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Oregon
Department of Forestry

Forest Health Highlights in Oregon—2010

March 2011

Front cover: Pine butterfly adults have been abundant near outbreak areas on the Malheur National Forest and adjacent lands northeast of Burns (Oregon Department of Forestry photo).

Forest Health Highlights in Oregon—2010

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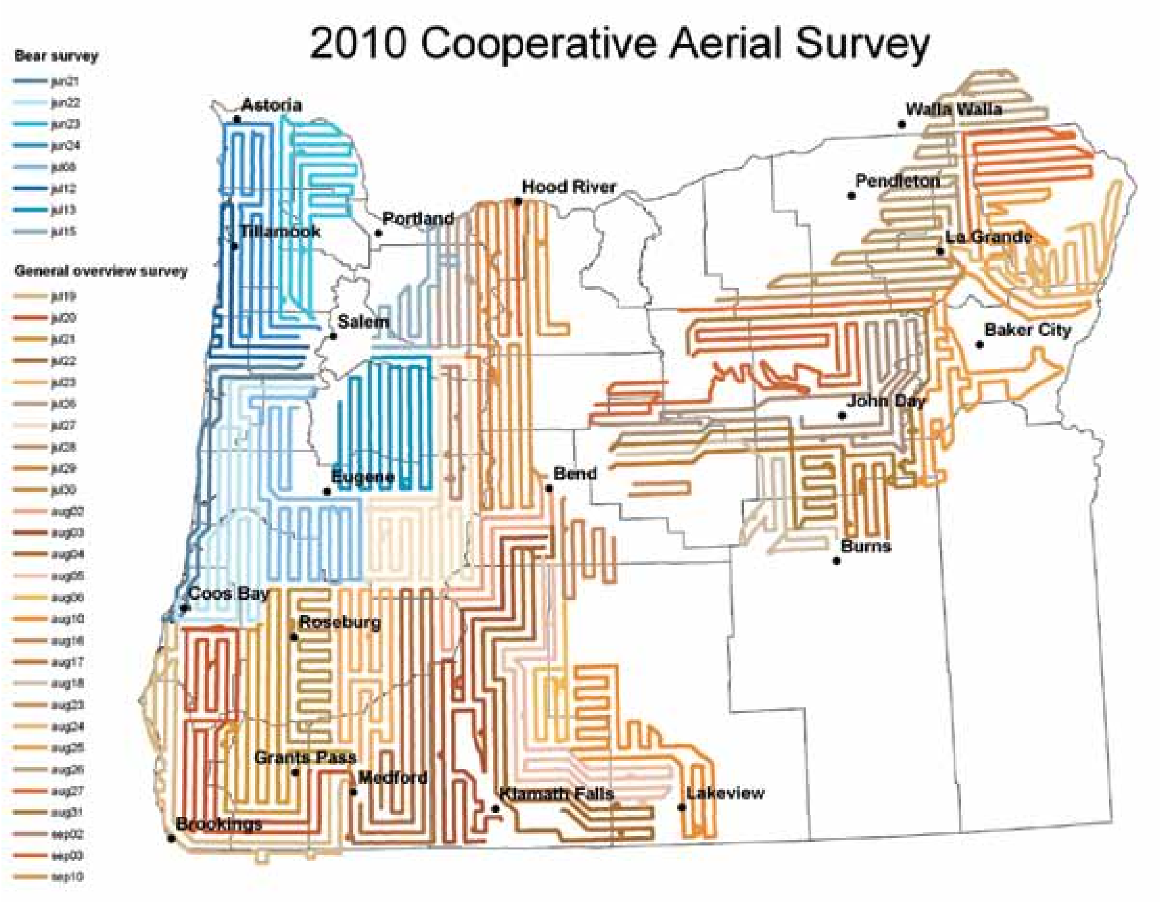

Coverage area and flight lines for the statewide aerial survey of Oregon forest lands, 2010.

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Introduction

Insects, diseases, and other agents cause significant tree mortality, growth loss, and damage over large areas of forest lands in Oregon each year. These occurrences affect management strategies of landowners and may contribute to hazardous forest fire conditions. However, these disturbance agents are usually 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 and others to assess forest health throughout the state annually. This is done by aerial and ground surveys that focus primarily on insect and disease detection, monitoring, and in some cases overseeing treatment or eradication efforts. This report provides an overview and summary of the status of forest health in Oregon for 2010. For additional information, please contact the specialists listed on the final page of this report.

Forest Resources

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 ground surveys within a statewide grid of permanent plots (Figure 1). A systematic sub-sample of plots is measured annually until all plots across the state have been sampled. Each plot is sampled once over approximately 10 years after which the cycle starts over and re-measurement begins. FIA data are valuable for assessing and describing tree mortality and damage that is not able to be detected by aerial surveys (http://www.fs.fed.us/pnw/fia/).

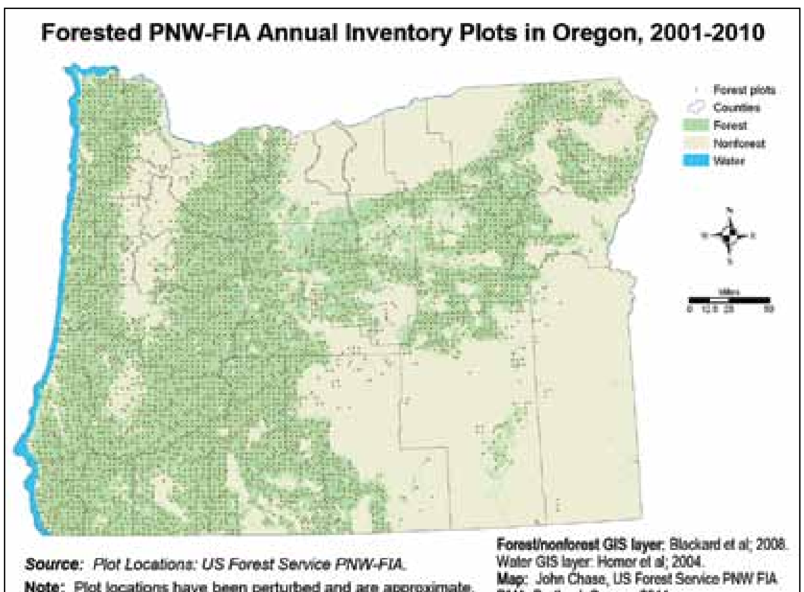

Figure 1: *Approximate locations of USDA-FS Forest Inventory and Analysis (FIA) survey plots in Oregon 2001-2010.*

Aerial Surveys

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

The statewide aerial survey covered approximately 28 million acres in 2010 (Figure 2). To document damage from Swiss needle cast, a foliage disease of Douglas-fir, a separate survey of 2 million acres in western Oregon has been completed annually since 1996. Maps, trend summaries, and GIS data from these surveys are distributed annually to cooperators and other interested parties, and are also available at the USDA Forest Service and Oregon Department of Forestry websites below.

USDA-FS: http://www.fs.usda.gov/goto/r6/ads

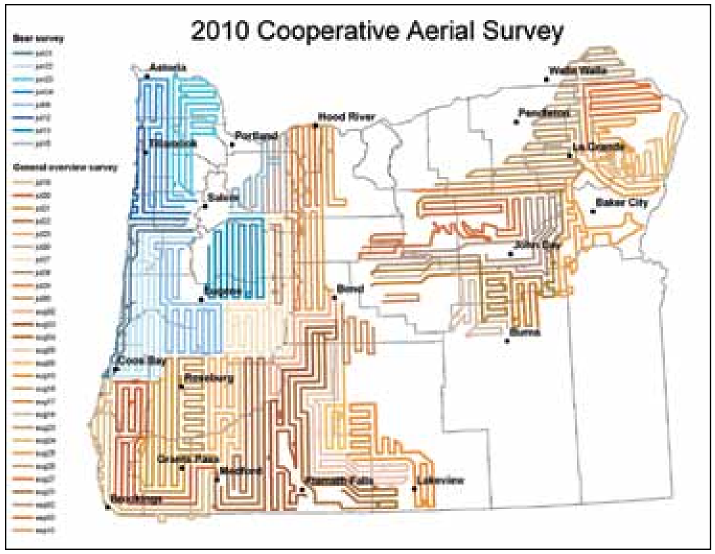

Figure 2. *Coverage area and flight lines for the statewide aerial survey of Oregon forest lands, 2010.*

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Figure 3: *Aerial serverys are used to detect dying tanoak trees that may be infected by* Phytophthora ramorum *in southwest Oregon.*

ODF: http://www.oregon.gov/odf/privateforests/fh.shtml

Special aerial surveys to detect tanoaks killed by sudden oak death 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 to assess the cause of mortality and sample for the SOD pathogen, *Phytophthora ramorum.* In 2010, SOD aerial surveys were conducted in May, July, and October, and covered over 1 million acres.

