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Department of Agriculture

Forest Service
Pacific Northwest Region

Oregon
Department of Forestry

Forest Health Highlights In Oregon – 2005

April 2006

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Front cover: Sawfly (Neodiprion spp.) feeding on Douglas-fir foliage, photo by Pete Kingzett

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 levels in Oregon in 2005. For additional information, or for specific questions, please contact the forest 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 (Figure 1).

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; 40% of the forest belongs to state and private landowners, and 60% is under federal ownership (Figure 2). In 1996, the Oregon Department of Forestry (ODF) initiated a separate late spring survey of 3 million acres in western Oregon for Swiss needle cast (SNC – a foliage disease of Douglas-fir). Maps for both the statewide and SNC survey 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. SNC maps and data are available at the ODF website – http://www.oregon.gov/ODF/PRIVATE_FORESTS/fh.shtml.

Figure 1 – The sketchmapper operates the software via the touchscreen. Photo by USDA Forest Service.

An aerial survey to detect tanoaks killed by sudden oak death was initiated in 2001, and the presence of the pathogen (*Phytophthora ramorum*) in Curry County was confirmed that same year. During this survey observers record the position of dead or dying tanoaks, and these suspect trees are then checked by ground crews to determine the cause of death. In 2005 two surveys with fixed-wing aircraft in June and October covered 324,000 and 263,000 acres respectively. Helicopter surveys followed each of the fixed-wing surveys (270,000 and 180,000 acres) to determine the precise coordinates needed by ground crews to find suspect trees. An additional helicopter survey was conducted in February for intensive monitoring of tanoak mortality within the quarantine and eradication zone (120,000 acres).

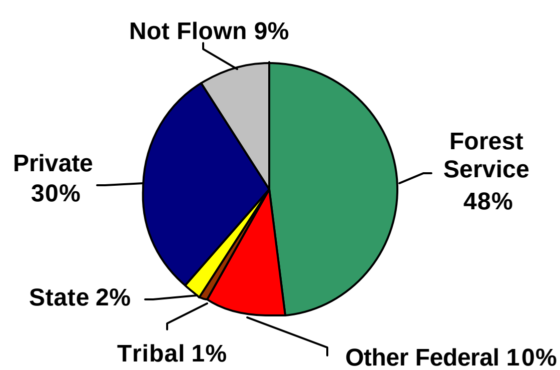

Figure 2 – Forested acres in Oregon surveyed by air in 2005, by land ownership category.

Weather and Forest Insect Outbreaks

Rainfall levels were normal to above normal in most forest areas of Oregon in 2004 - 2005. Higher precipitation levels reduce moisture stress on trees and typically result in greater resistance to bark beetle attacks. Improved tree vigor was likely responsible for the dramatic decline in fir engraver beetle infestations recorded in 2005. This decline explains much of the statewide decrease in bark beetle damage from 709,408 acres in 2004 to 515,789 acres in 2005 (Figure 3). Not all bark beetle infestations decline when wetter conditions return. Mountain pine beetle infestations in lodgepole pine typically continue regardless of fluctuations in annual precipitation. Populations of some insects, such as the green spruce aphid, benefit from wet warm conditions. Historical data indicate that spruce aphid outbreaks in coastal spruce stands occur immediately after a period of mild fall and winter temperatures, like those experienced in western Oregon during 2004 - 2005.

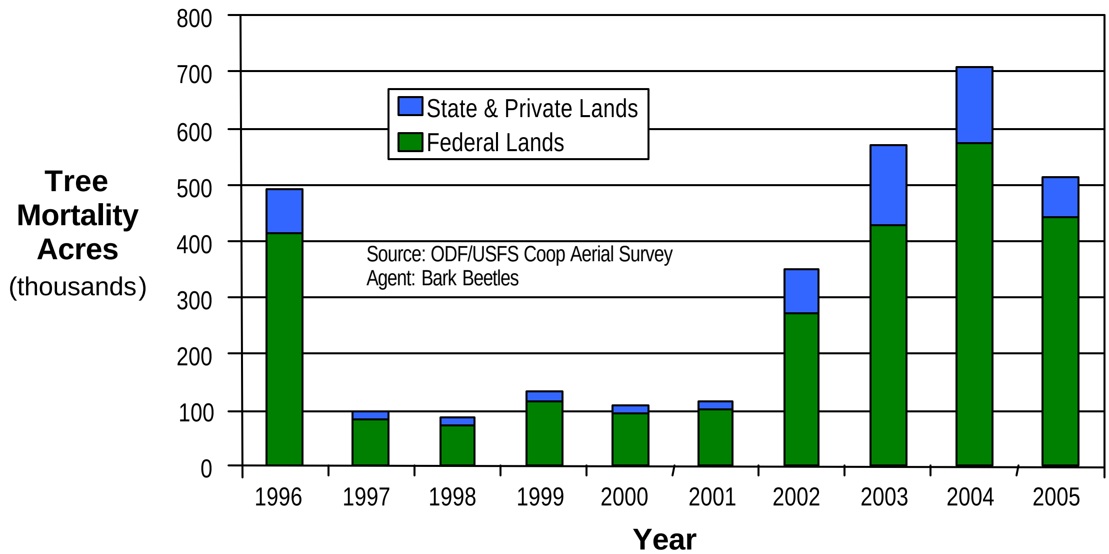

Figure 3 – Ten year trend data for bark beetle infested acres in Oregon.

