United States
Department of Agriculture

Forest Service
Pacific Northwest Region

Oregon
Department of Forestry

Forest Health Highlights
In Oregon – 2006

April 2007

Forest Health Highlights In Oregon – 2006

Contributors:

Alison Nelson[1] Alan Kanaskie[2] Keith Sprengel[1]
Rob Flowers[2] Mike McWilliams[2]

[1] U.S. Department of Agriculture, Forest Service
[2] Oregon Department of Forestry

Joint publication of:
Oregon Department of Forestry
USDA Forest Service, Pacific Northwest Region

R6-NR-FID-TP-02-2007
Portland, Oregon
April 2007

Front cover: ***Aerial survey of forest lands in Oregon celebrates its 60th year in 2006. Photo by Oregon Department of Forestry.***

Introduction

Insects and disease pathogens cause significant tree mortality, growth loss, and damage to large volumes of potential wood products each year. This can reduce management options for landowners, and contribute to hazardous forest fire conditions. However, these disturbance agents are a natural and necessary part of forest ecosystems. They contribute to decomposition and nutrient cycling, create openings which enhance vegetative diversity and create additional wildlife habitat. A healthy forest is never free of insects, disease, disturbances, and tree defects.

The Oregon Department of Forestry works cooperatively with the U.S. Forest Service in aerial surveys, insect and disease detection, mapping, monitoring, and eradication. This report provides information about major insect and disease activity in Oregon in 2006. For additional information, or for specific questions, please contact the specialists listed on the back page of this report.

Aerial Survey

Several aerial surveys are conducted each year in Oregon, including a statewide aerial detection survey, and separate surveys for Swiss needle cast and sudden oak death (SOD). All fixed-wing surveys use an advanced digital sketch mapping system. This system increases the spatial accuracy of the survey, and allows the rapid summarization and reporting of damage data.

The statewide aerial survey is flown each year to detect tree damage and mortality, primarily from insects, on all forest land. Approximately 28 million acres of forest are surveyed each year during the statewide mortality survey; 40% of the forest belongs to state and private landowners, and 60% is under federal ownership. In 1996 the Oregon Department of Forestry initiated a separate late spring survey of 2 million acres in western Oregon for Swiss needle cast (SNC), a foliage disease of Douglas-fir. Maps for both the statewide and SNC surveys are sent to interested landowners, and are also available to the public. Maps and data for the statewide survey are posted at a U.S. Forest Service website (http://www.fs.fed.us/r6/nr/fid/data.shtml), and SNC maps and data are available at the Oregon Department of Forestry website (http://www.oregon.gov/ODF/PRIVATE_FORESTS/fh.shtml).

Figure 1 – Aerial sketchmappers map and code mortality and damage agents using a touchscreen computer. Photo by Oregon Department of Forestry.

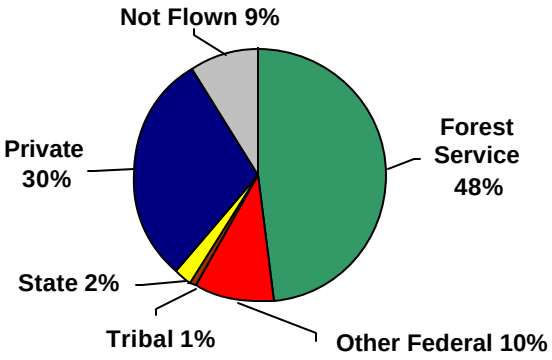


Figure 2 – Forested acres in Oregon surveyed by air in 2006, by land ownership category.

Aerial surveys to detect sudden oak death (SOD) have been conducted several times per year in Curry County since 2001. All surveys include a helicopter flight to record precise GPS coordinates of each dead or dying tanoak tree. All trees identified in the survey are visited by ground crews, checked for cause of mortality, and sampled for *Phytophthora ramorum* (cause of SOD). In 2006, SOD aerial surveys were conduted in February, June, and Ocotber.

Weather and Forest Insect Outbreaks

Rainfall levels were normal to above-normal in most forest areas of Oregon in 2006. Higher precipitation levels serve to reduce tree moisture stress and typically result in greater resistance to bark beetle attacks. Improved tree vigor in many areas was likely responsible for the continued statewide decline in total area affected by bark beetles which decreased by 25,832 acres to 489,957 acres in 2006 (Figure 3). The overall decline was driven in large part by decreased fir engraver mortality; however, not all bark beetles decline with increased moisture levels. Mountain pine beetle infestations, which increase in accordance with stand conditions, have continued to expand in many areas in Oregon. Severe winter storms produced high levels of windthrow this year, and may lead to increased stand susceptibility to bark beetles in these areas in the near future. Damage by defoliating insects also increased in 2006, due largely to the activity of western spruce budworm in eastern Oregon. Expansion of a native forest pest, the black pineleaf scale, was also notable this year, along with increased detection of gypsy moth, an invasive species.