Insects

Forest insect outbreaks are regulated by a number of factors that can lead to significant annual variation in damage. In 2010, statewide aerial surveys detected over 980,000 acres of insect-related tree mortality and other damage. Of the total area mapped, bark beetles accounted for the majority of detections (68%), followed by sap-feeding insects (18%) and defoliators (14%). Increased insect defoliation and bark beetle damage, especially in southwest and northeast Oregon, resulted in a 29% rise in the overall affected area compared to 2009.

Mountain pine beetle continued to account for the majority of tree mortality detected by aerial surveys in Oregon. While a slight increase was observed in the overall area mapped in 2010, the estimated amount of tree mortality within those areas declined for a second consecutive year. In contrast, tree mortality attributed to western pine beetle, Douglas-fir beetle, and fir engraver all increased this year. The majority of insect defoliation was due to western spruce budworm, pine butterfly, and balsam woolly adelgid, while more localized damage by larch casebearer, conifer sawflies, and fall webworm was also observed. Only a single gypsy moth was detected statewide in 2010.

Mountain Pine Beetle (*Dendroctonus ponderosae*)

The mountain pine beetle continued to cause widespread mortality of lodgepole pine in many areas of Oregon as well as more localized damage to ponderosa and 5-needle pines (western white, sugar, and whitebark) in 2010. Although the total area mapped with tree mortality increased by 4% this year, the estimated number of trees killed within those areas declined for a second year (Figure 4). Tree mortality was concentrated in remaining, susceptible areas along the crest of the Cascade Range and in Klamath and Lake Counties. Tree mortality was most prevalent in Deschutes National Forest near Mt. Bachelor and Newberry Crater, in the Fremont-Winema National Forests near Yamsay Mountain, Yainix Butte, southeast of Winter Rim, and in the Gearhart and Warner Mountains, as well as in the Wallowa Mountains and Eagle Cap Wilderness.

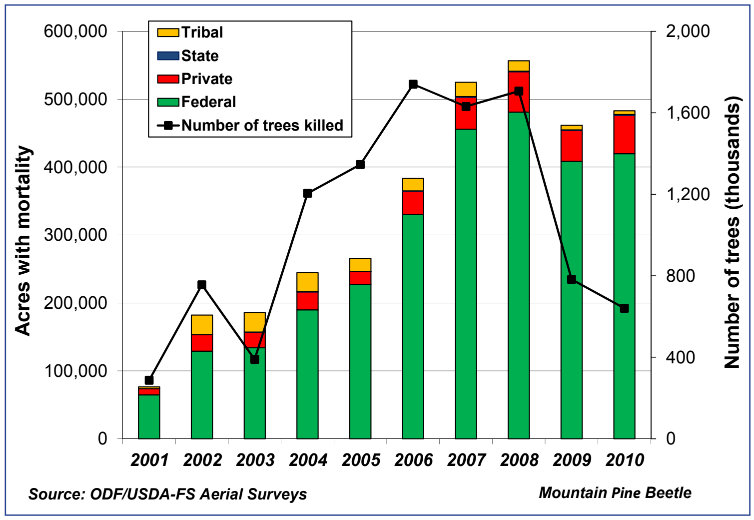

Figure 4: *Ten-year trend for total acres with mortality and the estimated number of trees killed by mountain pine beetle in Oregon.*

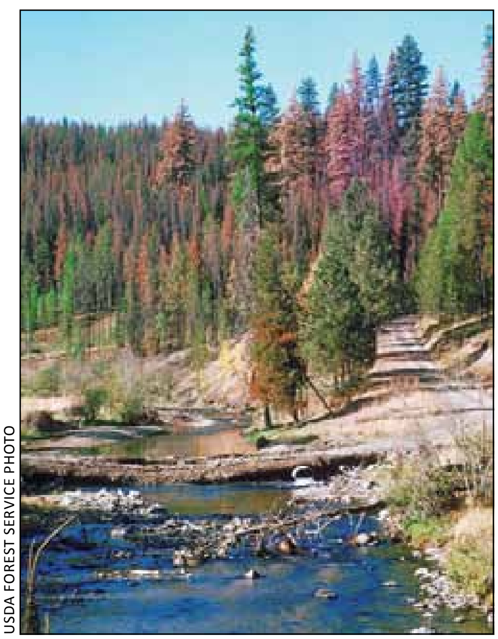

Figure 5: *Mountain pine beetle continues to cause mortality of lodgepole pine and other hosts in susceptible areas, such as along riparian buffers.*

High mountain pine beetle populations can overwhelm normally more resistant hosts, and this was again detected in 2010, especially in young, ponderosa pine stands adjacent to outbreaks. Historically, outbreaks cannot be sustained once the majority of mature lodgepole stands are exhausted, and the overall decline observed in 2009 and 2010 appears to be due to the depletion of these preferred hosts. Overall tree mortality should continue to decline; however, areas with high numbers of lodgepole pine remaining, particularly where larger-diameter trees exist, such as along riparian buffers, will continue to be affected (Figure 5). Ongoing management in heavily impacted areas includes treatments to reduce risks associated with dead trees and wildfire in developed areas as well as thinning adjacent, overly dense ponderosa pine stands to increase their resistance to bark beetle attacks.

Western Pine Beetle (*Dendroctonus brevicomis*)

Western pine beetle in Oregon most commonly causes tree mortality in large, individual ponderosa pine that have been affected by root diseases, moisture stress, defoliation, or wildfire damage. Group-killing of small-diameter ponderosa pine also occurs but is less common. Tree mortality attributed to the western pine beetle has been low in recent years, but a near three-fold increase was observed in 2010, with detections on over 91,000 acres (Figure 6). The majority of damage was represented by scattered, large-diameter ponderosa pine, particularly in the Applegate watershed in southwest Oregon and in areas of the Ochoco and Malheur National Forests previously damaged by the Egley Complex of wildfires that occurred northwest of Burns (Figure 7). While group-killing of younger stands was also documented, recent ground surveys have indicated that mountain pine beetle is often responsible when mortality is observed in close proximity to ongoing outbreaks or where there is a significant component of older lodgepole pine present.

