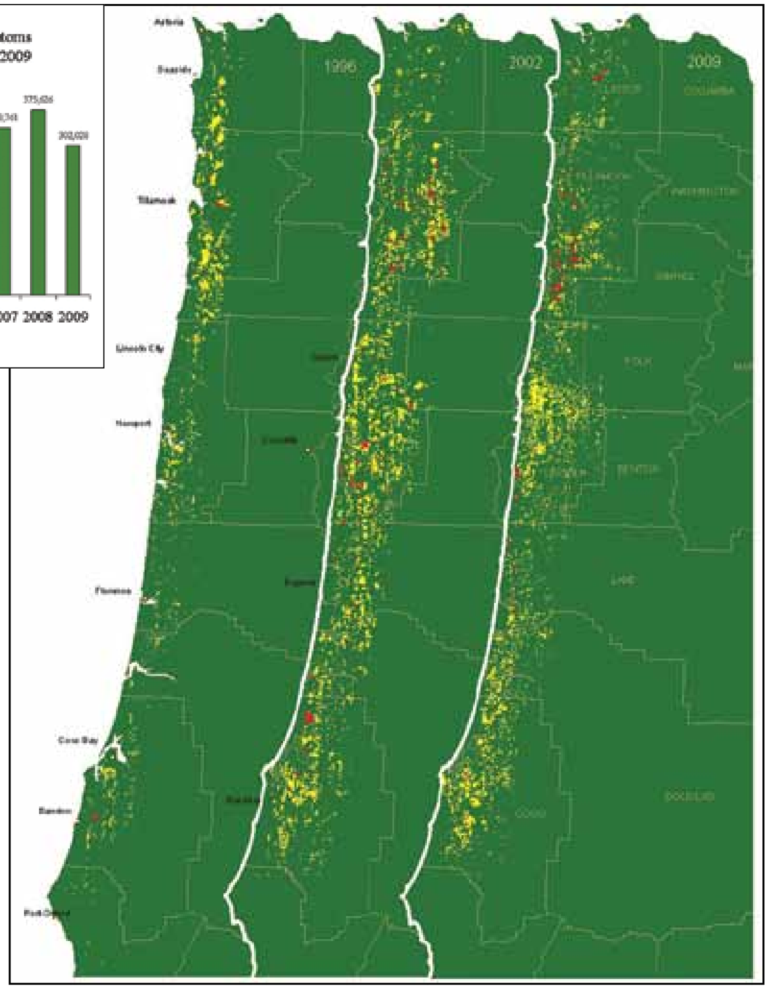

Figure 27: *Areas of Douglas-fir forest with symptoms of Swiss Needle Cast detected in the 1996, 2002, and 2009 aerial surveys: yellow = moderate damage, red = severe damage.*

Aerial surveys for SNC damage have been conducted each year since 1996 during April and May. The aerial observers map areas of Douglas-fir forest with obvious yellow to yellow-brown foliage, a symptom of moderate to severe Swiss needle cast damage. The 2009 survey mapped 302,028 acres of Douglas-fir forest with obvious symptoms of Swiss needle cast. This is a slight decrease in the area with SNC symptoms compared to the previous 3 years (Figure 26). As has been the case for the past several years, the eastern-most area with obvious SNC symptoms was approximately 28 miles inland from the coast in the Highway 20 corridor, but most of the area with symptoms occurred within 18 miles of the coast. Figure 27 shows the distribution of moderate and severe SNC symptoms in the 1996, 2002, and 2009 surveys.

The Swiss needle cast aerial survey provides a conservative estimate of damage because observers can map only those areas where disease symptoms have developed enough to be visible from the air. Permanent plot data and ground checks show that Swiss needle cast occurs throughout the survey area, but that discoloration often is not severe enough to enable aerial detection. The total area of forest affected by Swiss needle cast is far greater than indicated by the aerial survey. The aerial survey does, however, provide a reasonable depiction of the extent of moderate and severe damage, coarsely documents trends in damage over time, and establishes a zone in which forest management should take into account the effects of the disease.

For maps and GIS data of SNC, visit: http://www.oregon.gov/ODF/privateforests/fhMaps.shtml
For more information, visit the website of the Oregon State University Swiss Needle Cast Cooperative (SNCC) at: http://www.cof.orst.edu/coops/sncc/index.htm

Thousand Cankers Disease of Black Walnut

Dieback and death of mature walnut trees has been observed in the Willamette Valley since the late 1990's, and has become particularly noticeable in the Portland metropolitan area and elsewhere in the state since 2001 (Figure 28). Although several factors can lead to dieback and mortality in walnuts, much of the recent damage may be attributed to Thousand Cankers Disease, an insect-fungal pathogen complex consisting of the walnut twig beetle (*Pityophthorus juglandis*) and the newly described canker fungus *Geosmithia morbida* (Figure 29). This disease has caused considerable mortality of walnut trees in several western states and is considered a threat to several walnut species throughout their range.