Insects

Fir Engraver Beetle *(Scolytus ventralis)*

The area affected by fir engraver infestations in Oregon declined by 200,000 acres between 2004 and 2005 (Figure 4). The fir engraver beetle outbreak started in 2002 and now appears to be winding down as wetter conditions return. Unique aspects of this bark beetle outbreak have been the true fir mortality

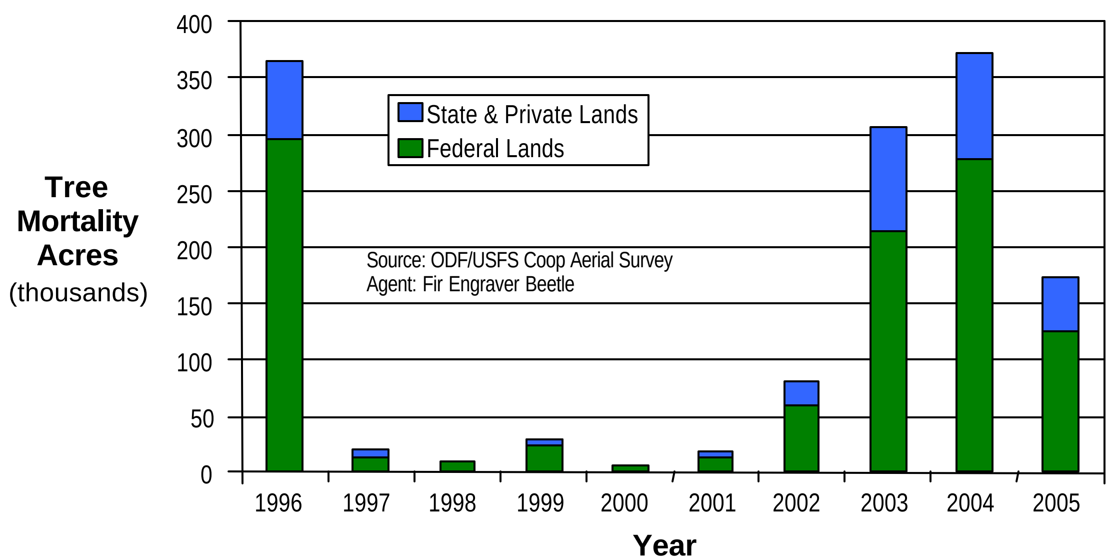

Figure 4 – A ten year trend in true fir mortality from fir engraver beetle attacks in Oregon

around the edges of the Willamette Valley and trees attacked and killed within sight of the ocean in Curry County. With normal to above normal precipitation expected in most areas of Oregon in 2005 - 2006, fir engraver populations and damage should decline further.

Figure 5 – Following a spruce aphid infestation, Sitka spruce displays a thin and sickly looking crown because the older foliage has been lost. Photo by Oregon Department of Forestry.

Spruce Aphid *(Elatobium abietinum)*

Spruce aphid defoliation was detected on 4,709 acres of Sitka spruce along a relatively narrow coastal strip extending from Astoria to Brookings. The spruce aphid is an introduced insect that feeds on older needles and defoliation is concentrated in the mid and lower crown of trees. Aphid damage causes the normally lush crowns of Sitka spruce to take on a thin, sickly appearance (Figure 5). Open grown trees and those growing along edges appeared particularly susceptible to defoliation. Branches on heavily defoliated trees are often killed and occasionally the entire tree may die. One unique aspect of the damage to spruce in 2005 was the extensive dieback of new shoots on roadside trees. Damage to new shoots may have resulted from exposure to high temperatures near the time of bud break or high temperatures in combination with heavy aphid feeding on older foliage. Only Sitka spruce, not other conifers, was affected by the dieback of new shoots. One factor contributing to the aphid outbreak was a period of mild temperatures during the fall of 2004 and the winter of 2005.

Mountain Pine Beetle *(Dendroctonus ponderosae)*

Mountain pine beetle outbreaks in lodgepole pine often create landscape level tree mortality that eventually fuels major wildfires (Figure 6). The large areas of mountain pine beetle damage in Oregon are located along the east slope of the Cascades from southern Deschutes Co. to Mt Hood (Figure 7).

Figure 6 – Mountain pine beetle infestation near Ollalie Butte in the Cascades showing recently killed trees (left) and old burned stand (right). Photo by Oregon Department of Forestry.

