



2003 Forest Insect and Disease Conditions Report

Native Insects

Mountain Pine Beetle, *Dendroctonus ponderosae*

Hosts: Jeffrey pine, lodgepole pine, ponderosa pine, sugar pine, western white pine, whitebark pine.

Mountain pine beetles occur throughout the range of the pine type in the Pacific Northwest. Both adults and larvae feed in the phloem layer of the inner bark, producing one generation per year. Fungi introduced by the beetles clog the conductive tissues of attacked host trees and contribute to tree mortality. Some infestations have resulted in extensive mortality over large areas.

Fewer trees were reported killed in 2003. In 2003, 409,596 acres were affected, with 4.03 trees per acre (TA), compared to 354,541 acres affected with an average of 5.32 TA in 2002. Overall decrease in mortality was reported in all host types except western white pine.

Tree mortality in lodgepole pine increased in acres, but lower intensity resulted in a decrease in overall tree mortality. Total reported affected acres increased from 208,948 acres, 7.75 TA in 2002 to 240,915 acres, 5.92 TA in 2003. Oregon's affected acreage in 2003, 105,611 acres, 3.07 TA, was similar to 2002 acreage, 106,864 acres, 6.12 TA, but intensity decreased by half. Washington reported 1/3 more acres at similar intensities: 135,304 acres, 8.13 TA, in 2003, from 102,084 acres, 9.46 TA in 2002.

Included in these lodgepole mortality totals are increases in North Cascades National Park, from 2,328 acres, 7.75 TA in 2002 to 5,627 acres, 5.92 TA in 2003. Yakama Indian Reservation increased from 7,799 acres, 4.63 TA in 2002 to 14,684 acres, 12.53 TA in 2003. Wenatchee Reporting Area increased from 11,782 acres, 5.57 TA in 2002 to 14,370 acres, 8.94 TA in 2003. Colville Reporting Area also increased from 924 acres, 4.1 TA in 2002 to 7,277 acres, 2.93 TA in 2003.

Areas that showed decreases in these lodgepole mortality totals include Okanogan, from 78,666 acres, 10.79 TA, in 2002 to 90,610 acres, 8.01 TA in 2003; Warm Springs Indian Reservation from 19,831 acres, 11.47 TA, in 2002 to 21,969 acres, 4.85 acres in 2003. Decrease also in Mt. Hood Reporting Area, from 11,516 acres, 2.43 TA in 2002 to 1,076 acres, 3.26 acres in 2003.

Significant increases of acres mapped in the ponderosa type occurred on all ownerships. In 2002, 103,958 acres, 1.47 TA were mapped, compared with 127,321 acres, 1.16 TA, in 2003. There was an increase in the number of acres, but overall decrease in number of reported trees killed. Examples of increased acreage, decreased trees killed include: the Malheur Reporting Area, from 14,865 acres, 1.9 TA in 2002 to 16,989 acres, .68 TA in 2003, and Okanogan Resource Area, from 13,496 acres, 2.79 TA in 2002 to 20,359 acres, 2.09 TA in 2003. Areas

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that decreased were Deschutes Reporting Area from 11,391 acres, 2.21 TA in 2002 to 10,665 acres, .67 TA in 2003. Areas that decreased include Ochoco Resource Area, from 9,027 acres, .62 TA in 2002 to 11,366 acres, 1.71 TA in 2003, and Wenatchee Resource Area, from 2,507 acres, 1.2 TA in 2002 to 14,417 acres, 1.17 TA in 2003.

Activity in sugar pine increased for the third straight year from 1,714 acres in 2001 to 1,988 acres in 2002, but at a slightly lower reported intensity (0.14 t/a, compared with 0.18 t/a in 2001). The majority of reported mortality occurred on Forest Service and Bureau of Land Management lands within the Rogue River and Siskiyou Reporting Areas. Additionally, over 400 acres of white pine blister rust were mapped within these same Reporting Areas.