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Figure 7: *Large-diameter ponderosa pines damaged by wildfire or insect defoliators are more susceptible to western pine beetle.*

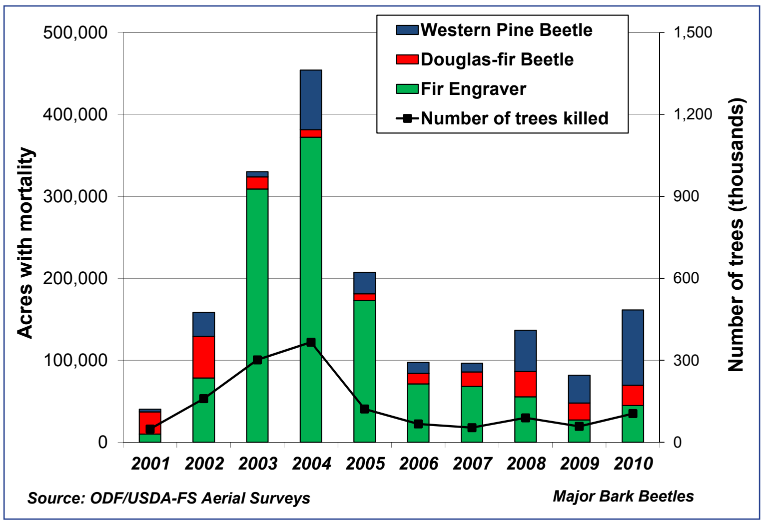

Figure 6: *Ten-year trend for total acres with mortality and estimated number of trees killed by other major bark beetles in Oregon.*

Douglas-fir Beetle (*Dendroctonus pseudotsugae*)

Tree mortality attributed to Douglas-fir beetle increased by 19% to over 24,000 acres in 2010 (Figure 6). In recent years, the majority of tree mortality has occurred in northwest Oregon, in association with the severe storm events of 2006 and 2007. High levels of large-diameter down or damaged Douglas-fir can lead to Douglas-fir beetle outbreaks sufficient to cause mortality in adjacent standing trees. While additional mortality continued to occur along coastal areas in 2010, increased damage this year was observed at mid-elevations along the western slopes of the Cascade Range and in the southern Coast Range (Figure 8). The most concentrated areas of tree mortality were observed in the Clatsop State Forest west of Vernonia, the Willamette National Forest along Santiam Pass south to the McKenzie River, and in the Siuslaw National Forest and adjacent private lands. Outbreaks appear to be associated with a number of factors that includes

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Figure 8: *Douglas–fir beetle caused tree mortality was prevalent along mid-elevation, western slopes of the Cascades and in the southern Coast Range.*

previous storm damage, moisture stress, root diseases, high stand densities, and having a large component of mature Douglas-fir.


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***Figure 9:** Douglas-fir beetle attacks (a) on trees in high priority areas can be reduced using pheromone repellents applied aerially or to individual trees (b).*

Management to prevent outbreaks of Douglas-fir beetle relies primarily on consistent thinning, salvage, and sanitation aimed at increasing stand vigor and reducing the opportunity for beetle population build-ups. At high-value sites or where silvicultural treatments are not possible, there has been increasing reliance on a pheromone repellent (or MCH) that can now be applied aerially or to individual trees (Figure 9). Additional Information on this product can be found at: http://www.fs.fed.us/r1-r4/spf/fhp/publications/MCH_brochure/MCH_online.pdf.

The area of tree mortality attributed to a common associate of the Douglas-fir beetle, the flatheaded fir borer *(Melanophila drummondi),* also increased in southwest Oregon this year, to over 16,000 acres. The majority of detections were in the Siskiyou Mountains, Applegate watershed, and foothills east of Medford to the Rogue River National Forest. Previous ground surveys in these areas have indicated that this woodborer is often one of the primary causes of tree mortality.

Fir Engraver Beetle (*Scolytus ventralis*)


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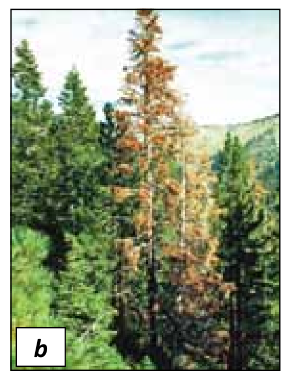
***Figure 10:** Tree mortality due to fir engraver (a) increased in areas of southwest and northeast Oregon (b) but remained at endemic levels overall.*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Fir engraver outbreaks periodically cause high levels of mortality in true fir species in Oregon. Historically, these have been most often associated with periods of below-average moisture or following large-scale disturbance by insect defoliators or wildfires. In 2010, tree mortality from fir engraver was estimated at over 44,000 acres (Figure 6). While the estimated area with mortality rose by 64% relative to 2009, damage continued to remain at a level considered to be endemic or background. The majority of detections in 2010 occurred in southwest Oregon in the Siskiyou Mountains and Rogue River National Forest, as well as in northeast Oregon in the Umatilla National Forest and other areas of the Blue Mountains (Figure 10). Below-normal moisture patterns have occurred in some of these areas in recent years, and increased tree mortality from fir engraver may be expected if this trend or ongoing insect defoliator outbreaks continue.

Western Spruce Budworm (*Choristoneura occidentalis*)

Defoliation from western spruce budworm has been consistently detected by aerial surveys in central and northeast Oregon since 2001. Damage within affected areas has slowly expanded over that time, with the exception of 2008, in which the appearance of defoliation was significantly delayed by weather conditions. Detection increased significantly in 2010 and was estimated at over 108,000 acres (Figure

11). Current outbreaks, which are affecting primarily Douglas-fir and true firs, are concentrated in the Ochoco and Malheur National Forests in areas near Snow Mountain, the Strawberry Mountains, and east of Silvies Valley northwest of Burns. Interestingly, the ponderosa and lodgepole pines in many of these same areas are also being defoliated by an ongoing outbreak of pine butterfly, which was first detected in 2008 (Figure 12). Defoliation severity by western spruce budworm appears to be low-to-moderate in most areas, with damage primarily in the upper crowns of large trees and diffuse within the understory. While the factors that regulate outbreaks are not completely understood, the increased abundance of preferred hosts in recent decades suggests that the current spruce budworm outbreak may continue to expand and intensify.

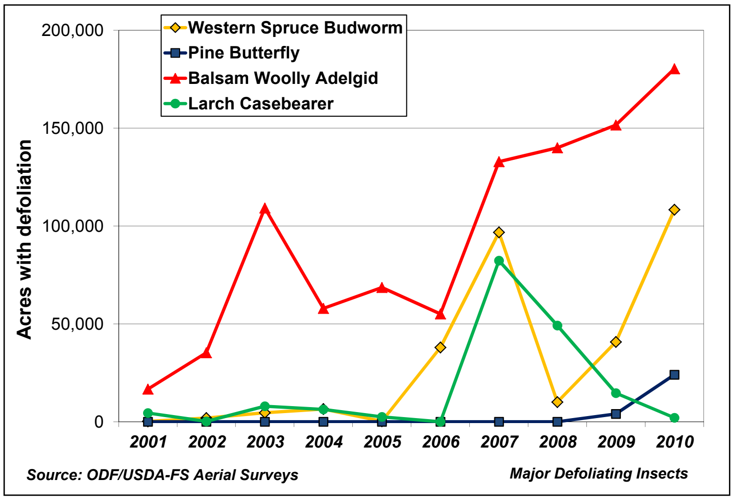

Figure 11: *Ten year trend of the total area affected by the major insect defoliators in Oregon, as detected by annual aerial surveys.*

Long-term approaches offer the best management strategies for insect defoliators, especially silvicultural strategies focused on improving stand vigor, reducing preferred hosts, and increasing species diversity. While activities are best timed to the period between outbreaks, they have also shown benefit during outbreaks in low infestation areas. Aerial insecticide sprays have had mixed success for western spruce budworm and other defoliators historically, due to the difficulty in obtaining proper timing and coverage, as well as the re-invasion that can quickly occur from surrounding areas.