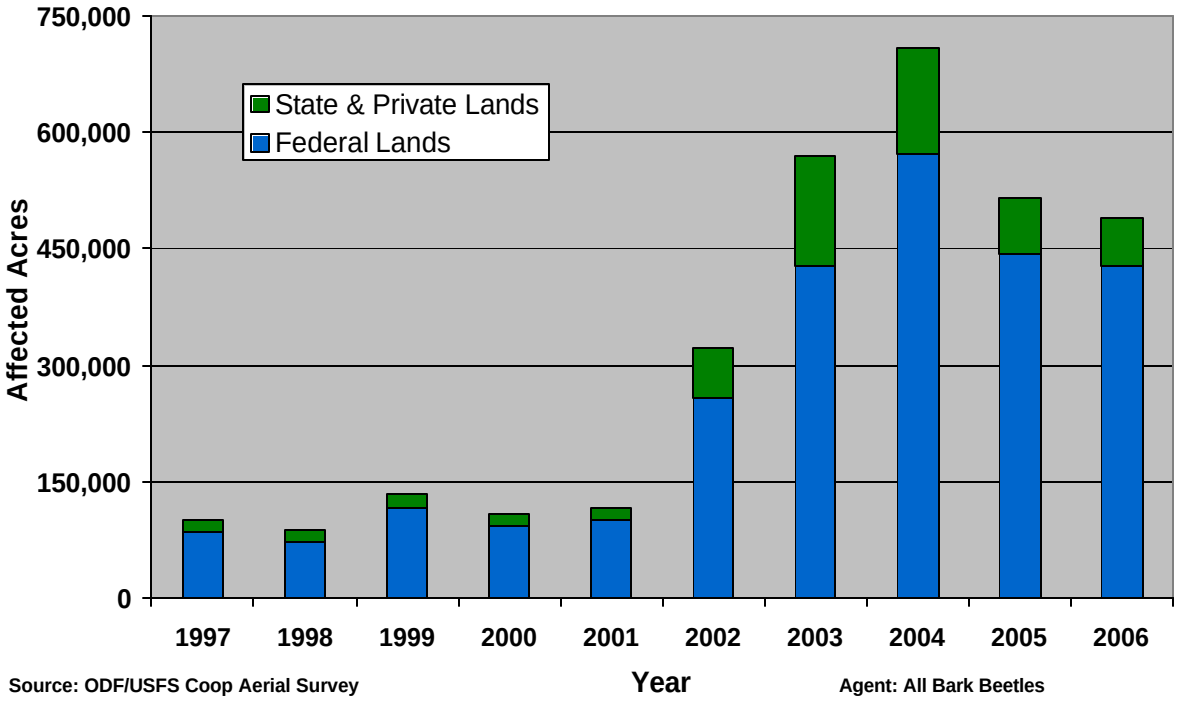
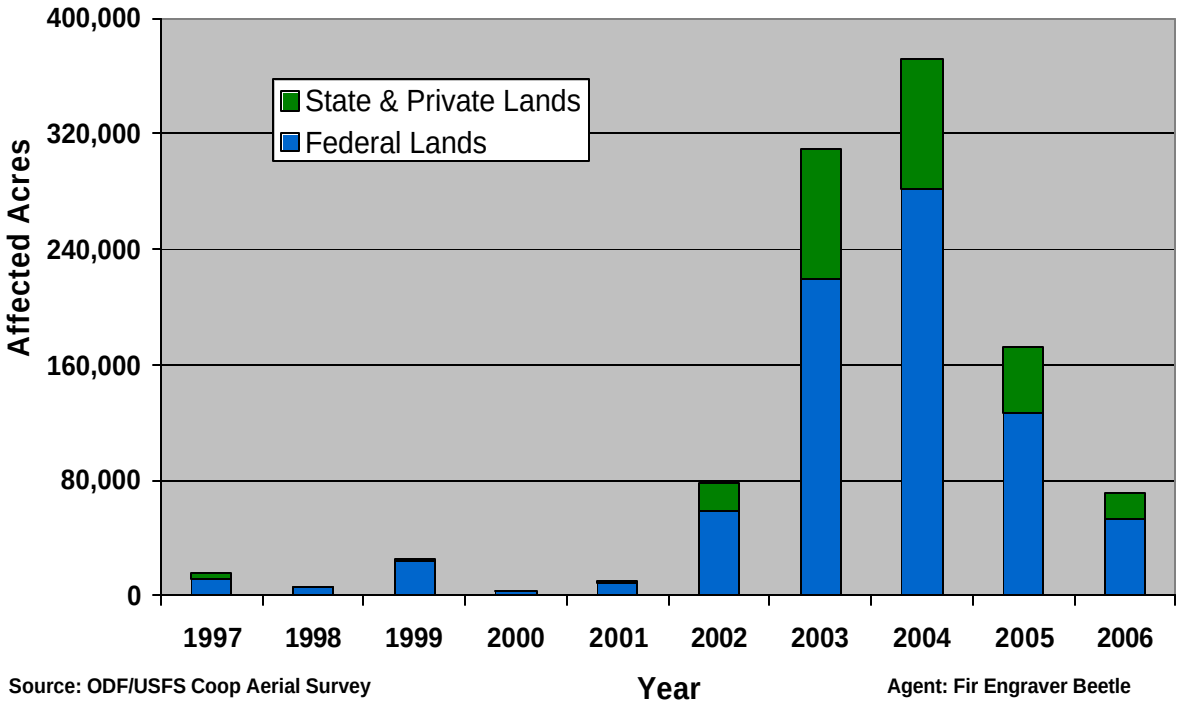


Figure 3 – Ten year trend for total acres affected by bark beetles in Oregon.

Insects

Fir Engraver Beetle *(Scolytus ventralis)*

Outbreaks of fir engraver have historically caused high levels of mortality in areas of southern and eastern Oregon. In 2006, true fir damage due to fir engraver was detected on 71,148 acres statewide. The affected area decreased by 101,394 acres from 2005 (Figure 4). The most recent outbreak, which began in 2002, was triggered by several years of below-normal precipitation and resulted in high levels of mortality in Oregon, particularly on federal lands. Unique aspects of the outbreak included true fir mortality on the edges of the Willamette Valley and along coastal areas of Curry County. With normal to above-normal precipitation levels, fir engraver damage should continue to decline.



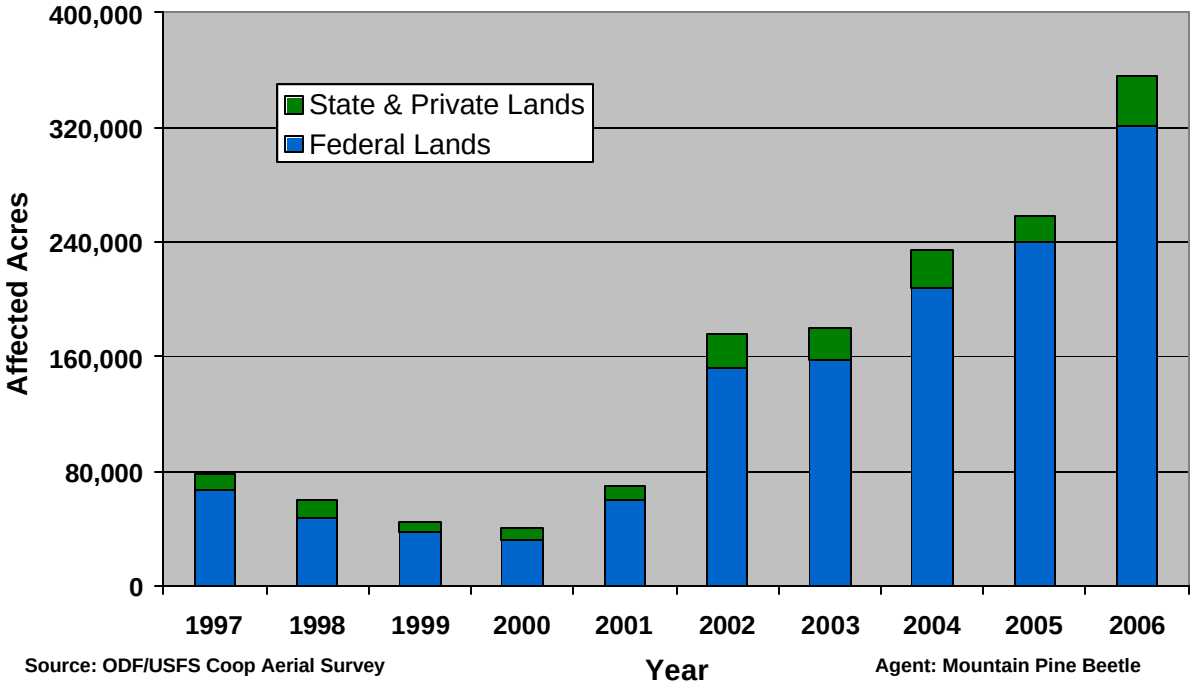
Source: ODF/USFS Coop Aerial Survey

Agent: Fir Engraver Beetle

Figure 4 – Ten year trend for total acres affected by fir engraver beetle in Oregon.