Activity in western white pine decreased, from 4,656 acres, .21 TA in 2002 to 2,160 acres, .35 TA in 2003, with less overall mortality, possibly related to this species rapidly decreasing in its ecosystem by blister rust and mountain pine beetle. Rogue River Resource Area went from 1,640 acres, .24 TA in 2002 to 548 acres, .26 TA in 2003, and Siskiyou Resource Area increased from 3,101 acres, .20 TA in 2002 to 1,008 acres, .47 TA in 2003. Aerial detection of western white pine mortality is difficult because it is often found as a minor component in mixed conifer stands and has a color signature very similar to that of Douglas-fir.

Finally, acres affected in the whitebark pine type decreased from 32,881 acres, 3.41 TA in 2002 to 25,550 acres, 2.41 TA in 2003. The Okanogan Reporting Area decreased from 22,242 acres, 4.14 TA to 8,149 acres, 2.12 TA, with a proportionate decrease in blister rust. In the Wenatchee Reporting Area, there were 7,880 acres, 2.35 TA in 2002, increasing to 11,316 acres, 3.21 TA in 2003, with blister rust doubling in this Reporting Area. In the Wallowa-Whitman Reporting Area, from 0 acres in 2002, an increase to 2,823 acres, .84 TA in 2003, with blister rust increasing from 1,297 acres in 2002 to 5,083 acres in 2003.

Dense stand conditions continue to predispose areas to mountain pine beetle infestations.

Douglas-fir Beetle, *Dendroctonus pseudotsugae*

Hosts: Douglas-fir

Douglas-fir beetles occur throughout the range of Douglas-fir and are considered the most important bark beetles which cause mortality in Douglas fir. Normally they breed in felled, injured, or diseased trees. The females bore into the bark and tunnel upward through the phloem. Tree mortality occurs when phloem continuity is disrupted by beetle larval galleries or by fungi introduced by the beetles. Mortality is widely scattered when at low levels. At times, these insects reach epidemic levels and kill apparently healthy trees over extensive areas.

We saw a lower overall decrease in mortality, from 142,035 acres, 1.49 TA in 2002 to 97,598 acres, 1.68 TA in 2003. Most notable decrease was mapped on the Wallowa-Whitman Reporting Area, from 29,419 acres, 1.57 TA in 2002 to 5,601 acres, 1.15 TA in 2003. Some of this may be attributable to observer ground checks leading to confirmation and mapping of fir engraver, as signatures are similar.

Areas that saw increases in tree mortality include the Colville Reporting Area, from 23,204 acres, 2.67 TA in 2002 to 32,309 acres, 2.21 TA, the Colville Indian Reservation, from 6,540 acres, 1.55 TA in 2002 to 5,672 acres, 2.00 TA in 2003, the Gifford-Pinchot Reporting Area,

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from 3,626 acres, .99 TA in 2002 to 7,069 acres, 1.23 TA in 2003, the Mount Baker-Snoqualmie Reporting Area, from 1,926 acres, 1.17 TA in 2002 to 2,714 acres, 1.60 TA in 2003, and finally the Okanogan, from 5,621 acres, 2.89 TA in 2002 to 8,417 acres, 2.72 TA in 2003.

Fir Engraver, *Scolytus ventralis*

Hosts: True firs

Fir engravers infest true firs in western forests. These beetles attack pole-sized and mature trees, causing significant mortality during and following periods of drought. Trees infected with annosus root disease are especially subject to attack. Trees defoliated by Douglas-fir tussock moth, western spruce budworm or Modoc budworm also are likely to be attacked. These beetles commonly breed in logging slash and windthrown trees.

Both Oregon and Washington had over a 3-fold increase in acres affected and total trees killed in 2003. Fir engraver went from 161,229 acres, .91 TA in 2002 to 606,143 acres, 1.35 TA in 2003. Tree mortality increased in almost all Reporting Areas except Glenwood and Siuslaw Reporting Areas.

Areas with significant levels of mortality in 2003 include: Colville Reporting Area, 120,254 acres, 1.84 TA, Umatilla Reporting Area, 86,955 acres, 1.40 TA, Wallowa-Whitman Reporting Area, 88,043 acres, 1.06 TA, Wenatchee Reporting Area, 45,434 acres, 2.11 TA, and Malheur Reporting Area, 49,617 acres, .63 TA.