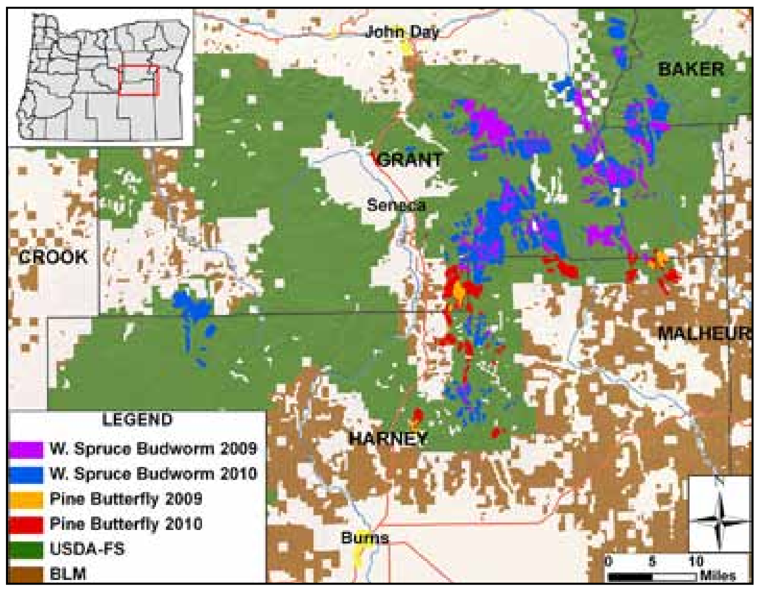

Figure 12: *Outbreaks and defoliation by the western spruce budworm and pine butterfly expanded in Oregon from 2009 to 2010.*

Pine Butterfly (*Neophasia menapia*)

Over the last century, outbreaks of pine butterfly in the Blue Mountains of Oregon have been reported only four times (1908-1911, 1940-1943, 1982, and 2008-present). While detailed descriptions of previous outbreaks are lacking, it appears that all were relatively short-lived and resulted in only minor defoliation of pine hosts. The current outbreak, first detected in 2008 by ground surveys, appears to have significantly expanded since that time. Aerial observations in 2010 estimated defoliation at over 24,000 acres, which represented a near six-fold increase relative to the previous year (Figure 11). However, recent ground surveys in these areas estimate the defoliation at over 68,000 acres.

The current outbreak is occurring primarily on ponderosa pine in the Malheur National Forest and on adjacent Bureau of Land Management (BLM) and private forest lands northeast of Burns (Figure 12). This appears to be similar to locations where previous outbreaks were described, and may be part of a regional trend as increased numbers of pine butterfly have been recorded in neighboring states. The population dynamics of pine butterfly are not well understood, but they appear to be regulated by natural controls (predators, parasites, and weather). While several natural enemies were observed in 2010, a parasitic wasp (*Theronia atalantae*) credited with controlling a previous outbreak has not yet been observed. Adding to the uncertainty, defoliation by a pine sawfly (*Neodiprion* spp.) has been co-occurring in these areas and it appears to be the primary damaging agent at some locations.

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Figure 13: *Pine butterfly larvae (a) were abundant in the Malheur National Forest and caused increased defoliation (b) of ponderosa pine.*

Pine butterfly and pine sawfly outbreaks tend to be short-lived; however, indications are that high populations may continue to exist through 2011. And, while the larvae of both species feed primarily on older needles, damage to current year foliage and some tree mortality has been reported historically in other states (Figure 13). The risk of tree mortality in non-forest settings is relatively low and despite public concerns as to the large number of butterflies moving through populated areas near outbreaks, they do not pose any health concerns. Cooperative research efforts, led by the USDA Forest Service, are ongoing to further document and describe this rather rare phenomenon.

Balsam Woolly Adelgid (*Adelges piceae*)

The balsam woolly adelgid is a sap-feeding insect, but its activity can indirectly cause substantial needle loss and in some cases even tree mortality. The detection of declining stands and mortality in true fir species has consistently risen in Oregon over the last decade. Aerial surveys in 2010 indicated a 30% increase in affected area relative to 2009, with detections on over 180,000 acres of primarily Pacific silver and subalpine fir (Figure 11). Tree mortality was observed on approximately 8% of affected areas. Scattered damage continued along the peaks of the Cascade Range from Mt. Hood to the Rogue River (Figure 14), while more concentrated areas of decline were observed in the Wallowa-Whitman and Umatilla National Forests, especially near the Elkhorn and Wallowa Mountains, as well as in Hells Canyon National Recreation Area.

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Figure 14: *Balsam woolly adelgid continues to cause widespread decline in subalpine fir stands in central and northeast Oregon.*

This long-established, non-native insect largely eliminated grand fir from much of western Oregon in the 1950's and 1960's, but it is unknown if a similar trend will occur to hosts in other areas. Control of adelgid populations is impractical in most settings, but sanitation treatments and systemic chemical applications can be used to help preserve high-value stands or individual trees Monitoring plots have been established by the USDA Forest Service in central and northeast Oregon to follow long-term trends and examine what other factors may be contributing to decline in these high-elevation forests.

Larch Casebearer (*Coleophora laricella*)


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Figure 15: *Research is underway to examine the current distribution and impact of natural enemies released decades ago for biological control of larch casebearer.*

Aerial detection of damage by the non-native larch casebearer moth declined 86% in 2010 to an estimated 2,000 acres (Figure 11). Detecting defoliation by this insect can be highly variable, as it can be obscured by larch re-foliating later in the summer or changes in survey timing. The damage from this insect also resembles that of two larch needle diseases with which it often co-occurs. In 2010, scattered defoliation was observed in previously affected stands in the Mt. Hood and Umatilla National Forests as well as adjacent private lands. While a number of factors have been shown to affect larch casebearer populations, the cause of recent declines is unknown. Research efforts, led by Oregon State University are currently investigating the distribution and impact of previously introduced natural enemies. These were released decades ago in northeast Oregon and other states as part of a biological control program (Figure 15). Recent ground surveys have indicated that larch casebearer remains abundant in many areas, and noted an increased amount of larch needle cast (*Meria laricis*) present.

Conifer Sawflies (*Neodiprion* spp.)

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Figure 16: *An outbreak of conifer sawflies, which resemble caterpillars (a), was observed on noble and Douglas-fir in the Willamette National Forest (b).*

An estimated 300 acres of defoliation by conifer sawflies (*Neodiprion* spp.) was detected this year in noble and Douglas-fir along Santiam Pass in the Willamette National Forest (Figure 16). In recent years, localized outbreaks by conifer sawflies have been detected in a number of other hosts including western hemlock as well as ponderosa, lodgepole, and ornamental pines. It is unknown what factors may be contributing to their increased detection, or in some cases, the co-occurrence of outbreaks. However, historically it's likely that these small-scale events were not well documented. Conifer sawfly outbreaks in mature stands tend to quickly subside with limited tree mortality, but damage can be severe when they co-occur with defoliators that prefer current year foliage or when they infest young trees. Cooperative trapping surveys have recently been undertaken by State and federal agencies in Oregon to assist in identifying the distribution of native and non-native sawfly species and examine host relationships.

Fall Webworm (*Hyphantria cunea*)

Fall webworms are one of the most commonly observed hardwood defoliators in Oregon. Larval colonies occur within or in close proximity to large silk webs, and characteristically "skeletonize" the leaves nearby (Figure 17). While their peak occurrence is often too late to be detected in annual aerial surveys, reports from southwest Oregon have indicated localized outbreaks of fall webworm in 2009 and 2010. While a wide number of hosts have been affected, damage has been most apparent on Pacific madrone. While the appearance of a large numbers of webs has caused some public concern, outbreaks are generally short-lived and damage minimal. However, outbreaks of this size appear to be uncommon historically in southwest Oregon, and research into the factors that may be driving this trend is underway.