Mountain Pine Beetle *(Dendroctonus ponderosae)*

Mountain pine beetle outbreaks in lodgepole pine are generally driven by the presence of large trees in overstocked stands. Outbreaks often persist until the majority of the stems with a diameter greater than 6" are killed, and these events can create landscape level mortality that may fuel major wildfires. The overall acreage affected by mountain pine beetle in Oregon increased by 97,329 acres to 355,287 acres in 2006 (Figure 5). The current outbreaks in Oregon, which began in 2001, are concentrated on federal lands along the east slope of the Cascades from southern Deschutes County to Mt. Hood and along the Winter Rim area southwest of Summer Lake in Lake County (Figure 6). While lodgepole pine is the predominant species affected, large numbers of ponderosa, sugar, whitebark, and western white pines are also being killed by mountain pine beetle. Outbreaks can last up to a decade or more when susceptible stand conditions persist.



Source: ODF/USFS Coop Aerial Survey

Agent: Mountain Pine Beetle

Figure 5 – Ten year trend for total acres affected by mountain pine beetle in Oregon.

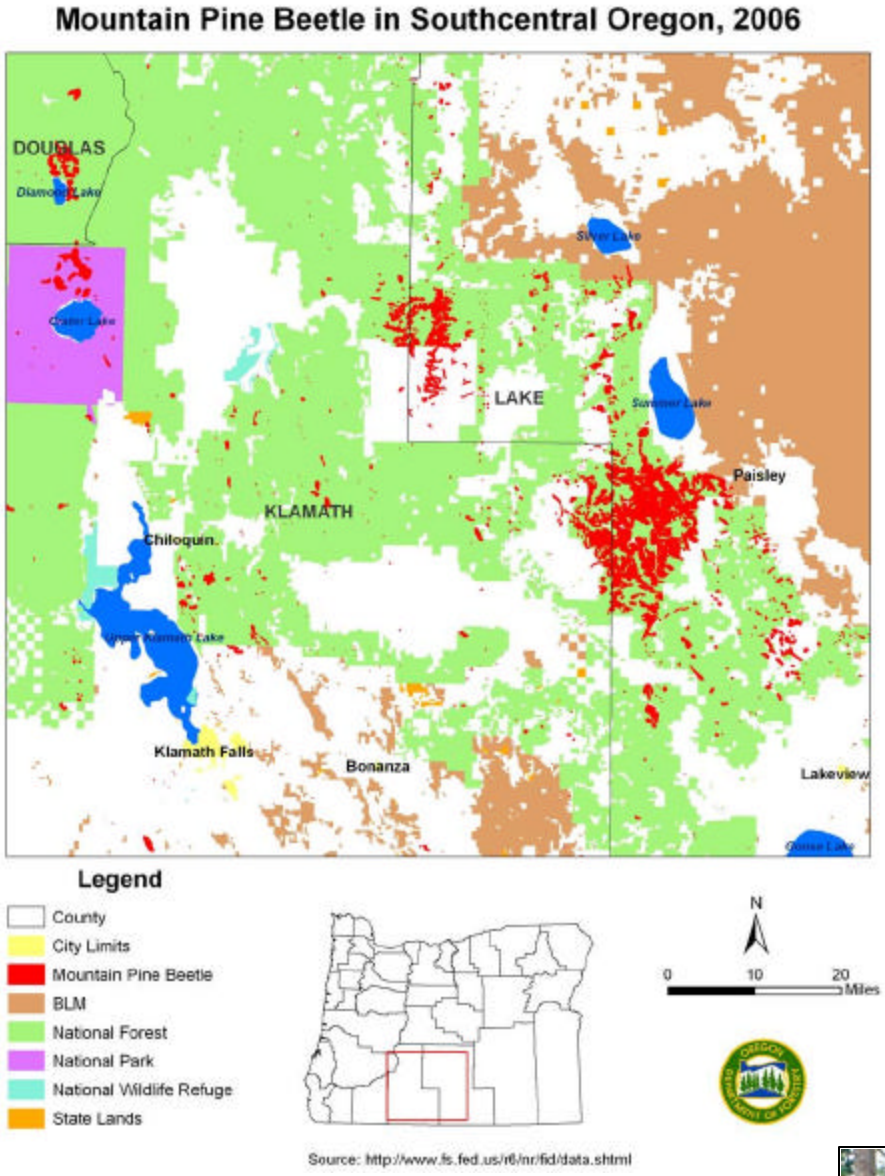


Figure 6 – Map showing area of mountain pine beetle caused mortality along the Winter Rim area of Klamath and Lake Counties in southcentral Oregon.

Douglas-fir Beetle (*Dendroctonus pseudotsugae*)

There were only 12,892 acres of damage attributed to Douglas-fir beetle in 2006; however, a tremendous amount of windthrow occurred this year due to a series of winter storms (Figure 7). Douglas-fir beetle outbreaks can occur when large diameter trees (greater than 14 inches) are damaged or killed by major disturbance events. These occurrences provide an abundance of breeding materials that allow populations to build to levels sufficient to attack standing trees the following 2-3 years. Contributing factors to beetle outbreaks include drought, fire, winter breakage and defoliation events, which have the potential to further damage areas affected by windthrow this year.

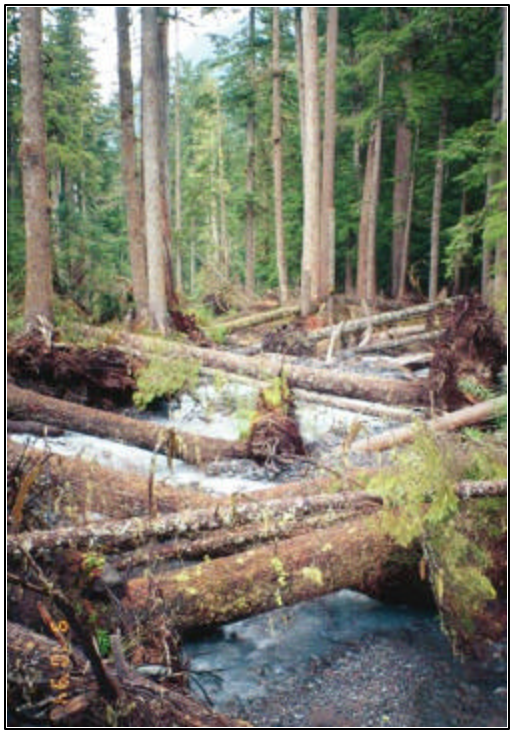


Figure 7 – Severe windthrow from winter storms can lead to damage from Douglas fir beetle. Photo by the USDA Forest Service.