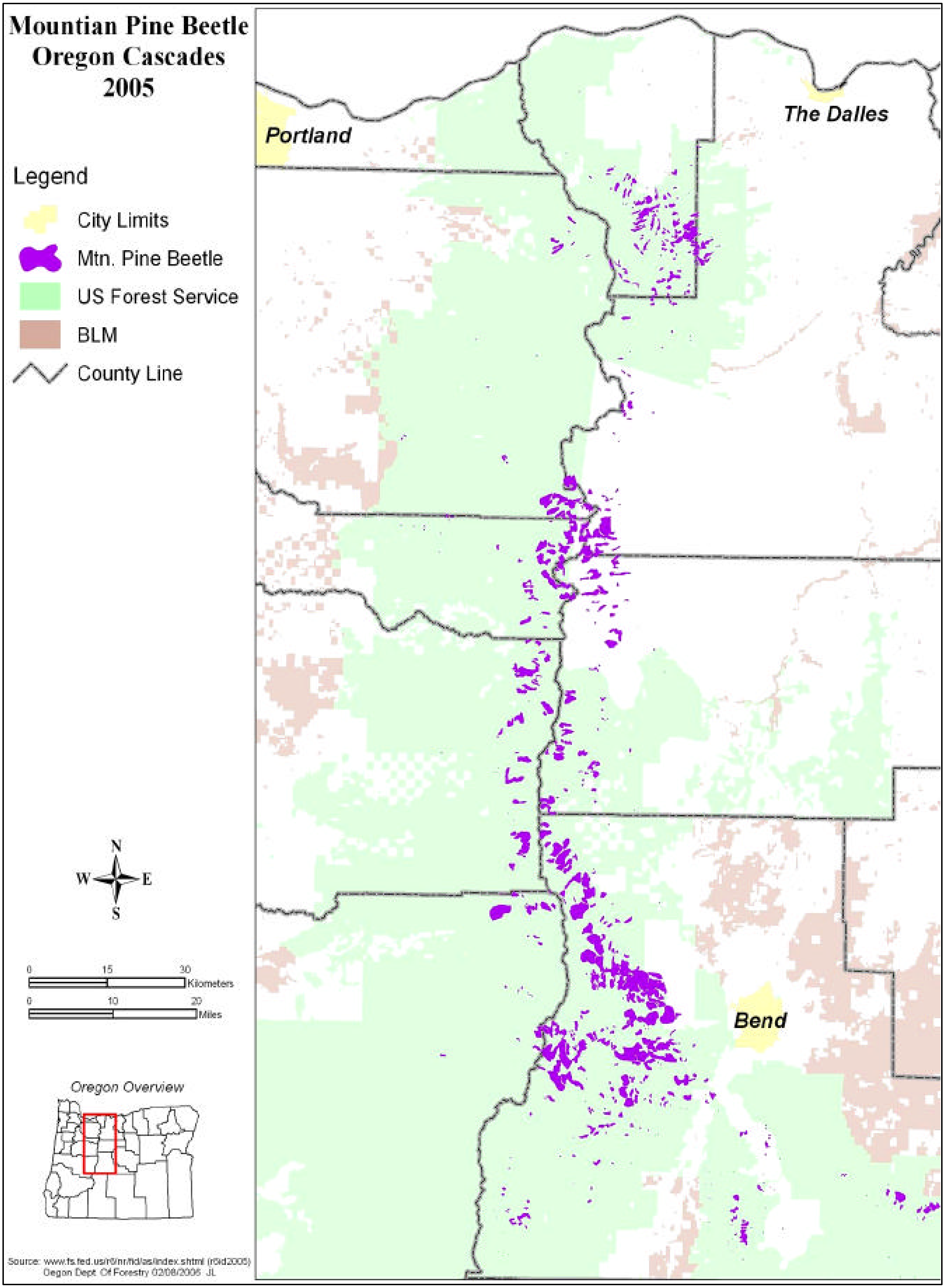

Figure 7 – Map showing areas with mountain pine beetle infestations along the east slope of the Cascades.

A second infestation area is located south and west of Summer Lake in Lake Co. The overall lodgepole acreage affected by mountain pine beetle in Oregon increased by 53,754 acres to 210,349 in 2005 (Figure 8). The current outbreak started in 2001 and could easily continue for a decade or more.