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Figure 17: *Outbreaks of fall webworm have continued to affect Pacific madrone and other hardwoods in southwest Oregon.*

Gypsy Moth (*Lymantria dispar*)


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Figure 18: *The presence of gypsy moths is monitored annually using a statewide network of over 12,000 traps.*

Gypsy moth trapping surveys have been completed in Oregon since 1979. Over 12,000 pheromone traps were placed in 2010, and resulted in the capture of only a single moth near Beaverton (Figure 18). It was determined to be the European (or North American) strain, which is most commonly found in Oregon. Despite consistent captures and a number of eradication projects since the gypsy moth program began, the 2010 result was actually the lowest number of moths detected since monitoring efforts began. The coming year will also be the first time that no eradication project will be completed for two consecutive years, as no additional gypsy moths were found at recently treated sites in 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 19). Tanoak is by far the most susceptible species in Oregon, and the disease seriously threatens the future of this species (Figure 20). *P. ramorum* also causes leaf blight or shoot dieback on a number of other hosts including rhododendron, evergreen huckleberry, Douglas-fir, and Oregon myrtle. *P. ramorum* has the potential to spread throughout coastal Oregon, Washington, California, and British Columbia. If allowed to spread it will seriously damage 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 19:** Dead and dying tanoak infected with* Phytophthora ramorum*, as seen in an aerial survey for sudden oak death.*

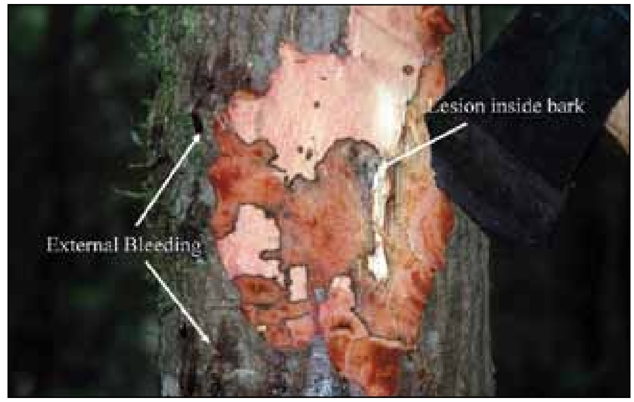

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***Figure 20:** Stem lesion, inner bark of tanoak (*Lithocarpus densiflorus*) caused by* Phytophthora ramorum.

P. ramorum spreads during rainy periods when spores produced on infected leaves or twigs are released into the air and are either washed downward or transported in air currents (Figure 21). *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.

Since fall of 2001, state and federal agencies have been attempting to eradicate *P. ramorum* from infested sites in adjacent apparently uninfected plants (Figures 22, 23). Between 2001 and the end of 2010 we conducted eradication treatments on more than 3,000 acres of forest at an estimated cost of over $6 million. The initial objective of the eradication program was to eliminate disease and the pathogen from the infested sites and thereby stop spread. Post-treatment monitoring in 2009 and 2010 showed clearly that the disease and the pathogen are absent from most, but by no means all, of the treated sites. Although eradication per se has not been achieved on all sites, the treatments have prevented disease intensification in most areas and slowed spread of the disease.

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***Figure 21:** Infected leaves and twigs of tanoak (*Lithocarpus densiflorus*) caused by* Phytophthora ramorum.

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***Figure 22:** Sudden Oak Death infested site, cut and ready for broadcast burn, Curry County, Oregon.*

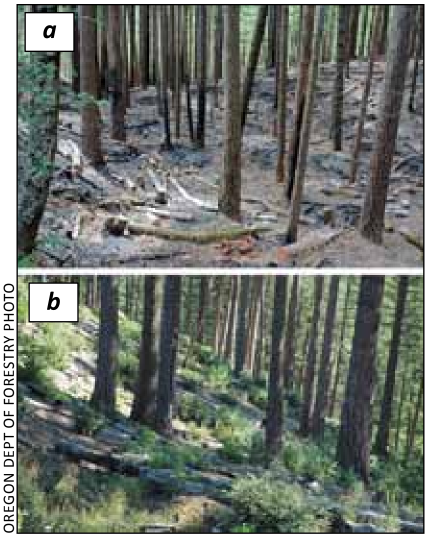

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***Figure 23:** Sudden Oak Death eradication site following cutting, piling, and burning tanoak in a mixed tanoak-Douglas-fir stand: a) immediately after treatment; b) two-years after treatment showing abundant stump-sprouting, BLM land, Curry County, Oregon.*

Disease spread between 2001 and 2010 has been predominantly northward, following the prevailing wind direction during storms and wet weather. From the initial infestations the disease has spread southward 1.2 miles, and northward and eastward 5.3 and 4.7 miles, respectively. The initial quarantine area was 9 mi^2 in size. It has been expanded four times since then, with the most recent expansion to 162 mi^2 occurring in 2008.

The number of infested sites discovered annually had stabilized at approximately 60 new sites per year from 2007 to 2009, but it turned upward in 2010 when we detected 83 new sites. These sites represent approximately 555 acres requiring eradication treatment (Figure 24). Seventy-five of these sites occurred on private land and eight occurred on lands administered by USDI Bureau of Land Management. All of the 2010 infested sites were well within the quarantine area and most contained few infected trees, suggesting reasonably early detection. The geographic distribution of new infested sites was uneven, with most located in the Taylor and Duley creek drainages two miles north of Brookings. The disease is intensifying and spreading in this area and treatments are challenging and expensive because of land ownership, dwellings, and difficult terrain. We also observed continued but less intense expansion of disease in the Bravo Creek area to the northwest (Figure 25).

Several factors contribute to continued spread of the disease despite the eradication effort. Latency of the pathogen, i.e., when it is present but not detectable, allows for disease spread during the time between initial infection and the development of visible symptoms. Uneven funding often delays treatments for months, during which time the disease intensifies and spreads. Many of the sites discovered in 2009 on private land remained untreated from 2009 through the very wet spring of 2010 and this undoubtedly contributed to disease spread and intensification. Federal stimulus funds (ARRA) became available in April 2010 and allowed us to resume work on the backlog of 2009 treatment areas and new sites identified in 2010. All high priority sites (outliers or those closest to the periphery of the quarantine area) were treated promptly in 2010. All of the infested sites on federal land have been treated. Funding for treatment of the remaining 2010 infested sites and anticipated new ones looms as a challenge for 2011.

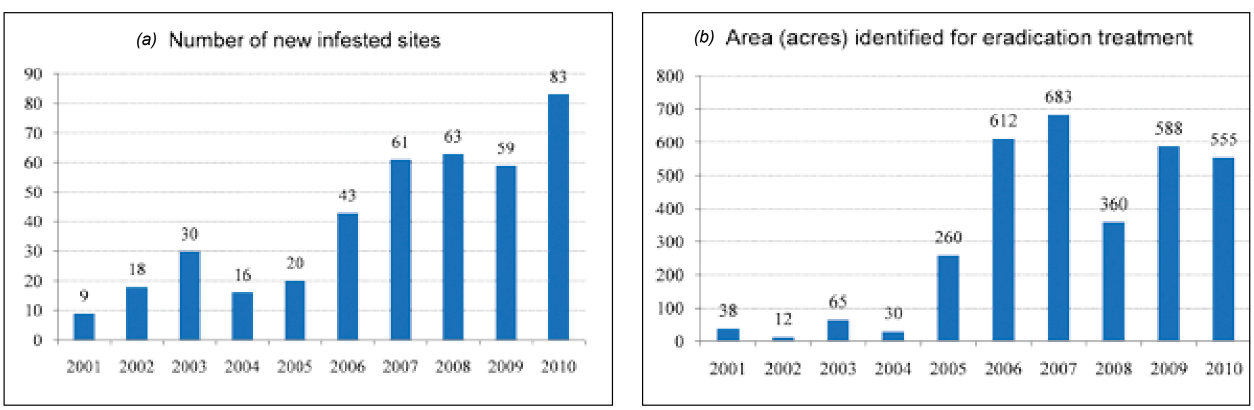

***Figure 24 (a and b):** Sudden Oak Death trends in southern Curry County, Oregon, 2001-2010: (a) number of new infested sites discovered each year; (b) area identified for eradication treatments each year.*