Western Spruce Budworm (*Choristoneura occidentalis*)

It has been 25 years since the last western spruce budworm outbreak in Oregon, but damage has been detected at low levels in eastern Oregon since 2001. In 2006, western spruce budworm defoliation was detected on 37,978 acres, a substantial increase from the 254 acres with damage in 2005. Much of the affected area occurs on the Ochoco and Malheur National Forests in Baker, Grant, and Harney Counties (Figure 8). Defoliation intensity was considered low to moderate in most areas. Fire suppression and management activities over the last century have led to an increase in susceptibility to budworm damage in many areas, as the percentage of shade-tolerant, late-successional species like true fir have increased. Although vigorous trees can often survive several years of defoliation, many become susceptible to damage from root disease and bark beetles. Management activities to reduce future impacts should be focused on altering stand characteristics to decrease susceptibility to budworm.

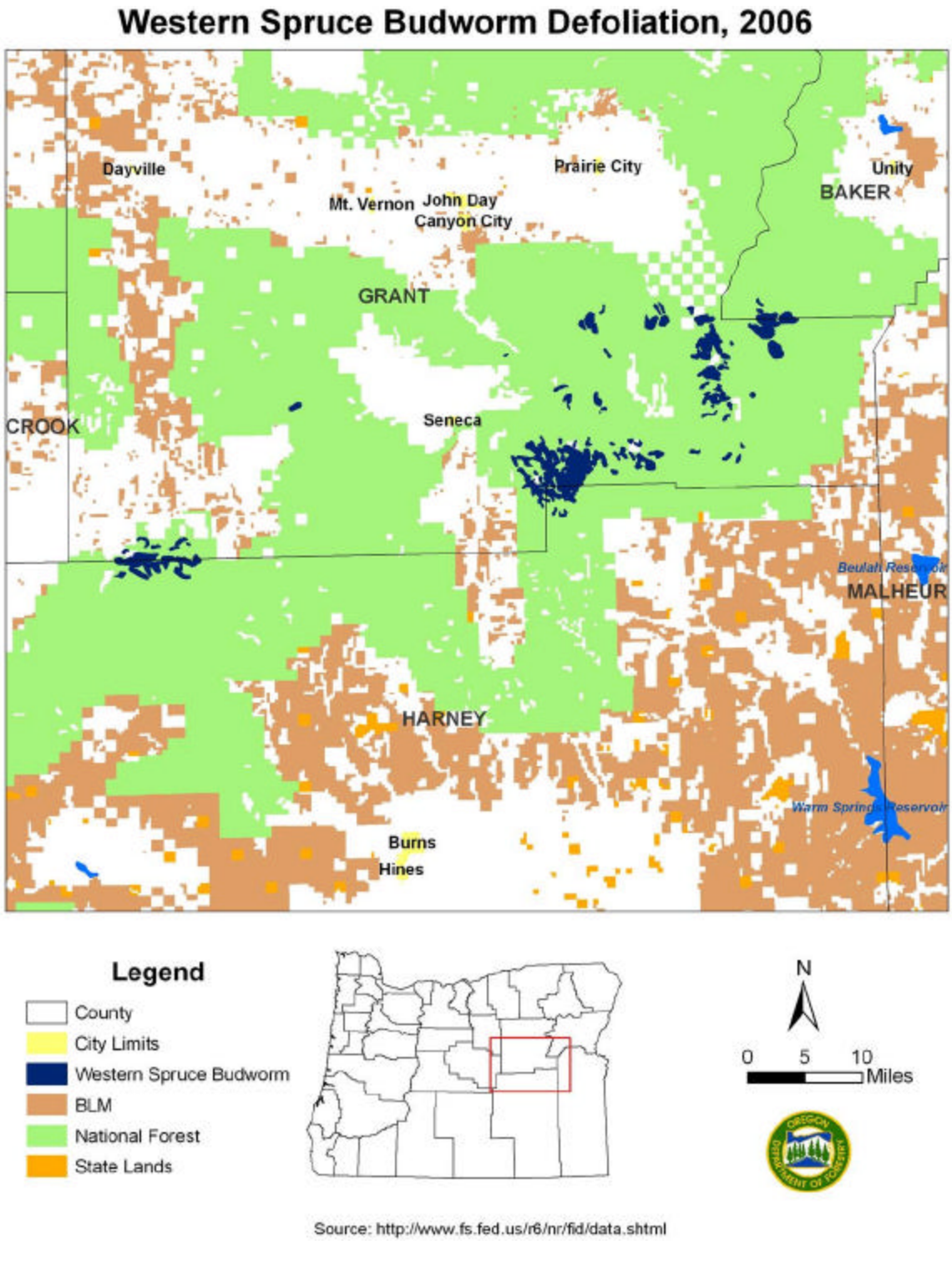


Figure 8 – Map showing areas with western spruce budworm defoliation in eastern Oregon.

Diseases

Sudden Oak Death *(Phytophthora ramorum)*

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.

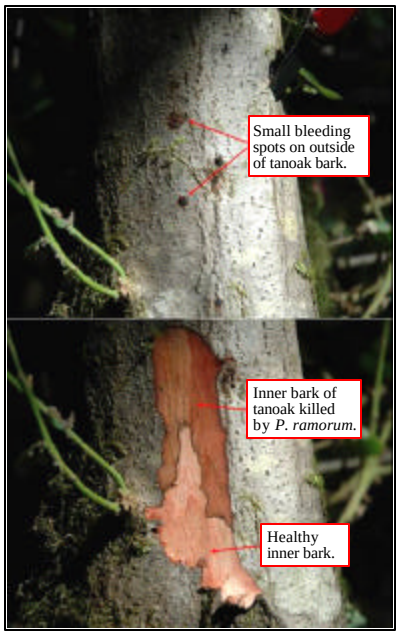


Figure 9 – Stem lesion, inner bark of tanoak (Lithocarpus densiflorus) caused by P. ramorum. Oregon Department of Forestry photo.

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 9). *P. ramorum* causes leaf blight or shoot dieback on a number of other hosts including rhododendron, evergreen huckleberry, Douglas-fir and Oregon myrtle (Figure 10, 11).

Figure 10 – Flower and shoot dieback of Pacific rhododendron (Rhododendron macrophyllum caused by P. ramorum. Oregon Department of Forestry photo.

Figure 11 – Shoot dieback Douglas-fir (Pseudotsuga menziesii) caused by P. ramorum. Oregon Department of Forestry photo.

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. *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 infected plant parts.

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 12, 13). Each eradication site is monitored twice yearly for presence of *P. ramorum* by sampling vegetation and soils.

Figure 12 – Eradication of the Sudden Oak Death pathogen, Phytophthora ramorum in southwest Oregon.

During the first few years of the eradication effort, the pathogen survived the initial treatment on most sites and was present in stump sprouts of host vegetation for one or more years after treatment. In 2003 we began chemical sprout treatment (non-federal lands only) and herbicide injection of tanoaks prior to cutting. Since then, recovery of *P. ramorum* within treated sites has decreased dramatically. *P. ramorum* has been recovered from soils at several eradication sites, but with very low abundance.