Pine Engraver Beetles, *Ips* spp.

Hosts: Ponderosa pine

Pine engraver beetles affect all species of pine but are most notable for their effect on ponderosa pine. Populations commonly build up in weakened trees, improperly treated logging and thinning slash, and windthrow. High populations in warm, dry years may kill large numbers of apparently healthy saplings and pole-sized trees as well as tops of mature trees.

2003 found a decrease in acres affected by pine engraver beetles, but an overall increase in reported trees killed. Numbers went from 9,545 acres, .92 TA in 2002 to 7,835 acres, 1.54 TA in 2003. Mortality was scattered throughout the Region with approximately 50% of the affected acres reported in northeast Washington.

Western Pine Beetle, *Dendroctonus brevicomis*

Hosts: Ponderosa pine

Western pine beetles periodically kill large numbers of ponderosa pine in the Pacific Northwest. Normally, these beetles breed in large, old trees; in windfalls; in trees infected by root disease; or in trees weakened by drought, overstocking, or fires. Under epidemic conditions, they will

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attack and kill trees of all ages having bark sufficiently thick to protect the insect during development. Two generations per year of this beetle are typical in the Pacific Northwest.

Acres affected by western pine beetle activity increased from 38,999, 1.07 TA in 2002 to 129,877 acres, 1.11 TA in 2003. Western pine beetle decreased in Oregon (from 29,978 acres, .99 TA in 2002, to 6,302 acres, .51 TA in 2003) and increased in Washington (9,021 acres, 1.31 TA in 2002, to 123,575 acres, 1.14 TA in 2003). Increases were noted in both large and pole-sized pines. These increases include the Colville Reporting Area, from 607 acres, 1.21 TA in 2002 to 44,912 acres, .91 TA in 2003, the Colville Indian Reservation, from 2,661 acres, 1.20 TA in 2002 to 20,228 acres, 1.13 TA in 2003. Also, increases noted in Northeast Washington Reporting Area, from 780 acres, 1.93 TA in 2002 to 10,944 acres, 1.06 Ta in 2003, and Spokane Reporting Area, from 231 acres, 2.28 TA in 2002 to 38,233 acres, 1.45 TA in 2003. One decrease of notice is the Rogue River Reporting Area, from 22,037 acres, 1.13 TA in 2002 to 1753 acres, .55 TA in 2003.

Spruce Beetle, *Dendroctonus rufipennis*

Hosts: Engelmann spruce

Spruce beetles infest all species of spruce and are the most significant mortality agent of mature spruce trees. Populations build up in windthrown trees. Stand susceptibility can relate to a variety of factors including geographic location, tree diameter, basal area, and percentage of spruce in the canopy.

All reported mortality in Oregon and Washington in 2002 was in Engelmann spruce. Reported acres affected went from 27,657 acres, 11.52 TA in 2002 to 19,106 acres, 7.51 TA in 2003. The majority of mortality occurred on Forest Service lands within the Okanogan Reporting Area. Increases include Colville Indian Reservation, from 113 acres, 1.34 TA in 2002 to 2,964 acres, 2.69 TA in 2003, and the Colville Reporting Area, from 74 acres, 1.73 TA in 2002, to 440 acres, 3.45 TA in 2003. Decreases include the Okanogan Reporting Area, from 22,914 acres, 13.32 TA in 2002 to 14,156 acres, 9.21 Ta in 2003, and the Wenatchee Reporting Area, from 2,972 acres, 4.07 TA in 2002 to 1,092 acres, 2.85 TA in 2003. The spruce beetle outbreak in the Tiffany Mountain area appears to have run its course. Virtually all of the large spruce has been killed on about 187,000 acres. Spruce beetle population is expected to return to endemic level in 2004.