Disease occurs when twig beetles carrying the fungus tunnel into the bark of branches and limbs of walnut trees. The fungus colonizes and kills the inner bark at each point of attack, causing many coalescing cankers (localized necrotic areas) which eventually can kill large branches and entire trees (Figure 30). Depending on the size species of the walnut tree, mortality can occur within a few years or take up to many years. The relatively recent increase in this disease may be related to the apparent recent expansion in the geographic range of the walnut twig beetle from its native range in the southwestern U.S. The cause of the expansion is unknown, but may be associated in some cases with the movement of infested wood.

Black walnut (*Juglans nigra*) is highly susceptible to the disease. Other species including California walnut (*Juglans hindsii*)

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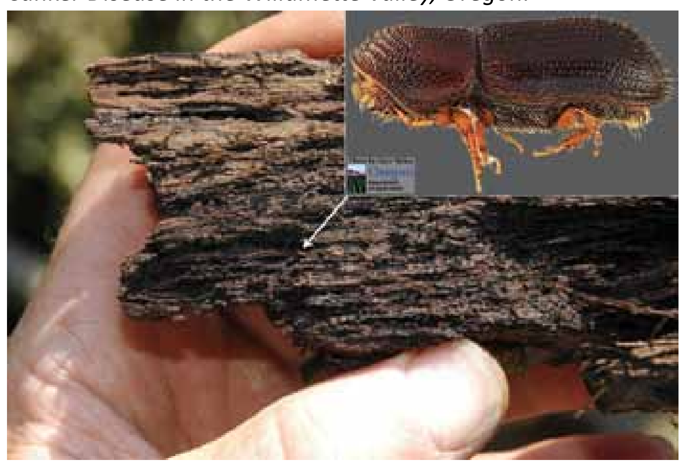
Figure 28: *Dieback of black walnut attributed to Thousand Canker Disease in the Willamette Valley, Oregon.*



OREGON DEPT OF AGRICULTURE PHOTO.

Figure 29: *Walnut twig beetle* (Pityophthorus juglandis) *beneath the bark of black walnut in the Willamette Valley. Length of beetle is 1.5-1.9 mm.*

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Figure 30: *Recent tunneling by the walnut twig beetle and the beginning of a canker caused by Geosmithia morbida.*

and southern California walnut (*Juglans californica*), also are susceptible, but to a much lesser degree than black walnut. Many of the large walnut trees in western Oregon are thought to be *J. nigra, J. hindsii,* or hybrids thereof. Persian (English) walnut (*Juglans regia*) is resistant to the disease.

Currently there are few management options for this disease. The most important precaution is to avoid moving walnut firewood, logs, or sawn wood with intact bark to areas that do not currently have the disease.

For more information on Thousand Cankers Disease, visit:
http://www.ext.colostate.edu/pubs/insect/0812_alert.pdf
http://www.thousandcankerdisease.com/

Heat Injury

For the second year in a row, the occurrence of high summer temperatures damaged tree foliage at several locations around the state. Damage was most apparent on bigleaf maple, Douglas-fir, with other common landscape species also affected (Figure 31). Heat injury can cause varying degrees of damage from mildly discolored leaves to severe desiccation. Most trees recover from this injury but may experience some growth loss.


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Figure 31: *High temperatures in July caused heat injury to bigleaf maple and several other tree species in western Oregon.*

Other Damage

Red Belt / Winter injury

Red belt is a type of winter injury that is so-named because the damage appears at distinct elevational bands on mountain slopes (Figure 32a, front cover). Damage occurs when warm, winter winds produce a temperature inversion in which the warm air layer cannot mix downward into the colder air in valley bottoms. At night, the cold air drains downward, raising the warm air layer such that trees are exposed to warm air by day and freezing temperatures at night. The alternating warm and cold air conditions, combined with often frozen soils, results in foliage desiccation as transpiration rates exceed the uptake of water from the soil (Figure 32b). In 2009, damage was observed on approximately 2,800 acres at many locations around the state. Ground surveys indicated that ponderosa pine and Douglas-fir were most commonly affected. Even with severe foliage damage, tree buds are typically not affected and flush normally, limiting the amount of tree morality that occurs.

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Figure 32: *(a) Red belt winter injury develops at elevational bands on mountain slope; (b) damaged foliage often takes on a "burned" appearance due to desiccation.*

Ozone Monitoring

Ozone is formed when emissions from combustion engines (cars, trucks, etc.) interact with sunlight on warm sunny days. High levels of ozone can damage plants (including trees), leading to growth loss, increased susceptibility to diseases, and mortality (Figure 33). The Oregon Department of Forestry and the USDA Forest Service cooperate in a national ozone bio-site monitoring program. Each year in late July and August, indicator plants are monitored for ozone injury in 35 sampling hexagons distributed throughout the state (Figure 34). To date, ozone injury to plants has not been detected in any of the Oregon plots.