Figure 13 – Replanting a Sudden Oak Death eradication site in southwest Oregon.

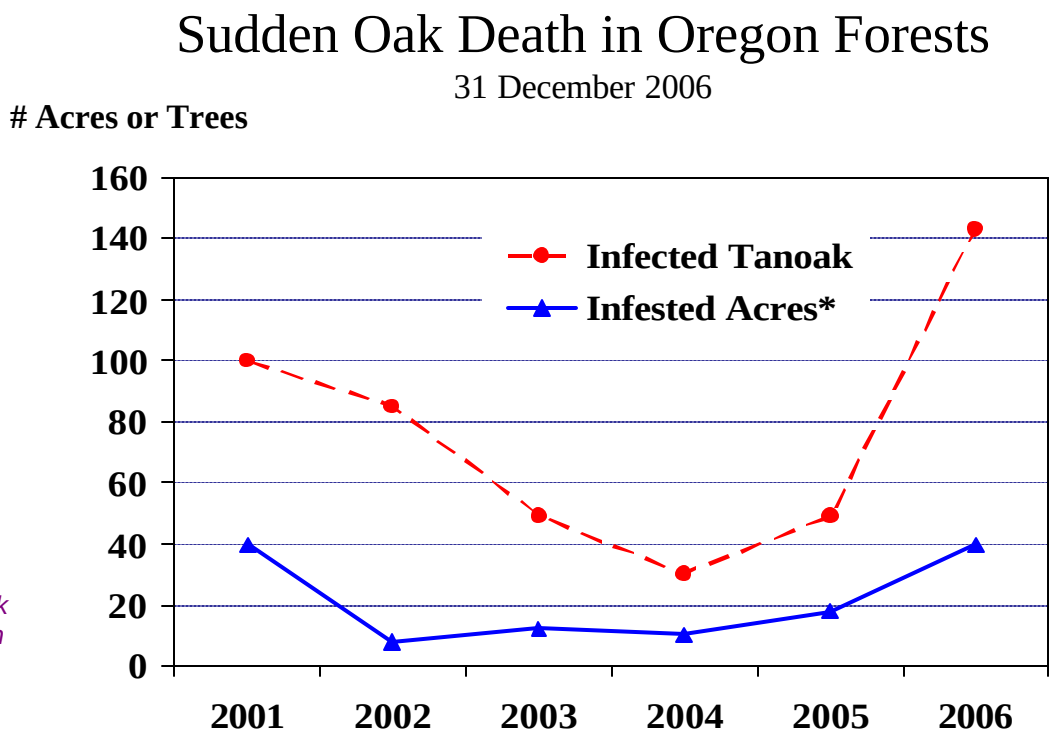


Figure 14 – Sudden Oak Death trends in southern Curry county, OR.

*The estimated of number of infested acres includes new infested sites and expansions of eradication sites existing prior to 2006.

During the first four years of the eradication effort, the number of new infested sites and infected trees decreased each year. That trend ended in 2005 when the number of infected trees and the number of new infested acres increased compared to the previous year (Figure 14). In 2006 we discovered 36 new infested sites (143 infected tanoak trees). Two of the new sites occurred outside of the quarantine zone: one was 1 mile to the east, and the other 1.5 miles to the west of the boundary. Each of these sites was more than 2 miles from the nearest other infested site. Most of the other new sites were small (less than 1 acre) and scattered near the center of the quarantine zone along the North Fork Chetco River and its tributaries (Figure 15). The largest new site covered 10 acres and contained more than 40 infected trees. In addition to the new sites, six existing eradication sites were expanded to include infected trees that were found near their perimeters. We attribute this uncommon and unexpected amount of disease expansion to two consecutive years of unusually wet spring and early summer weather which appears to favor long distance spread of *P. ramorum*.

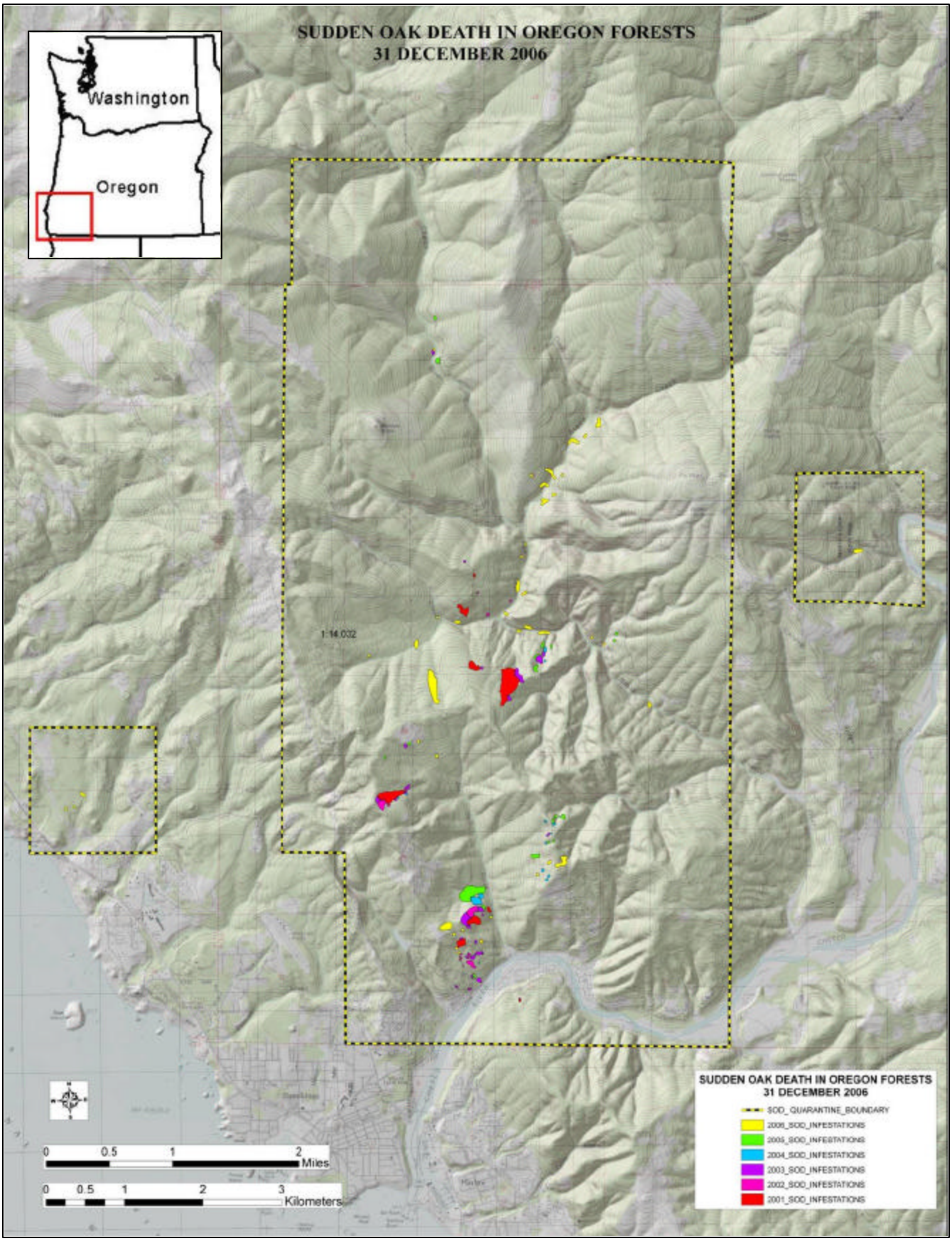


Figure 15 – Location of areas infested with Phytophthora ramorum in southwest Oregon, December 2006. All infested sites have received eradication treatments.