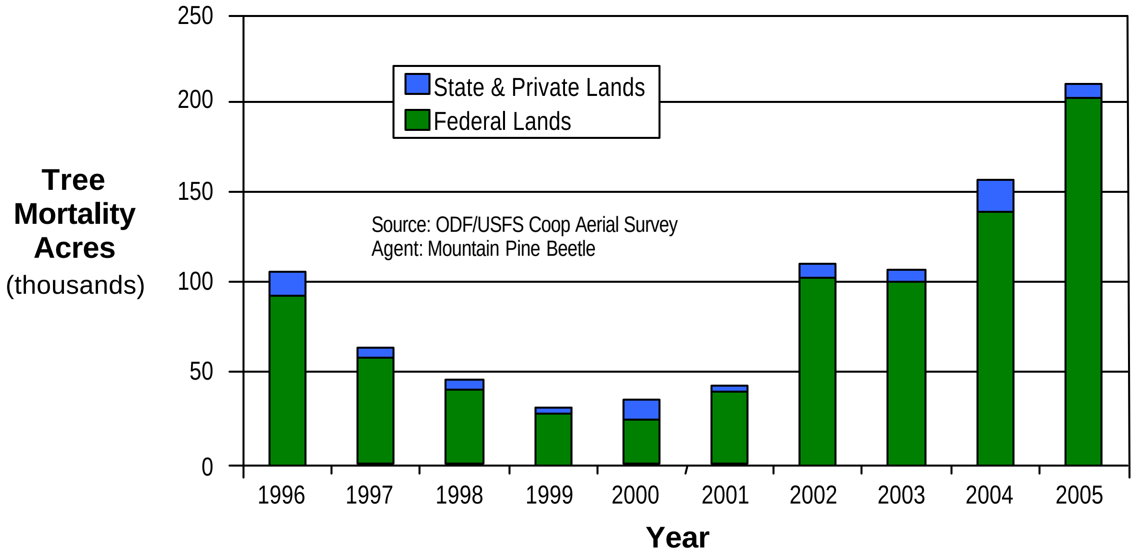

Figure 8 – A ten year trend for lodgepole pine mortality from mountain pine beetle infestations in Oregon.

Sawfly Damage *(Neodprion abietus* complex)

Several reports were received of defoliation in Douglas-fir plantations around the western edge of the Willamette Valley. The counties involved were Yamhill, Polk, and Lane and the defoliation was concentrated on the older needles in the lower crowns of Douglas-fir. It is probable that the sawfly responsible belongs to the *Neodiprion abietus* complex (Figure 9). From the number of reports, this appears to be one of the most extensive sawfly outbreaks ever recorded in northwest Oregon, but so far the damage to Douglas-fir appears minor. The last time defoliation of Douglas-fir by sawflies was reported was in 1982.

Figure 9 – Neodiprion sawflies similar to those found defoliating Douglas-fir in northwest Oregon. Photo by Canadian Forest Service.

Apple Wood Stainer *(Monarthrum mali)*

The Oregon department of Agriculture continues to trap specimens of *Monarthrum mali*, the apple wood stainer, in and around The Dalles (Figure 10). This ambrosia beetle is native to the southern United States, but is considered an exotic pest in Oregon. In the southeast U.S. this beetle is considered a pest of hardwoods such as maple, oak, and apple (Figure 11), but it occasionally infests conifers such as pines, hemlock, and cedar. As with any newly introduced tree pest, it is difficult to predict how susceptible native trees will be to infestation and damage. The large variety and number of hosts identified for this beetle make it very likely to establish in Oregon.

Figure 10 – The apple wood stainer (monarthrum mali) is a small ambrosia beetle, approximately 1.8-2.4 mm in length, that is native to southeastern U.S. and has recently been detected in Oregon. Photo by James Solomon, USFS.

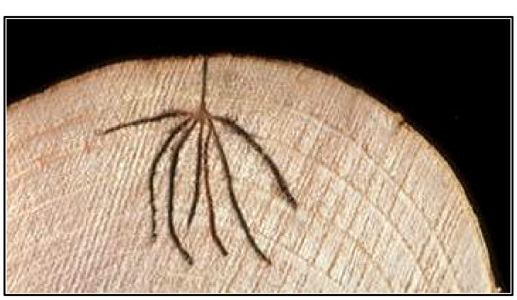

Figure 11 – Typical Monarthrum mali gallery and associated stain on a disk cut from a hardwood. Photo by James Solomon, USFS.

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.

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 12). It also can cause leaf blight or shoot dieback on a number of other hosts including rhododendron, evergreen huckleberry, and Oregon myrtle (Figure 13). A complete *P. ramorum* host list can be found at: http://www.aphis.usda.gov/ppq/ispm/pramorum/pdf_files/usdaprlist.pdf

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.

Figure 12 – Stem lesion, inner bark of tanoak caused by Phytophthora ramorum. Photo by Oregon Department of Forestry.

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 14, 15). As of the end of 2005, eradication was in progress on approximately 51 sites, totaling 88 acres (Figure 16).

Figure 13 – Leaf blotch and shoot dieback on evergreen huckleberry caused by Phytophthora ramorum. Photo by Oregon Department of Forestry.

Figure 14 – Eradication of the Sudden Oak Death pathogen, Phytophthora ramorum in southern Oregon. Photo by Oregon Department of Forestry.

Figure 15 – One of the original eradication sites, shown here 4 years after treatment. Photo by Oregon Department of Forestry.