Douglas-fir Tussock Moth, *Orgyia pseudotsugata*

Hosts: Douglas-fir, true firs

The primary hosts of the Douglas-fir tussock moth are Douglas fir, grand fir, subalpine fir and white fir. Early instar larvae feed on the current year's foliage as the shoots elongate and later instars feed on all foliage. Normally this insect occurs at very low population levels; however it experiences cyclic population increases every 7 - 13 years, and populations can have significant impacts on resources when these irruptive outbreaks occur.

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A total of only 743 acres of defoliated we recorded for DFTM in 2003, a continuing decrease from the 16,655 acres reported in 2002. The Douglas-fir Tussock Moth Early Warning System confirms that populations have returned to endemic levels. Average number of moths trapped for the Region remains similar to 2002 at about 1.0 moth per trap. However, trap catches on the Fremont and Winema NF and adjacent areas continue to oscillate, increasing to an average of approximately 10.0 moths per trap. These numbers are comparable to the higher trap catches recorded for those Forests since the DFTM Early Warning System was established.

Western Spruce Budworm, *Choristoneura occidentalis*

Hosts: Douglas-fir, true firs, Engelmann spruce, western larch

Western spruce budworm is a common defoliator of conifers in the Pacific Northwest. Budworm outbreaks commonly occur in the true fir/Douglas-fir forest types east of the Cascade Mountains crest. Larvae prefer new foliage but also feed on older foliage when new foliage is in short supply. On western larch, larvae not only feed on the needles but also sever new shoots. Repeatedly defoliated trees experience substantial radial growth reduction and, if defoliation is great enough, are predisposed to lethal infections by root pathogens or attack by various bark beetles. Increasingly effective fire prevention and suppression during this century have eliminated many major fires and nearly all surface fires. As a consequence, host trees have increased, resulting in an abundant and expanding source of the budworm's favorite food: shade-tolerant, late-successional species such as true fir.

Areas of visible defoliation increased from approximately 58,463 acres in 2002 to 143,412 acres in 2003. Small areas of light and moderate defoliation were detected on the Mt. Hood (total = 623 acres), Ochoco (total = 476 acres) and Wallowa-Whitman (total = 81 acres) Resource Areas in Oregon, and on the North Cascades NP (total = 1,581 acres), the Okanogan Resource Area (total = 476 acres) and near Glenwood (total = 1,194 acres), in Washington. A second year of defoliation was recorded on the Malheur Resource Area, increasing from 1,896 to 3,435 acres. After a significant decline in 2002, acres of defoliation on the Yakama Indian Reservation increased from 1,296 acres to 6,010 acres in 2003. The most notable increase in budworm defoliation occurred on the Wenatchee Resource Area where acres of visible defoliation increased from 51,892 acres in 2002 to 125,010 acres in 2003. Defoliation in the moderate and heavy defoliation categories increased three-fold in 2003.

The most notable decrease occurred on the Gifford-Pinchot Resource Area.

955 acres of moderate intensity defoliation occurred in the northeast corner of Washington near the Idaho Panhandle. Due to the variety of hosts involved, it is believed the defoliation is caused by a budworm complex, which includes western spruce budworm and blackheaded budworm.

Western Blackheaded Budworm, *Acleris gloverana*

Hosts: Western hemlock (preferred), Sitka spruce, white spruce, true firs, Douglas-fir and mountain hemlock

Larvae feed within buds and on current year's foliage and can cause top-kill, growth loss, and, sometimes, death of the host. Defoliation becomes apparent in June and July as partially eaten

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needles dry and turn red, giving crowns of host trees a red or brown appearance. Weather plays an important role in regulating budworm populations. Relatively warm, dry days in June through August following a warm September in the previous year can result in a rapid increase in blackheaded budworm. Natural controls have resulted in significant decreases of blackheaded budworm populations. Some wasps parasitize budworm eggs, larvae, and pupae. A virus, fungi, and larval starvation also have contributed to budworm declines. Songbirds are also effective natural enemies.