USDA FOREST SERVICE PHOTO.

Figure 33: *Scouler's willow is one of several bio-indicator plants. Ozone injury causes red-brown stipple on the upper surface of leaves.*

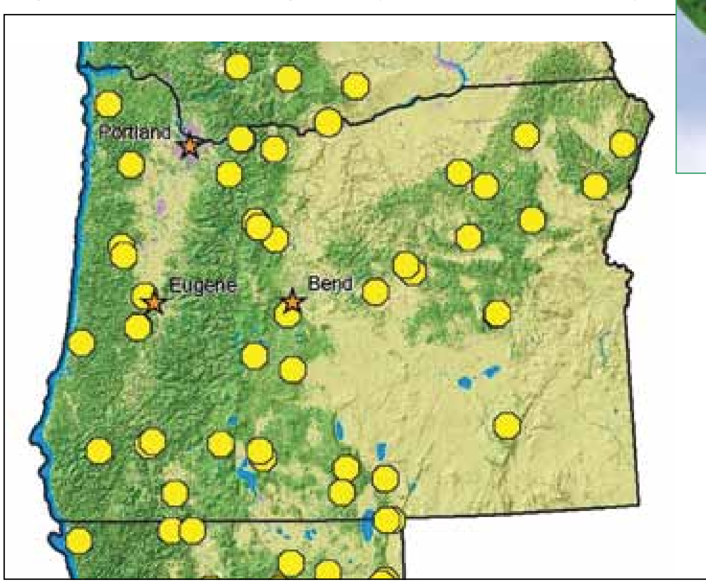

Figure 34: *Approximate location of ozone bio-site monitoring plots in Oregon.*

Bear

Black bears damage a large number of trees in western Oregon each spring by peeling the bark to feed on the inner tissues. Tree mortality of young trees is commonly observed, while partial peeling of larger trees can reduce growth or provide entry for decay organisms that lower wood quality (Figure 35). Long-term trends in bear damage are determined from a special aerial survey, flown in early summer, that covers over 7 million acres of the Coast Range and western slopes of the Cascades..

***Figure 35:** Damage and (a) mortality (red trees) of Douglas-fir in western Oregon associated with (b) spring bark peeling by black bear.*

Damage estimates based on aerial survey observations are adjusted using a ground verification factor obtained from previous studies. Adjustments are necessary as there are a number of other damaging agents that may cause tree mortality alone or in combination. In 2009, damage was observed on 13,000 acres, which was significantly less than the 10-year average of 28,000 acres, and represented a 54% decline relative to 2008 (Figure 36). Damage from root diseases, insects, and drought are also common in areas that may be affected by bear; however, it is difficult to determine the relative contribution of each without annual ground surveys.

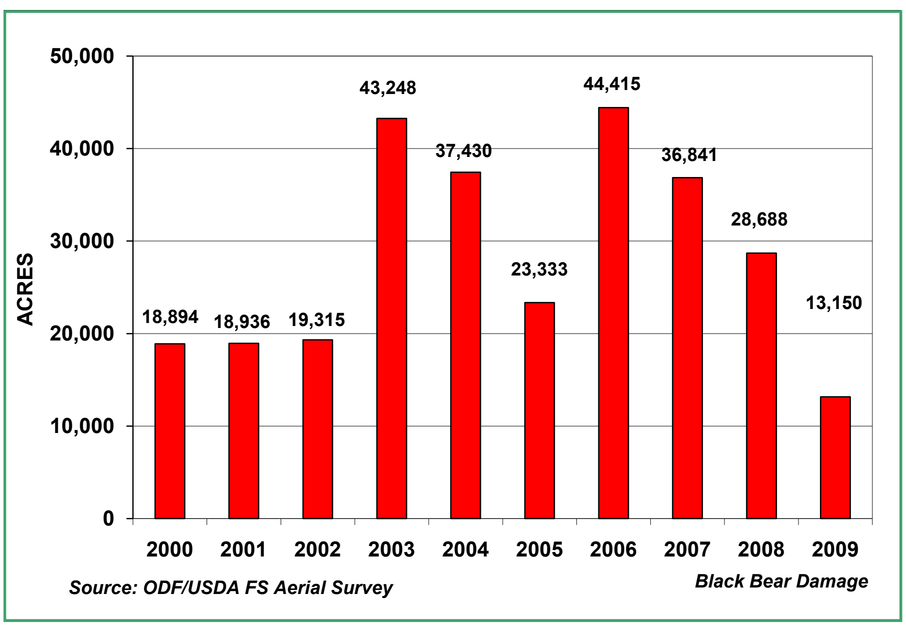

***Figure 36:** Ten-year trend in bear damage for tracking counties in northwest Oregon. Acres are adjusted according to a previously determined ground verification factor.*

Contacts and Additional Information

If you have questions about forest insect and disease activity in Oregon, please contact one of these regional or field offices:

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