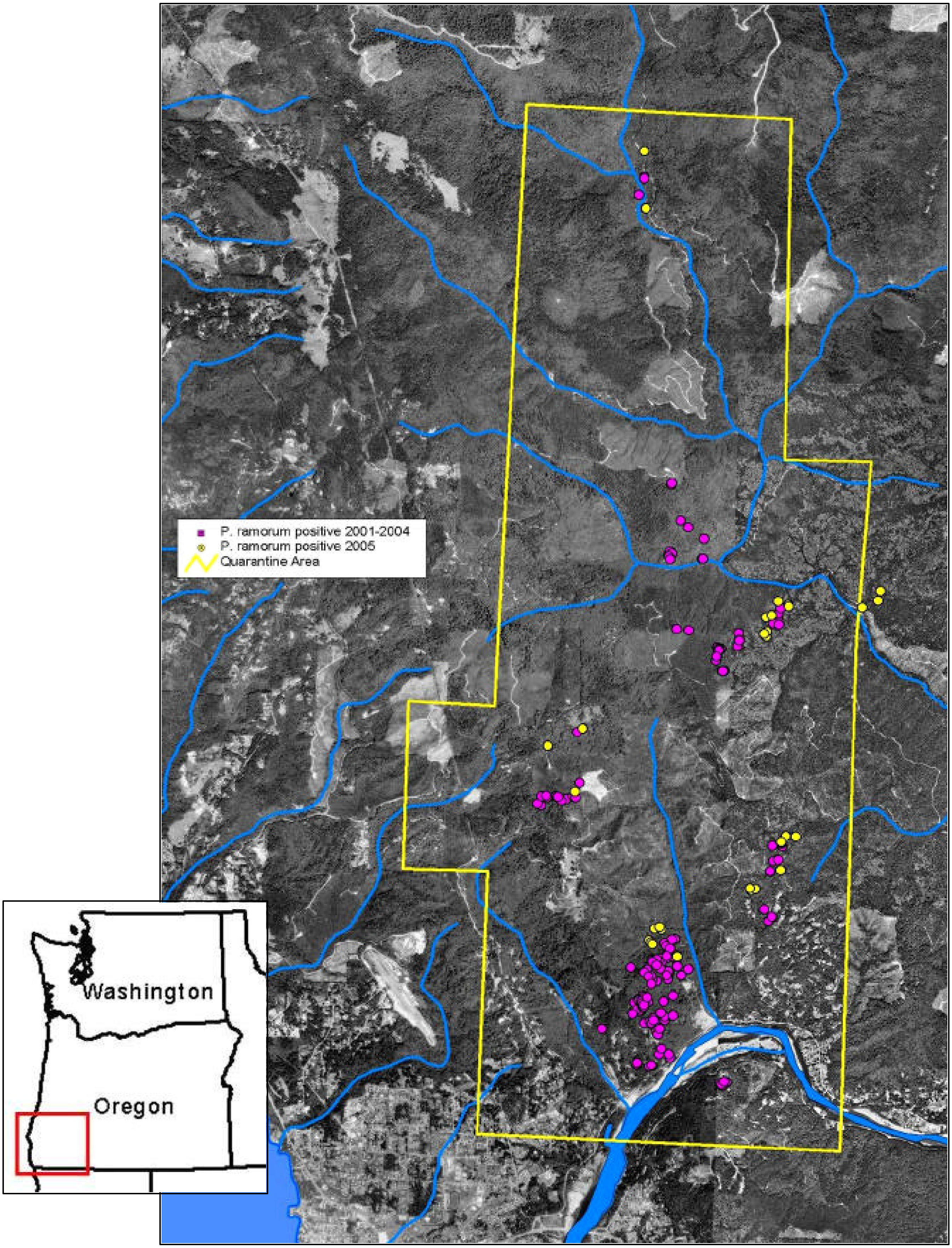

Figure 16 – Location of trees infected with Phytophthora ramorum, and the Sudden Oak Death Quarantine area in southwest Oregon, December 2005. Yellow = infected trees discovered in 2005; magenta = infected trees discovered 2001-2004. All infected trees have been cut and burned. Photo by Oregon Department of Forestry.

Each eradication site is monitored twice yearly for presence of *P. ramorum* by sampling vegetation and soils. 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. With the advent of more aggressive chemical sprout treatment (non-federal lands only) in 2003-2005, 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 frequency.

Both the number of new infected trees and the number of new infested acres increased in 2005 compared to 2004 (Table 1). This increase may be partially attributable to the unusually wet spring and summer weather that is conducive to disease spread. Of the nine new sites detected in 2005, eight were within 1/4 mile of previously known sites, and one was approximately 1/2 mile away from a known site. This latter site was discovered during ground surveys triggered by the recovery of *P. ramorum* from rhododendron leaf baits in a nearby stream in October 2005, and was located just east of the quarantine boundary. In addition to these nine new sites, nine existing eradication sites were expanded to include infected trees that were found near their perimeters in 2005. At the landscape level, the distribution of new infected trees suggests spread in a north to northeast direction, following the south to southwest winds that prevail during rainy periods.

Sudden Oak Death in Southwest Oregon

YEAR	# Tanoaks infected with *P. ramorum*	# New disease patches (does not include expansions of existing sites)	# Acres newly infested each year (new sites plus expansions of existing sites)
2001	100+	9	40
2002	85	12	8
2003	49	12	12
2004	30	9	10
2005	49	9	18
TOTAL	313+	51	88

Table 1. Number of infected trees, number of new disease patches, and number of acres infested with P. ramorum in Oregon, 2001-2005. December 2005.