Acres of defoliation decreased from 2,390 acres in 2002 to 2,247 acres in 2003. Small areas of defoliation were recorded on the Mount Baker-Snoqualmie and Wenatchee Resource Areas. In Northeastern Washington, near the Idaho Panhandle border, 1,252 acres of defoliation were detected that is believed to be a complex of budworms including the western spruce budworms and the western blackheaded budworm. (This includes the 955 acres reported for western spruce budworm and blackheaded budworm)

Phantom Hemlock Looper, *Nepytia phantasmaria*

Hosts: Douglas-fir and western hemlock

The primary hosts of the phantom hemlock looper are western hemlock, although western red cedar, Sitka spruce, true firs, and pines have also been recorded as hosts

Larvae feed first on the new foliage, then on the old. Outbreaks of phantom hemlock looper are often not observed because they tend to be local and sporadic. Populations of phantom hemlock looper have been found to be abundant in identified outbreaks of western hemlock looper and western blackheaded budworm.

Approximately 5,700 acres of defoliation were mapped in 2002. No acres were mapped in 2003.

Western Hemlock Looper, *Lambdina fiscellaria lugubrosa*

Hosts: Western hemlock and associated conifers.

The primary hosts of the western hemlock looper are western hemlock; however, during outbreaks other associated conifer species are also defoliated, including western red cedar, true firs, Douglas-fir, spruces, western white pine and larch.

The larvae are wasteful feeders, chewing off needles at their bases and thus causing the stand to appear yellowish-red and brown in color. In heavy infestations, trees may be stripped in a single season. Defoliation starts in the upper crown, but as feeding progresses more and more of the crown is affected, increasing the risk of mortality. Late in summer, larvae are very mobile, crawling over tree trunks and shrubs, and by dropping by silken threads from the trees to the ground.

Western hemlock looper has caused more mortality of western hemlock than has any other defoliator. Outbreaks generally last for 2 to 3 years on any one site, and mortality seems to be greatest in old growth, although 80 to 100-year old stands can be heavily defoliated. Outbreak collapse is usually brought about by the combined effects of pathogens, parasites, predators, and sometimes, adverse weather conditions or larval starvation.

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Acres defoliated in Washington State decreased significantly from over 35,200 acres in 2002 to 1,411 acres in 2003. Defoliation was mapped mostly south of Baker Lake (965 acres). Additionally, a 283-acre area in the North Cascades National park and a 163-acre spot within the Northwest Washington Resource Area were mapped in 2003.

Non-Native Insects

Balsam Woolly Adelgid, *Adelges piceae*

Hosts: True firs

The balsam woolly adelgid is an introduced insect that has had significant impact on grand fir, silver fir and sub alpine fir in Washington and Oregon. It can kill trees slowly by infesting the twigs or branches, or quickly, by infesting the bole. It also causes gouting of branch nodes. During the 1950's and 1960's it caused extensive mortality primarily along the Cascade Range. Since that initial mortality, BWA damage has been chronic and subtle and is not often visible from the air.

Balsam woolly adelgid activity continued to increase for a fourth straight year in the Region. Over 142,050 acres of BWA damage were detected in 2003, compared to a total of 82,429 acres affected in 2002, and 50,824 acres in 2001, and 6,300 acres in 2000. Increases were noted on most Oregon Reporting Areas where host occurs, although slightly fewer acres were detected on the Umatilla Resource Area in 2003. In Washington, Acres affected by BWA increased on the Gifford-Pinchot, but decreased slightly on the Olympic NP. Favorable environmental conditions during the winters and springs of 2001 thru 2003 have supported increased levels of activity. A change in aerial survey signatures, using lichen loads as indicators of BWA, have also been responsible for the increased number of acres detected. The validity of this signature method will be evaluated over the next two years.

Gypsy Moth, *Lymantria dispar*

Hosts: Oaks, apple, sweetgum, other hardwoods

While no defoliation has been observed in either State, pheromone traps continue to catch moths. These catches represent either new introductions or populations not completely eradicated by previous treatments.

Washington: 59 moths were caught in 17 areas. 14 were caught in Port Ludlow, and 3 egg masses were found. In the Bellevue area 17 moths were caught and two egg masses found. In the Roanoke area, still in King County, 5 moths were trapped, but no egg masses have been found. In Lewis County, 8 moths were found in one trap, and other life stages were found. Washington Department of Agriculture is proposing three eradication sites; Port Ludlow (15-20 acres) and Bellevue (10-15 acres) and near Mossy Rock.