Despite several new occurrences of *P. ramorum* in 2006, 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 spread of the pathogen. In 2006, three aerial surveys and numerous ground-based surveys failed to detect the pathogen in forests beyond this area. Stream sampling for *P. ramorum* spores throughout western Oregon also failed to detect the pathogen outside of this area. The forested area in Oregon under quarantine by the Oregon Department of Agriculture and USDA-APHIS was 11 mi^2 in 2005, increased to approximately 22 mi^2 in early 2006, and will increase soon to 26 mi^2 to include recent discoveries. Efforts to eradicate the pathogen from Oregon forests likely will continue for several years. 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, go to: http://nature.berkeley.edu/comtf/

Swiss Needle Cast
(Phaeocryptopus gaeumannii)

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 the tree, ultimately reducing tree growth and survival (Figures 16, 17). Tree mortality is rare, occurring only after many years of defoliation.

Figure 16 – Sparse yellow crowns of Douglas-fir damaged by Swiss needle cast, western Oregon. Oregon Department of Forestry photo.

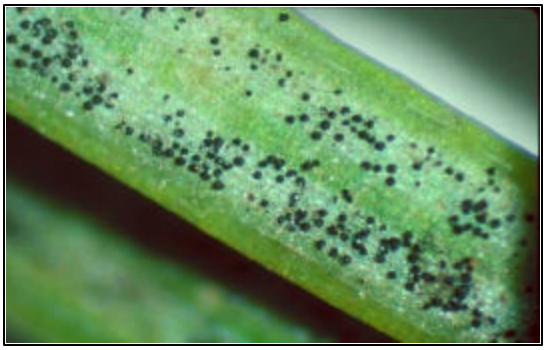


Figure 17 – Small black fruiting bodies of the Swiss needle cast pathogen (Phaeocryptopus gaeumannii) on the underside of Douglas-fir foliage. Oregon Department of Forestry photo.

Growth loss as a result of Swiss needle cast correlates with foliage retention – the less foliage retained on the tree, the greater the growth loss (Figure 18). 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.

Figure 18 – Reduction in the last 5 years of radial growth increment of Douglas-fir caused by Swiss needle cast, Tillamook, OR. Oregon Department of Forestry photo.

Since the late 1980's, the disease has become particularly damaging to Douglas-fir forests on the west slopes of the Oregon Coast Range. Starting in 1996, aerial surveys for SNC damage have been conducted each year 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 easternmost area with obvious SNC symptoms has stabilized about 25-30 miles inland from the coast, with most of this occurring within 18 miles of the coast (Figure 19).

The 2006 survey covered approximately 2.9 million acres of forest and showed a marked increase in the area with symptoms of Swiss needle cast compared to the previous 3 years. Observers mapped 324,500 acres of Douglas-fir forest with obvious symptoms of Swiss needle cast; 227,000 acres north of the Lincoln-Lane county line, and 98,000 acres south of the Lincoln-Lane county line. Survey conditions were excellent and the observers considered the 2006 survey to be the most reliable to date. Symptoms developed rapidly following a period of low temperatures in late February and warm sunny weather in April and early May. In contrast, the 2004 and 2005 surveys were confounded by late symptom development, early bud-break, and cloudy conditions during the narrow survey window (Figure 20).

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. We know (from permanent plot data and ground checks) that Swiss needle cast occurs throughout western Oregon, but that discoloration often is not severe enough to enable aerial detection. The aerial survey does, however, reasonably depict of the extent of moderate to 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.

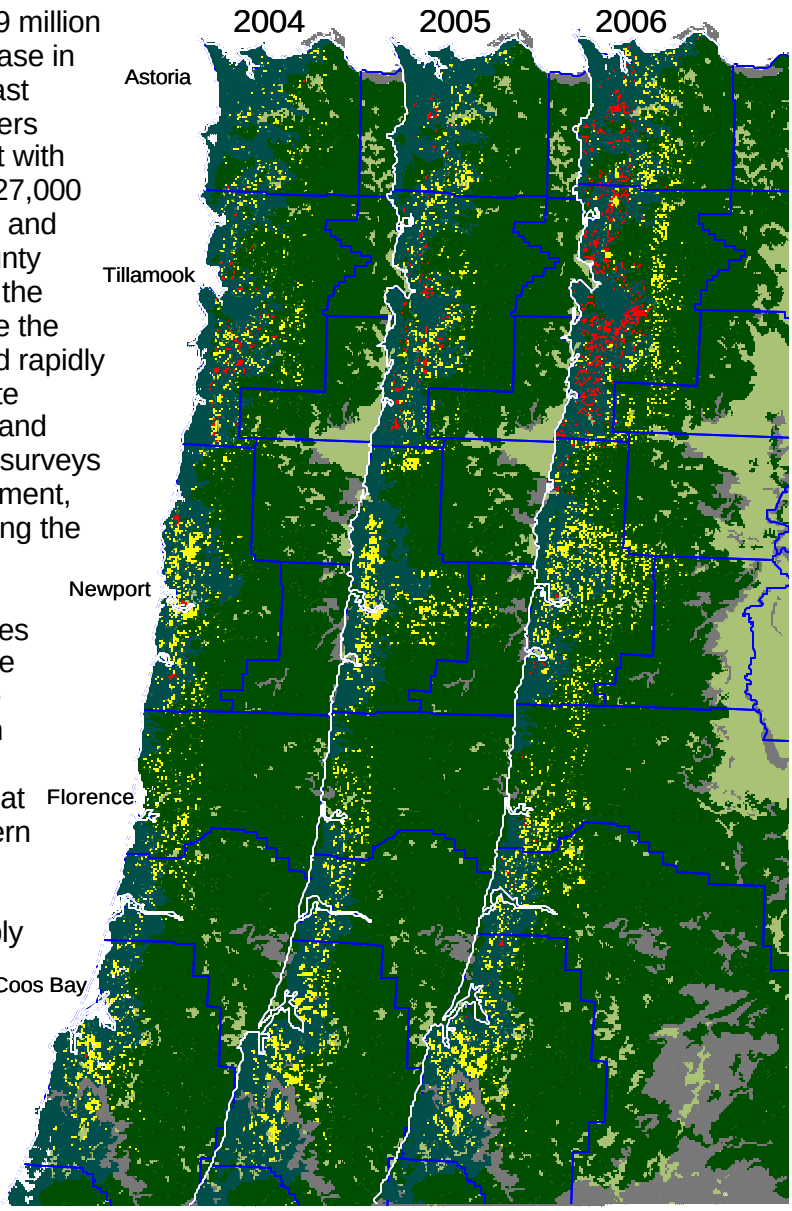


Figure 19 - Areas of Douglas-fir forest with symptoms of Swiss Needle Cast detected in the 2004-2006 aerial surveys. Yellow = moderate damage, red = severe damage.