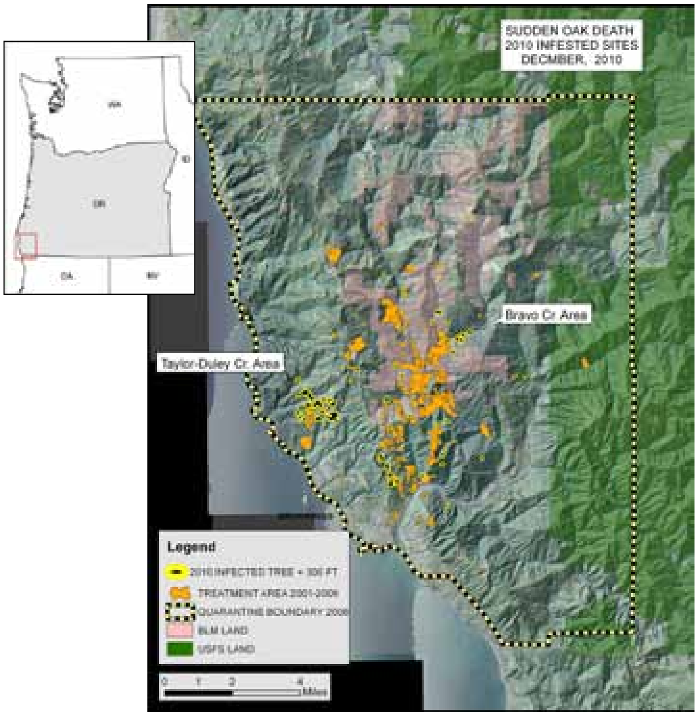

***Figure 25:** Location of areas infested with* Phytophthora ramorum *in SW Oregon, December 2010. Sites enlarged for visibility.*

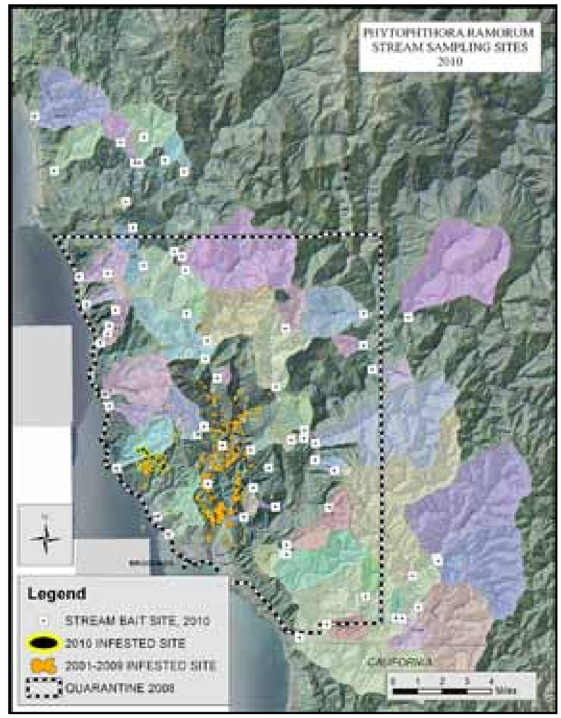

Figure 26: Phytophthora ramorum *stream baiting location in SW Oregon: there were no new detections outside of the core area of the quarantine zone.*

Despite the new occurences of *P. ramorum* in 2010, distribution of the pathogen in Oregon forests remains limited to a very small area near Brookings. Four aerial surveys, numerous ground-based surveys, and extensive stream baiting (63 drainages) have failed to detect the pathogen in forests beyond this general area of infestation (Figure 26). The early detection and eradication effort continues to slow disease spread, but it is unlikely that we will completely stop it or eradicate the pathogen.

A complete *P. ramorum* host list can be found at:
http://www.aphis.usda.gov/hungrypests/suddenOakDeath.shtml

For more information on Sudden Oak Death, go to: http://www.suddenoakdeath.org/

Swiss Needle Cast

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Figure 27: *Fruiting bodies of* Phaeocryptopus gaeumannii, *the fungus that causes Swiss needle cast, on the underside of a Douglas-fir needle. The pathogen disrupts photosynthesis and reduces tree growth.*

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 (Figures 27). 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.

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Figure 28: *Swiss needle cast causes foliage loss and sparse yellow crowns in Douglas-fir in western Oregon.*

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 severe damage and reduced tree growth (Figure 28). 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 impacts, SNC alters wood properties and affects stand structure and development. This complicates stand management decisions, especially in pure Douglas-fir stands.

Aerial surveys to detect and map the distribution of SNC damage have been flown annually since 1996. Although the disease occurs throughout the range of Douglas-fir, it is most severe in the forests on the west slopes of the Coast range, and in this area it presents a unique aerial survey signature that is highly visible for approximately 6 to 8 weeks prior to bud break and shoot elongation, usually late April to early June. 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 2010 Oregon Coast Range survey was flown on May 13 & 14 and June 3, 7, & 8, 2010 and covered approximately 4 million acres of forest. The survey area extended from the Columbia River south to Brookings near the California border and from the coastline eastward until obvious symptoms were no longer visible. The Cascade Range was not surveyed in 2010, but Swiss needle cast does occur there and damages trees in several areas.

The 2010 survey showed an increase in the area of forest with symptoms of Swiss needle cast compared to the previous 3 years, reaching an all-time high. We mapped 393,923 acres of Douglas-fir forest with obvious symptoms of Swiss needle cast. As has been the case for the past several years, the easternmost 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 29). Figure 30 shows the trend in damage from 1996 through 2010.

***Figure 29:** Areas of Douglas-fir forest with symptoms of Swiss needle cast detected in the 2010 aerial survey. Yellow=moderate damage, red=severe damage.*

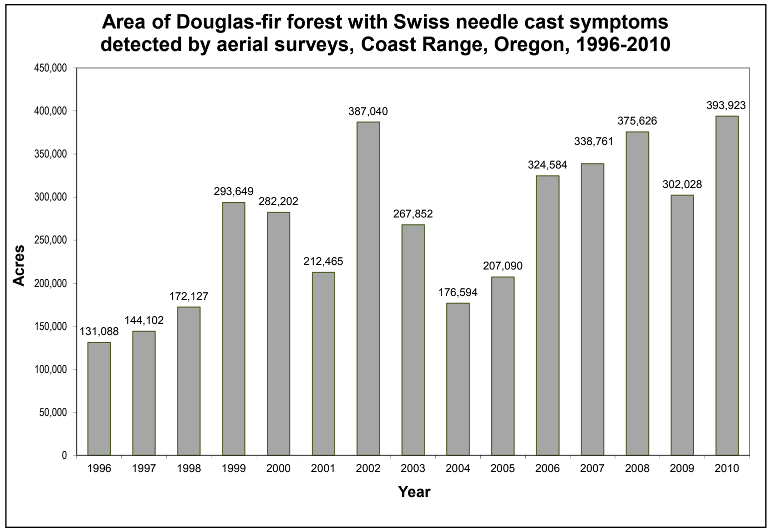

***Figure 30:** Trend in area of Douglas-fir forest in western Oregon with symptoms of Swiss needle cast detected during aerial surveys in April and May, 1996-2010. Results for 2008 were estimated by extrapolating from 3 sample survey blocks.*

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 provides a reasonable depiction of the extent of moderate and severe damage, coarsely documents damage trends over time, and establishes a zone in which forest management should take into account the effects of the disease.

The GIS data and a .pdf file of the map can be accessed via the ODF web page at:
http://www.oregon.gov/ODF/privateforests/fhMaps.shtml

For more information on Swiss needle cast, visit the website of the Oregon State University Swiss Needle Cast Cooperative (SNCC) at: http://sncc.forestry.oregonstate.edu/

Foliage Diseases

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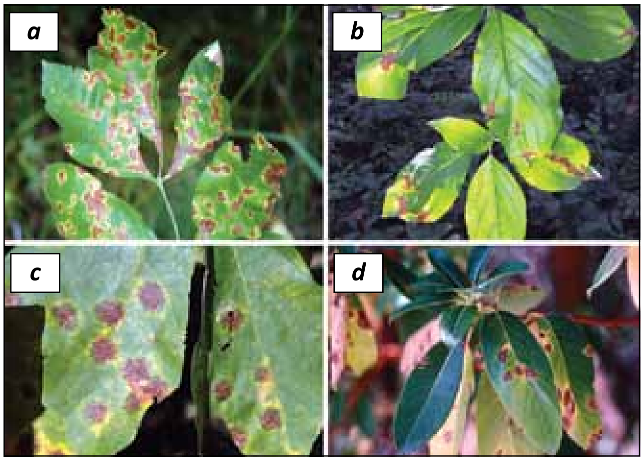

Figure 31: *Hardwood foliage disease flourished in 2010 due to wet spring and summer weather: (a) ash leaf spot (*Mycosphaerella fraxinicola*; (b) dogwood anthracnose (*Discula destructiva*); (c) dotted tar spot of maple (*Rhytisma punctatum*); (d) madrone leaf spot.*

Persistent wet weather in spring and early summer allowed foliage diseases to flourish throughout the state, especially on broadleaf trees. Anthracnose was unusually severe on ash, sycamore, and dogwood. Many minor diseases became highly visible (Figure 31). In most cases the outbreak of disease caused no lasting damage.