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Oregon: 27 moths were caught in 2003. 17 moths were caught in the Eugene area, and all other life stages were also found, including female moths laying new egg masses. Two moths were found in the Gresham area. This is the third year that moths have been caught at this site, but intensive searches have yet to find any egg masses. 3 moths were caught in the Ames area along Bull Run Road. Most of the rest of the moths were single catches scattered throughout the state. No moths were caught in the Fisher site where the state conducted an aerial eradication project this year. The only area proposed for treatment in 2004 is the Eugene site.

Larch Casebearer, *Coleophora laricella*

Hosts: Western larch

After years of negligible occurrence, larch casebearer-caused defoliation of western larch slowly increased in the late 1990's to 15,836 acres reported in 1999. Ideal timing for a larch casebearer survey in the Pacific Northwest is in June; however, most of the surveys in larch type occur in late July through early September.

Approximately 25,200 acres were mapped in 2003 compared to only 248 mapped in 2002. This marks the first increase in detected defoliation after four straight years of declines. Increases included the Mount Hood Reporting Area, from 241 acres in 2002 to 2,643 acres in 2003, and the Umatilla Reporting area, from 7 acres in 2002 to 259 acres in 2003. New this year are the Colville Reporting Area, 6,669 acres, the Kaniksu Reporting Area, 4,431 acres, the Okanogan Reporting Area, 5,023 acres, the Wallowa-Whitman Reporting Area, 2,996 acres, the Ochoco Reporting Area, 1,169 acres, the Malheur Reporting Area, 806 acres, the Colville Indian Reservation, 697 acres, Northeast Washington Reporting Area, 358 acres, and Warm Springs Indian Reservation, 125 acres.

Introduced parasites released in the Pacific Northwest in the early 1960's and established years ago, along with needle diseases on larch, helped maintain low levels of casebearer for many years. As casebearer populations declined, so did the introduced parasites. Parasites are expected to respond to the increasing casebearer population, although there may be several more years of defoliation before they increase to effective levels. Refoliation of larch in late summer typically masks most of the defoliation, and because of this these trees are not as evident to observers late in the season. The ability of larch to refoliate is one of the reasons we do not expect to see tree mortality as a result of this insect. Accurate assessment of the casebearer situation would require extensive aerial survey in early June, rather than late summer.

Native Diseases

Annosus Root Disease, *Heterobasidion annosum*

Hosts: True firs, ponderosa pine, western hemlock

Annosus root disease causes damage primarily in partially harvested white and grand fir stands in southern and eastern Oregon and eastern Washington. Damage from stem decay also

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occurs in subalpine fir, red fir, noble fir, pacific silver fir, and mountain hemlock, especially in partially harvested stands and in wounded trees. Mortality is high where annosus root disease and fir engravers occur together. Despite high infection levels in stumps cut 15 to 20 years ago, mortality of surrounding true fir regeneration is low in northeastern Oregon, but decay levels may be high. Annosus root disease in low-elevation western hemlock occurs primarily as a butt rot in wounded trees. Efforts are underway to artificially inoculate unwanted western juniper with *H. annosum* to create mortality centers in eastern Oregon.

Armillaria Root Disease, *Armillaria ostoyae*

Hosts: Conifers

Armillaria root disease causes serious mortality losses east of the Cascade Range in mixed-conifer stands. It is the most commonly encountered root disease in Oregon and Washington. True firs sustain the most losses; however, in localized areas Douglas-fir and ponderosa pine mortality can be significant. The world's largest known root disease clone occurs in northeastern Oregon, and several large Armillaria clones exist throughout the region. Thinning of young conifers has been shown to significantly increase tree growth rates and reduce mortality caused by Armillaria root disease in the Cascade Range of Oregon and Washington. Armillaria root disease has been recently shown to significantly affect stand structure, plant species diversity, and fuel loads in central Oregon. Assessing species resistance on a site-by-site basis and discriminating for the more resistant species during stand management activities are considered the most effective means of reducing disease spread and tree mortality.