Acres of Douglas-fir forest with Swiss Needle Cast symptoms detected by aerial surveys; Coast range, Oregon 1996-2006

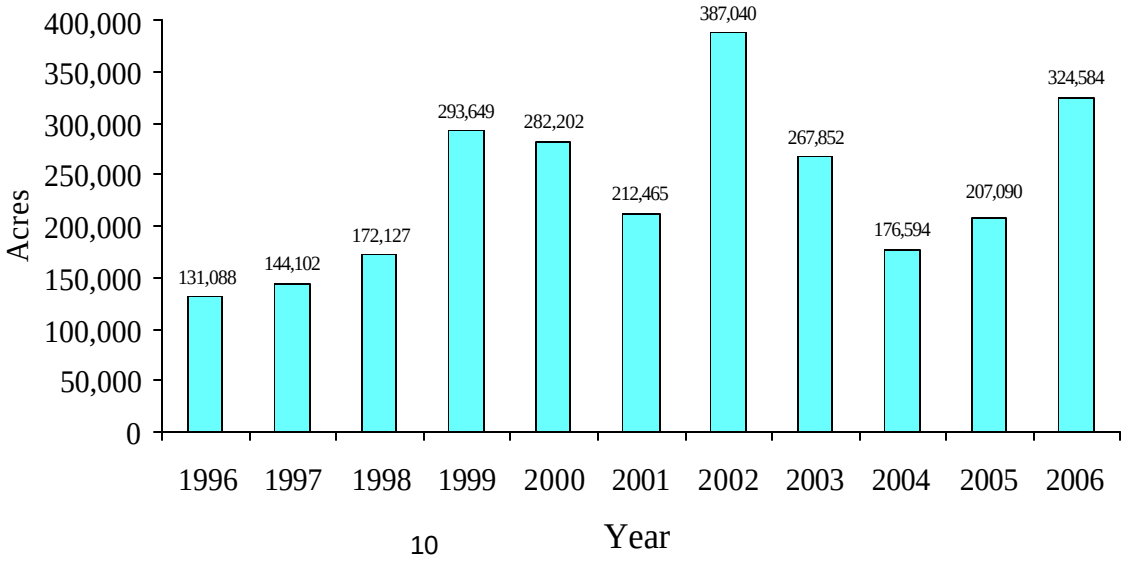


Figure 20 - Trend in the number of acres of Swiss needle cast mapped in aerial surveys between 1996 and 2006 in the Coast Range of Oregon.

Spruce Foliage/Shoot Blight

An unusual amount of new shoot dieback and foliage loss on Sitka spruce was reported along coastal roadways in late spring and early summer of 2005. Initial symptoms included bleaching of the 2005 needles, which eventually turned brown and fell from the shoot. In many cases the entire shoot turned brown and remained on the tree through summer. Loss of older foliage often was associated with the shoot dieback. Damage was most severe in the lower crown, and appeared to progress gradually upward. Damage generally was restricted to exposed sides of trees, especially along roadsides and other openings (Figure 21). Although some of the damage resembled that of spruce aphid, new shoot dieback of this sort has not previously been attributed to aphids. Attempts to associate fungal pathogens with the shoot dieback and foliage loss were unsuccessful at several laboratories. The most likely explanation is an interaction between extremely high daytime temperatures (90 degrees Fahrenheit in late May 2005) and toxins injected into the spruce by aphids.

Figure 21 - Shoot dieback and foliage loss in lower crown of roadside Sitka spruce, Highway 101 near Florence, Oregon, July 2005. Oregon Department of Forestry photo.

Affected trees were re-examined in 2006 and we observed no recurrence of the phenomenon. Many affected branches and twigs had died, but remaining parts of the tree appeared healthy. The lack of symptom progression and no continuing decline of trees support the hypothesis that environmental factors were the primary factor. Damage from spruce aphid also was relatively low in 2006.

Port-Orford-Cedar Root Disease (*Phytophthora lateralis*)

Port-Orford-Cedar Root Disease, caused by the non-native pathogen *Phytophthora lateralis*, was first identified in the Port-Orford cedar (POC) forests of southwestern Oregon in 1952 (Figure 22). Since then the disease has expanded throughout the range of Port-Orford cedar. Recent advances by the US Forest Service and Oregon State University in screening trees for genetic resistance offers renewed hope for the species.

Figure 22 - Port-Orford cedar killed by Phytophthora lateralis, western Oregon. Oregon Department of Forestry photo.

The federal POC Program objective is to maintain cedar as an ecologically and economically significant species. Integrated POC management focuses on maintaining disease-free watersheds, preventing spread through sanitation, seasonal road closures, bough-cutting restrictions, and restoring cedar in plant communities using resistant and non-resistant seedlings. Port-Orford-cedar management slows the spread of the pathogen enough to maintain POC's significant ecological and economic functions at a reasonable cost.

Other Root Diseases

Several root diseases continue to affect Oregon forests, in many cases causing substantial damage. The degree of damage often reflects past management practices and fire exclusion, which have resulted in overstocked stands with a large component of disease-prone shade-intolerant species. Laminated root rot is the most destructive of these root diseases statewide, and is most damaging to Douglas-fir, true firs, and mountain hemlock. Armillaria root disease and Annosum root disease are particularly damaging in southern and Eastern Oregon. Root diseases do not lend themselves to detection by aerial survey, so annual damage trends are lacking. Manipulating the composition of stands to favor disease-tolerant tree species can mitigate root disease losses.

Other Damage

Ozone Damage

The Oregon Department of Forestry and the US Forest Service cooperate in a national ozone-monitoring program. Each year in late July and August, indicator plants are monitored in 35 sampling hexagons distributed throughout the state (Figure 23). To date, ozone injury to plants has not been detected in any of the Oregon plots.

Figure 23 - Red Elderberry (Sambucus racemosa) is one of the indicator plants assessed for symptoms of ozone injury.

Bear Damage

In the Pacific Northwest, black bears damage forest trees in the spring of the year by peeling the bark and eating the succulent inner tissue (Figure 24). When peeling the entire circumference of the tree bole, the result is tree death (Figure 25). While partial peeling can reduce tree growth, vitality, and introduce decay that lowers wood quality and eventually may result in mortality.