Despite several new occurrences of *P. ramorum* in 2004 and 2005, 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 2005, three aerial surveys and numerous ground-based surveys failed to detect the pathogen in forests beyond this area. The forested area in Oregon under quarantine by the Oregon Department of Agriculture and USDA-APHIS was 11 mi^2 as of the end of 2005, and will increase to approximately 22 mi^2 in 2006 to include recent discoveries. Efforts to eradicate the pathogen from Oregon forests likely will continue for several years.

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 tree, ultimately reducing tree growth and survival (Figures 17 and 18). Tree mortality is rare, occurring only after many years of defoliation.

Figure 17 – Sparse yellow crowns of Douglas-fir damaged by Swiss needle cast, western Oregon. Photo by Oregon Department of Forestry.

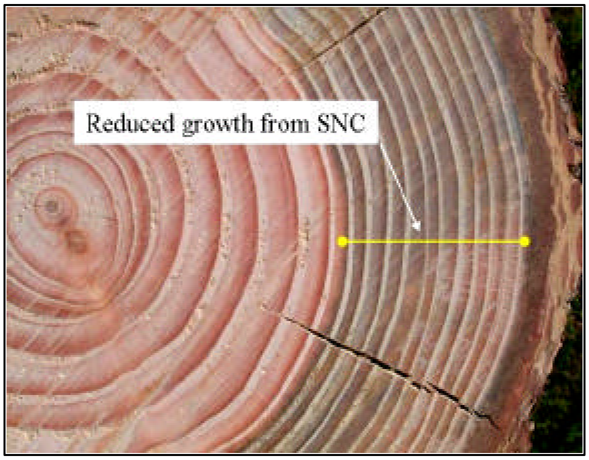

Figure 18 – Reduction in the last 12 years of radial growth increment of Douglas-fir caused by Swiss needle cast, Tillamook, OR. Photo by Oregon Department of Forestry.

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. 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.

Since the late 1980's, the disease has become particularly damaging to Douglas-fir forests on the west slopes of the Oregon Coast range. 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 recent downward trend in acres mapped with SNC symptoms (2003-2004) ended when the 2005 survey mapped symptoms on 207,000 acres (Figure 20). Ground-based observations within the survey area also suggest a very slight improvement in the foliage color and retention in 2003-2005 compared to previous years. Even though this trend might be encouraging, the survey still shows an impressively large area with significant damage from Swiss needle cast.

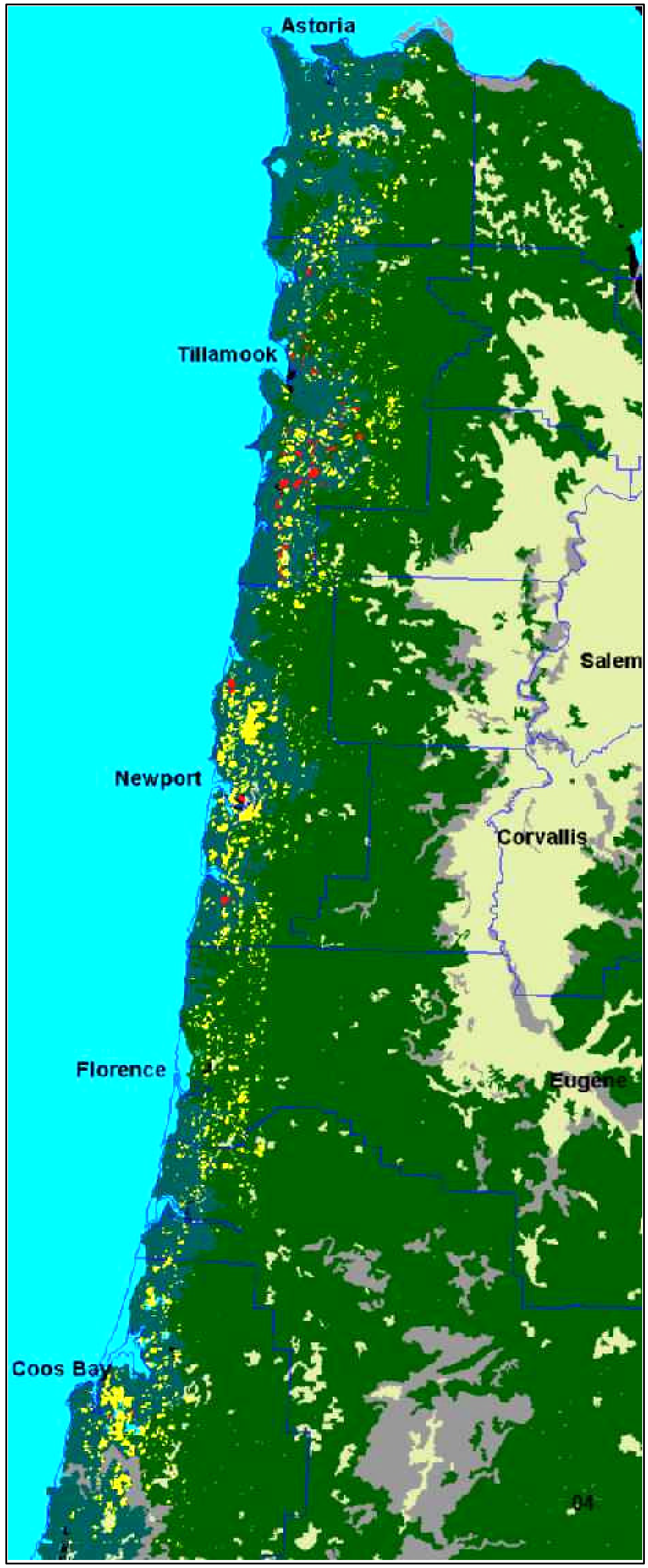

Figure 19 – Areas of Douglas-fir forest with symptoms of Swiss Needle Cast detected in the 2003-2005 aerial surveys. Yellow = moderate damage, red = severe damage.