Other Damage

Ozone Monitoring

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Figure 32: *Red elderberry is one of several bio-indicator plants for ozone injury.*

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. The Oregon Department of Forestry and the US Forest Service cooperate in a national ozone biosite monitoring program. Each year in late July and August, indicator plants (Figure 32) are monitored for ozone injury in 35 sampling hexagons distributed throughout the state (Figures 33, 34). To date, ozone injury to plants has not been detected in any of the Oregon plots.

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Figure 33: *Ozone injury is likely to occur in high-elevation forests near major cities.*

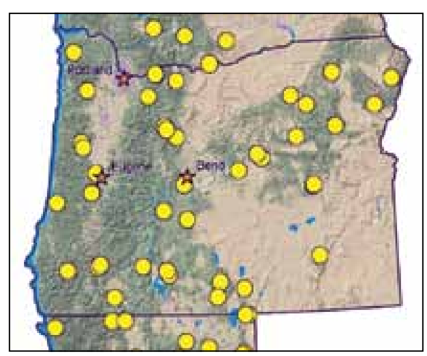

Figure 34: *Approximate location of ozone biosite monitoring plots, Oregon.*

Bear

Figure 35: *Damage to ponderosa pine due to spring bark peeling by black bear in the Willamette Valley.*

Black bear damage a large number of conifers in Oregon each spring by peeling the bark to feed on inner tissues (Figure 35). Tree mortality of young trees in plantations is most commonly observed, but partial peeling of older trees also occurs and may reduce growth and provide entry points for decay organisms. In 2010, bear damage was estimated at over 13,000 acres statewide. This was significantly below the long-term average and represented the lowest level of detection over the last decade (Figure 36). Previous ground surveys indicate that in addition to bear damage, tree mortality at these sites is also commonly due to root diseases and moisture stress. However, as annual ground surveys are not completed, "bear" damage, as described here, actually represents the complex of agents that occur at those sites. It is unknown what has contributed to the recent trend, but spring weather conditions were much colder and wetter than normal in 2010, and anecdotal observations have suggested that the onset of damage symptoms (or change in foliage color) may have occurred later than usual, resulting in less detection.

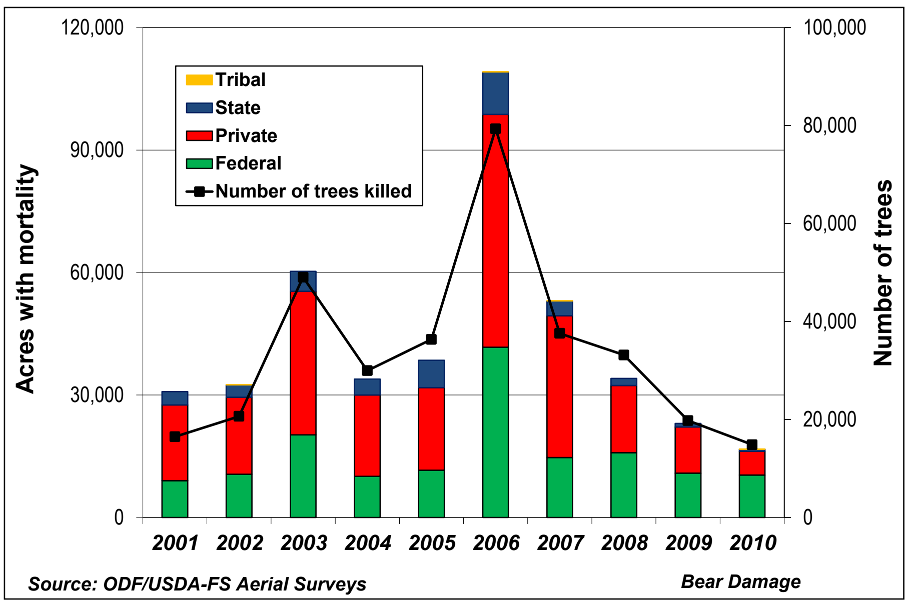

Figure 36: *Ten-year trend of total acres with mortality and estimated number of trees killed by bear and associated agents (root diseases, drought) in Oregon.*

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:

State of Oregon

Forest Health Protection
Oregon Department of Forestry, Bldg D
2600 State Street, Salem, OR 97310
http://oregon.gov/ODF/privateforests/fh.shtml

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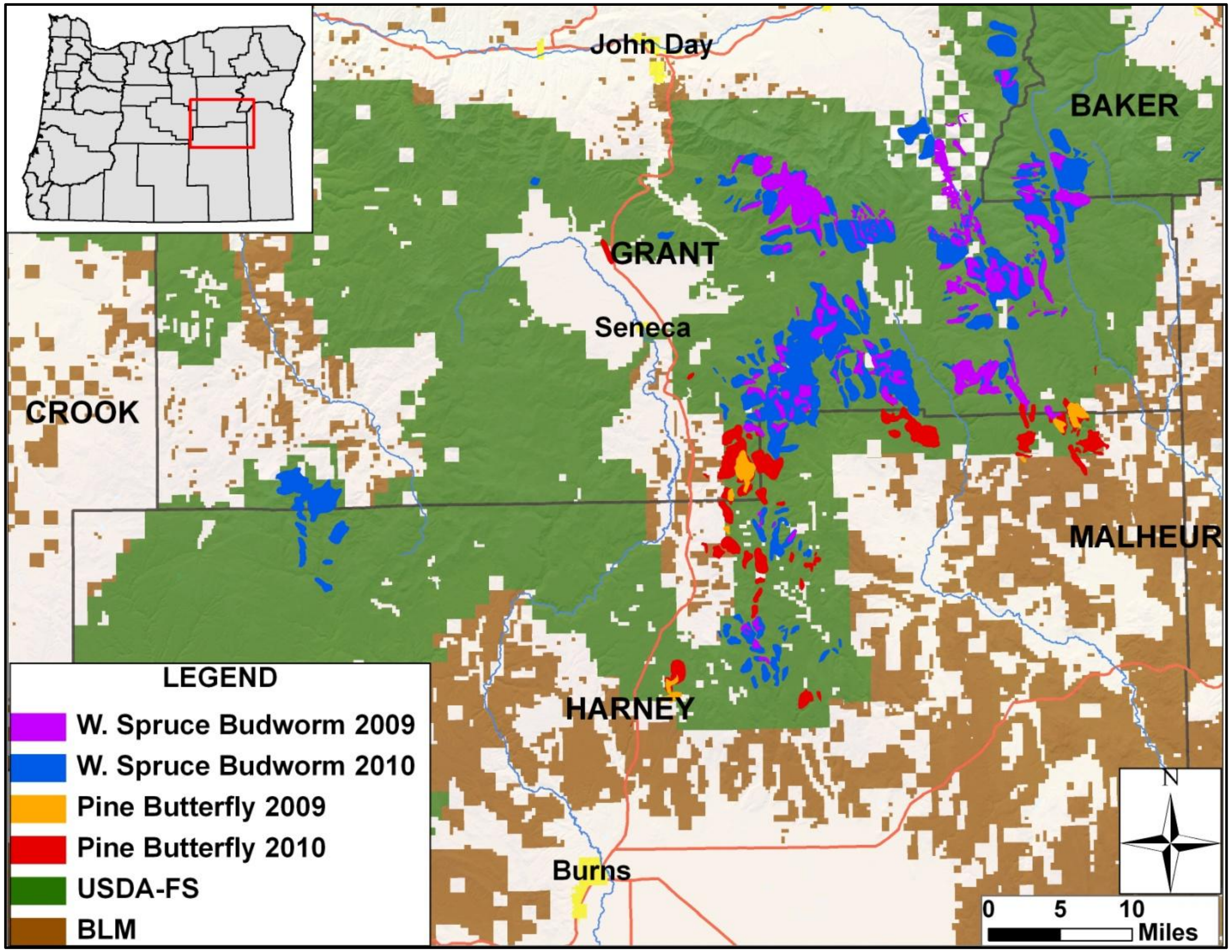