Black Stain Root Disease, *Ophiostoma wageneri*

Hosts: Douglas-fir, ponderosa pine

In southwestern Oregon, black stain root disease is the most commonly encountered disease in Douglas-fir plantations. High-risk areas are those where disturbances, such as road building or soil compaction, have occurred or where road maintenance equipment injured roadside Douglas-firs. Infected larger individuals are found scattered in previously entered forest stands.

Black stain root disease continues to be observed on ponderosa pine east of the Cascades; it is widespread on the southeastern portion of the Malheur National Forest. Some smaller localized infestations are known in other portions of the Blue Mountains. Black stain root disease is seen infrequently in eastern Washington. Pacific Northwest Research Station scientists are investigating relationships with natural and prescribed fire, vector insects, and management strategies.

Cytospora canker of true firs, dwarf mistletoe, sawfly (unknown species), and fir engraver beetle complex, *Cytospora abietis*, *Arceuthobium spp.*, *Neodiprion sp.?* and *Scolytus ventralis*

Hosts: True Firs

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The various agents of this complex are widely distributed throughout Oregon and Washington wherever true firs occur. Activity levels of each agent typically fluctuate more-or-less independently among locations and over time. *Cytospora abietis* is a weak, canker-inducing fungus that attacks stressed trees. It commonly infects branches bearing dwarf mistletoe infections (described below), causing branch death. Conifer-feeding sawfly larvae feed on old foliage, temporarily weakening trees and slowing their growth. Outbreaks are usually sporadic and subside quickly. Fir engraver beetle (described above) activity is strongly associated with tree stress.

1,209 acres of this complex were mapped during 2003, down from 2,309 acres mapped in 2002. Most of the aerially detected damage occurred within the Rogue River Reporting Area, from 842 acres in 2002 to 795 acres in 2003. Mapped activity on the Siskiyou fell from 1,467 acres in 2002 to only 23 acres in 2003. New spots were mapped on the Gifford-Pinchot Reporting Area (96 acres) and the Wenatchee Reporting Area (295 acres). Aerial observers sometimes mistake the color signature of *Cytospora* with that of balsam woolly adelgid. Incidence was associated with mature noble fir stands located near ridge tops, and is probably related to drought stress.

Laminated Root Rot, *Phellinus weirii*

Hosts: Conifers

Laminated root rot is the most serious forest tree disease west of the Cascade Mountain crest in Washington and Oregon. Overall, an estimated eight percent of the area with susceptible host species is affected in this portion of the Region. Locally, 15 to 20 percent of an area may be affected. East of the Cascade crest, laminated root rot affects mixed conifer stands north of the Crooked River in central and northeastern Oregon and throughout eastern Washington. Effects of the disease include significant changes in species composition, size, and structure. Regeneration of susceptible species in root disease centers may not grow beyond sapling and pole size. Hardwood trees and shrubs, which are immune to the fungus, often increase their site occupancy.

Dwarf Mistletoes, *Arceuthobium* spp.

Hosts: Conifers

Dwarf mistletoes are present on approximately 9.5 million acres of forested lands in the Pacific Northwest Region. Their status changes little from year to year. However, long-term impacts, including reduced growth, mortality, deformity, and top-kill, are significant, particularly in unmanaged stands. Most conifer species are affected to some degree. Douglas-fir dwarf mistletoe is abundant east of the Cascades and in southwestern Oregon. Western larch dwarf mistletoe causes significant effects in northeastern Oregon and eastern Washington. The intensity of dwarf mistletoes in eastern Oregon and Washington and in southwest Oregon is closely related to fire ecology. Lack of frequent, periodic fire in the last century has allowed infection levels to increase on many sites, especially those where mistletoe was not culturally controlled. New management policies including green tree retention requirements and restrictions on silvicultural treatment of certain sensitive areas and large diameter trees will

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reduce sanitation opportunities, and allow mistletoe intensification in the future. New information about wildlife use of dwarf mistletoe is leading to retention of infected trees in some locations.