Some of the decrease in acres mapped in 2003-2005 compared to 1999-2002 may have resulted from recent changes in forest management such as clearcutting severely damaged stands and widespread planting of hemlock and cedar. Weather prior to and during the aerial survey also affects survey results. In 2004 and 2005 SNC symptoms were rather late developing, and an early bud-flush confounded observation. Cloudy conditions during the narrow survey window also made observation and mapping unusually difficult.

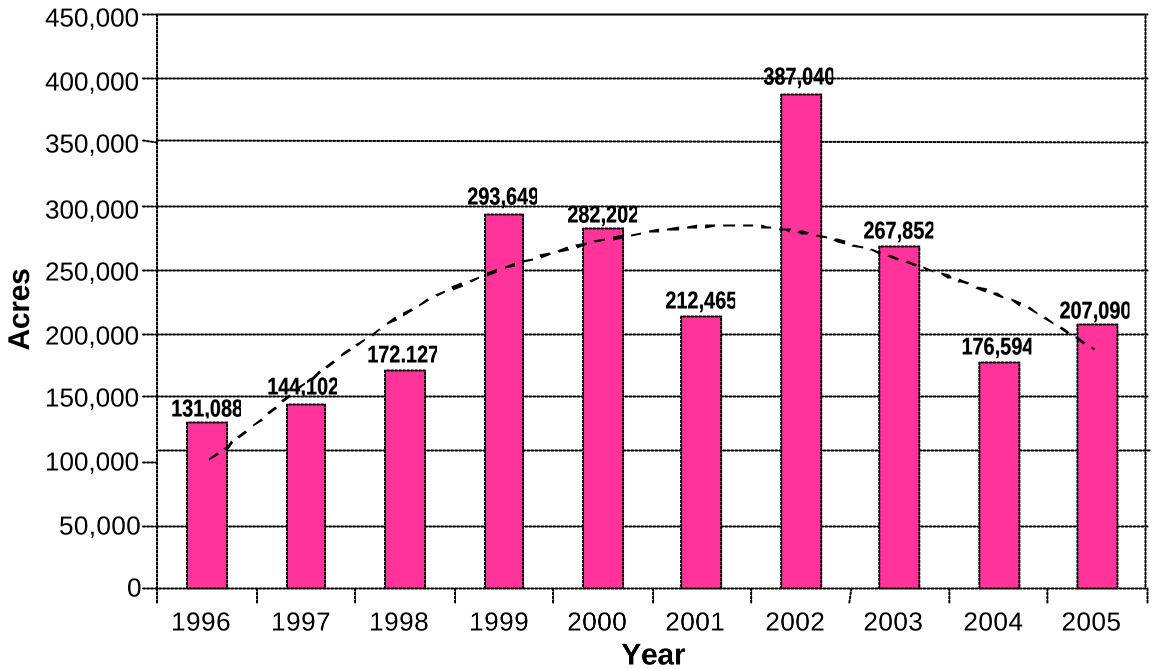

Figure 20 – Trend in the number of acres of Swiss needle cast mapped in aerial surveys between 1996 and 2005 in the Coast Range of Oregon.

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.

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 (Figure 21). 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 22). Although some of the damage resembled that of spruce aphid (see insect section), 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.

Figure 21 – New shoot dieback on Sitka spruce, coastal Oregon, July 2005. Photo by Oregon Department of Forestry.

In late May 2005, coastal areas of Oregon experienced extremely high daytime temperatures (90 degrees Fahrenheit) for two days. Spruce is the earliest conifer to break bud in spring, so it is possible that it may have been more susceptible to heat injury than other conifers. A most likely explanation is an interaction between the high temperatures and toxins injected into spruce by aphids. This would explain the pattern of damage on individual trees and why spruce was the only tree species affected.

Figure 22 – Shoot dieback and foliage loss in lower crown of roadside Sitka spruce, Highway 101 near Florence, Oregon, July 2005. Photo by Oregon Department of Forestry.

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.

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 forests of southwestern Oregon in 1952. 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. Integrated Port-Orford cedar management focuses on maintaining disease-free watersheds, preventing spread through sanitation, seasonal road closures, and bough-cutting restrictions, and restoring cedar in plant communities using resistant and non-resistant seedlings (Figure 23).