Figure 12: *Outbreaks and defoliation by the western spruce budworm and pine butterfly expanded in Oregon from 2009 to 2010.*

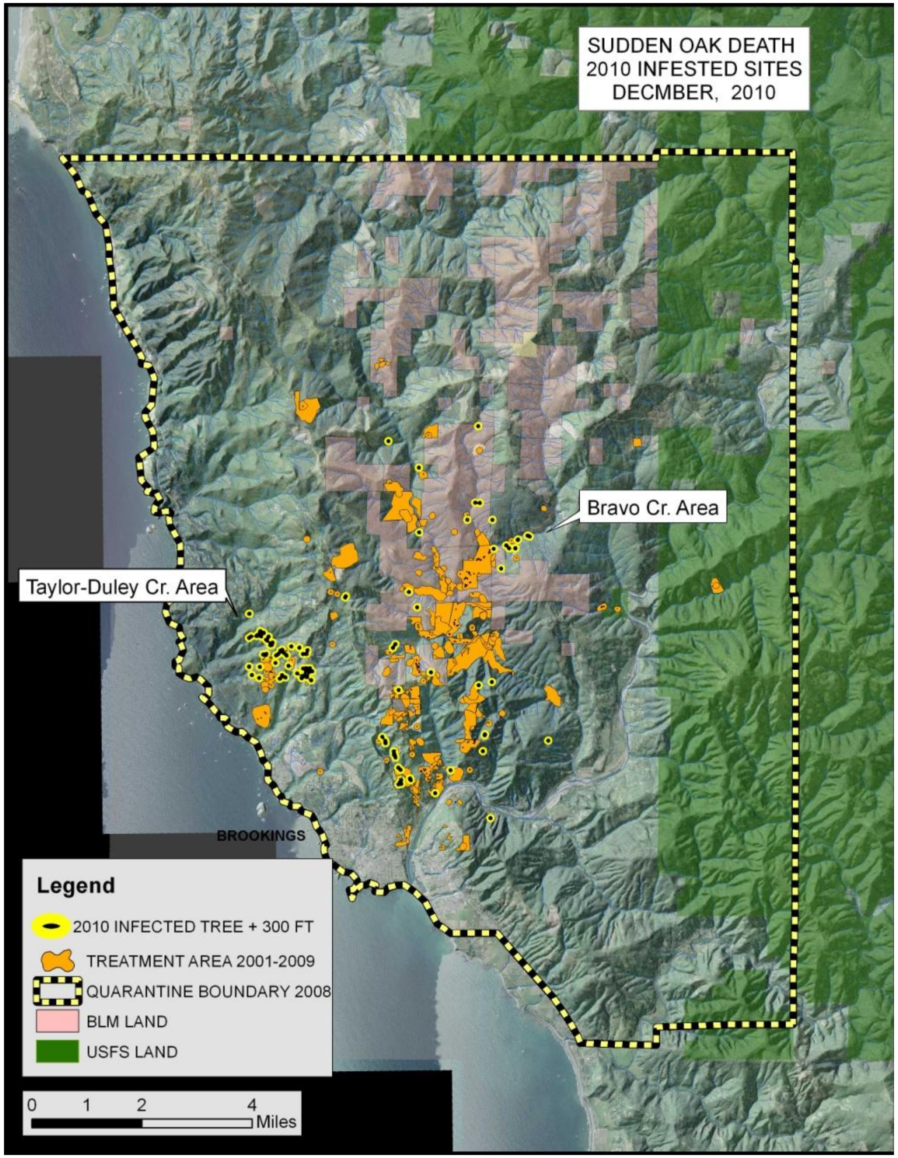

Figure 25: *Location of areas infested with* Phytophthora ramorum *in SW Oregon, December 2010. Sites enlarged for visibility.*

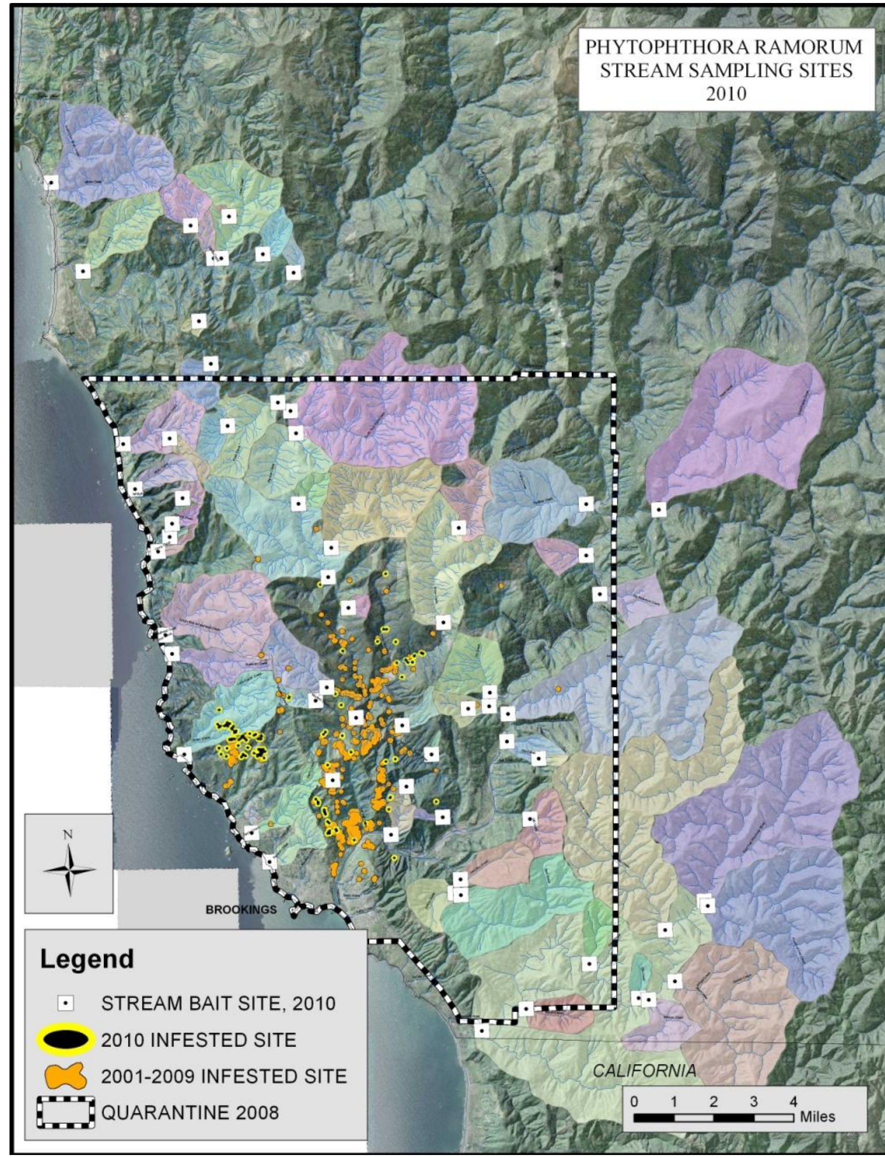

Figure 26: Phytophthora ramorum *stream baiting locations in SW Oregon; there were no new detections outside of the core area of the quarantine zone.*