Long-term trends in bear damage are determined from special aerial surveys of approximately 7 million acres of the Coast Range and west slope of the Cascade Range. These surveys have closer flight lines than the regular statewide survey, and flights occur in June or early July when damage from the previous year is most visible. Damage estimates based on aerial survey observations are adjusted using ground verification data obtained from previous studies. Adjustments are necessary as there are a number of root diseases, insects, and other agents that cause a significant amount of tree mortality in these areas each year.

Figure 24 – Damage to Douglas-fir caused by black bear, western Oregon. Photo by the Oregon Department of Forestry.

The 2006 survey indicated bear damage on 44,415 acres in western Oregon (Figure 26). Approximately 60 percent of the damage occurred on state and private lands, while 40 percent occurred on federal lands. The survey estimate for 2006 was much greater than the ten-year average of 27,000 acres. Analysis of the aerial survey polygon size distribution (bear damage is more likely in large polygons) suggests that the relatively high acreage estimates in 2006 likely are due to an increase in the amount of detectible bear damage rather than damage from other mortality agents such as root disease, insects, or drought.

Figure 25 – Douglas-fir mortality attributed to black bear, western Oregon. Photo by the Oregon Department of Forestry.

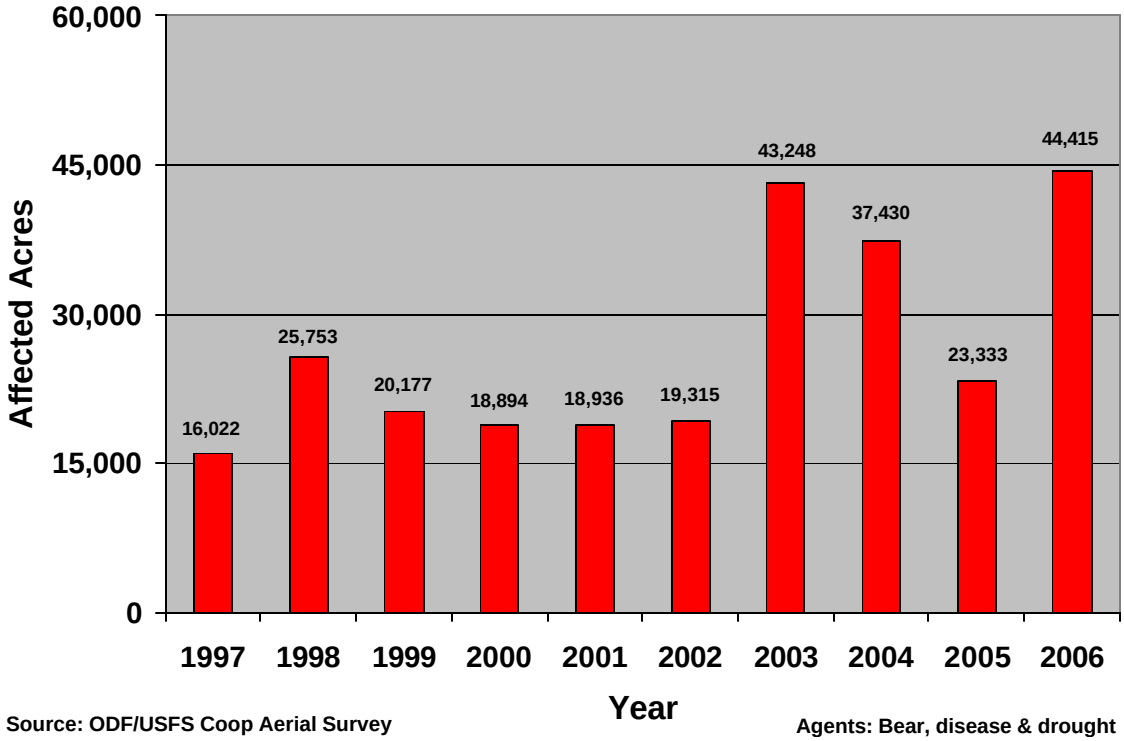


Figure 26 – Ten year trend in bear damage for tracking counties in western Oregon as estimated by aerial survey with ground verification.

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 Management Unit
Department of Forestry
Operations Building
2600 State Street
Salem, OR 97310
http://oregon.gov/ODF/PRIVATE_FORESTS/fh.shtml

Marganne Allen, 503-945-7240, mallen@odf.state.or.us
Rob Flowers, 503-945-7396, rflowers@odf.state.or.us
Alan Kanaskie, 503-945-7397, akanaskie@odf.state.or.us
Michael McWilliams, 503-945-7395, mmcwilliams@odf.state.or.us

Forest Service

Forest Health Monitoring Program
Pacific Northwest Region, Natural Resources
P.O. Box 3623
Portland, OR 97208-3623
Alison Nelson, 503-808-2976, asnelson@fs.fed.us
http://www.fs.fed.us/r6/nr/fid/wc-fhm/

Forest Health Protection
Pacific Northwest Region, Natural Resources
P.O. Box 3623
Portland, OR 97208-3623
Doug Daoust, 503-808-2913, ddaoust@fs.fed.us
http://www.fs.fed.us.r6/nr/fid/

Blue Mountains Service Center
Northeastern Oregon
Forest Sciences Laboratory
1401 Gekeler Lane
LaGrande, OR 97850
Craig Schmitt, 541-962-6544, clschmitt@fs.fed.us
Don Scott, 541-962-6545, dwscott@fs.fed.us
Lia Spiegel, 541-962-6575, lspiegel@fs.fed.us

Central Oregon Service Center
Deschutes National Forest
1645 Highway 20 East
Bend, OR 97701
Andy Eglitis, 541-383-5701, aeglitis@fs.fed.us
Kristen L. Chadwick, 541-383-5587, klchadwick@fs.fed.us
Helen Maffei, 541-383-5591, hmaffei@fs.fed.us
Jim Stone, 541-383-5783, jstone01@fs.fed.us

Southwest Oregon Service Center
J. Herbert Stone Nursery
2606 Old State Road
Central Point, OR 97502
Frank Betlejewski, 541-858-6127, fbetlejewski@fs.fed.us
Don Goheen, 541-858-6125, dgoheen@fs.fed.us
Ellen Goheen, 541-858-6126, egoheen@fs.fed.us
Katy Mallams, 541-858-6124, kmallams@fs.fed.us
Robert Schroeter, 541-858-6123, rshroeter@fs.fed.us

Westside Oregon Service Center
Mount Hood National Forest
16400 Champion Way
Sandy, OR 97055
Diane Hildebrand, 503-668-1474, dhildebrand@fs.fed.us
Bruce Hostetler, 503-668-1475, bhostetler@fs.fed.us
Ben Smith, 503-668-1761, bsmith02@fs.fed.us
Keith Sprengel, 503-668-1476, ksprengel@fs.fed.us
Beth Willhite, 503-668-1477, bwillhite@fs.fed.us