Figure 23 – Port-Orford cedar killed by *Phytophthora lateralis*, western Oregon. *Photo by Oregon Department of Forestry.*

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 36 sampling hexagons distributed throughout the state (Figure 24). To date, ozone injury to plants has not been detected in any of the Oregon plots.

Figure 24 – Thinleaf huckleberry (Vaccinium membranaceum) is one of the indicator plants assessed for symptoms of ozone injury. Photo by Oregon Department of Forestry.

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. If the entire circumference of the bole is peeled, the tree will die (Figure 25). Partial peeling can reduce tree growth and vitality, and introduce decay that lowers wood quality and eventually may result in mortality. In young conifer plantations, up to 50 percent of trees can be killed or damaged by bears, although the average level of damage is much lower.

In the 2005 statewide aerial survey, bear damage was mapped on approximately 38,000 acres of forestland; 70 percent on state and private lands, and 30 percent on federal lands. This estimate is based on the aerial observer's determination of bear damage, with no ground verification to confirm the cause of tree mortality (root diseases, insects, and other agents also cause tree mortality).

Long-term trends in bear damage are determined from special aerial surveys of approximately 6 million acres of the Coast range and west slope of the Cascade Range. These surveys fly tighter flight lines than the regular statewide survey, and occur in June or early July when bear damage is most visible. The number of acres with recent mortality from bear damage is estimated by adjusting aerial survey observations with ground verification data.

Figure 25 – Damage to Douglas-fir caused by black bear, western Oregon. Photo by Oregon Department of Forestry.

The 2005 survey estimated 23,000 acres with bear damage, which is consistent with the long-term average (20,000 acres), but considerably lower than 2003 and 2004 survey estimates (Figure 26). Analysis of the aerial survey polygon size distribution (bear damage is more likely in large polygons than in small polygons) suggests that the relatively high acreage estimates in 2003 and 2004 probably were due to agents other than bear, such as root disease and drought conditions.

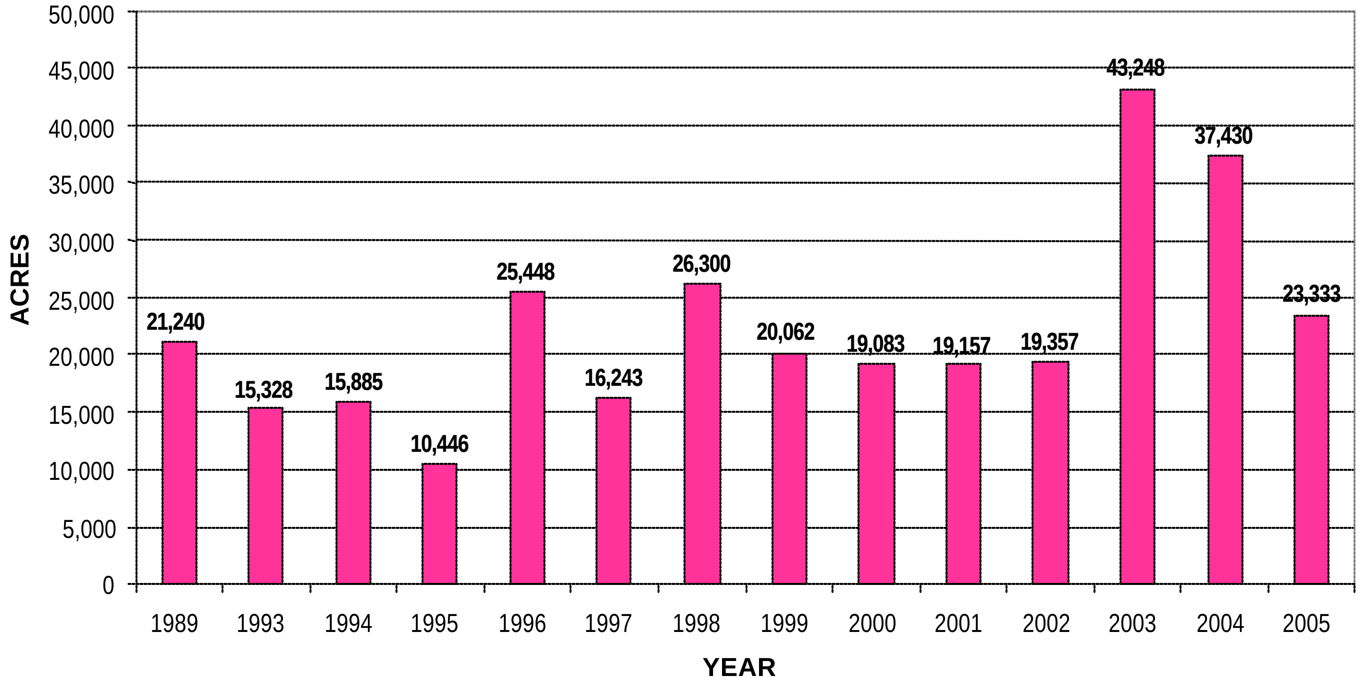

Figure 26 – Trend in bear damage in western Oregon as estimated by aerial survey with ground verification, tracking counties only, 1989-2005.

Notes

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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