Swiss Needle Cast, *Phaeocryptopus gaumannii*

Hosts: Douglas-fir

Swiss needle cast, a fungal-caused foliage disease of coastal Douglas-fir, has caused significant volume growth loss estimated at 25% throughout coastal Oregon and parts of Washington. A combination of warmer winters, increasing acreages of Douglas-fir, and the presence of two distinctive lineages of the fungus may be the cause of the severe disease symptoms over the past 15 years. In spring 2003, 268,000 of 3 million acres of Douglas-fir had obvious symptoms of Swiss needle cast in coastal Oregon. In general, symptoms decreased in 2003 as compared to 2002. The disease is also severe in localized areas in coastal Washington and in the Cascade foothills of Oregon and Washington. Thinning of young trees has been recently shown to result in improved volume growth of severely affected trees. Research on Swiss needle cast continues at Oregon State University and the PNW Research Station concerning growth impact, infection biology, nutrient imbalances, fungicide testing, and fertilizer and vegetation control.

Larch Needle Cast and Larch Needle Blight, *Meria laricis* and *Hypodermella laricis*

Hosts: Western larch

Larch needle blight and larch needle cast, which are reported as a complex because of their similar signatures as viewed from the air, increased from 261 acres reported in 2002 to approximately 1403 acres in 2003. This includes 457 acres mapped on the Wallowa-Whitman NF, 693 acres on the Wenatchee NF, and 113 acres on the Yakama Indian Reservation. New spots were also mapped on the Colville Reporting Area (34 acres), the Gifford-Pinchot Reporting Area (73 acres) and Mount Baker-Snoqualmie Reporting Area (33 acres). Concentrations of infections were quite localized and mainly involved dense thickets of seedlings and saplings. These foliage diseases were most severe in stands of western larch growing in moist grand fir and moist sub-alpine fir plant associations as well as in riparian areas.

Lodgepole Pine Needle Cast, *Lophodermella concolor*

Hosts: Lodgepole pine

Appearance of this needle disease on lodgepole pine is sporadic and strongly influenced by weather conditions. Infected trees will shed foliage prematurely, and vigor and growth may be reduced with successive years of infection. Trees are affected with heavy discolorations of the lower crowns of lodgepole pine. Areas mapped as affected by lodgepole pine needle cast in 2003 totaled 5,315 acres, down from the 7,006 acres reported in 2002. Over 50% was mapped on the Wallowa-Whitman Reporting Area, and 20% mapped on the Rogue River Reporting Area, the bulk occurring on federal lands.

Douglas-fir Needle Cast, *Rhabdocline pseudotsugae*

Hosts: Douglas-fir

There was above normal occurrence of Douglas-fir needle cast in Douglas-fir in northeast Washington, especially the Republic area.

Non-Native Diseases

Port-Orford-Cedar Root Disease, *Phytophthora lateralis*

Hosts: Port-Orford-cedar

Port-Orford-cedar root disease continues to cause mortality of Port-Orford-cedar on sites with conditions favorable for spread and establishment of the causal pathogen. The annual aerial survey reported evidence of the disease on 8,701 acres, .89 TA in 2003, up from 5,971 acres, 1.2 TA in 2002. The vast majority of the reported mortality was mapped on private land within the Coos-Douglas Reporting Area (5,060 acres, 1.03 TA). Private lands within the Siskiyou Reporting Area had the second highest reported levels of mortality (3,173 acres with 1.03 TA).

Hosts growing in riparian areas, swamps, drainage ditches, and low-lying areas downhill from roads suffer by far the greatest impacts. Trees on about 9 percent of the area within the limited range of Port-Orford-cedar are affected. Management activities such as road gating during the wet season, washing vehicles before they enter uninfested areas, and roadside sanitation treatments help slow the spread of the pathogen.

A major cooperative effort between the Forest Service, Bureau of Land Management, and Oregon State University to develop Port-Orford-cedar that is resistant to *P. lateralis* now has results. In fall 2002, the first operational collections of resistant seed from the Dorena containerized seed orchard occurred. Sowing will occur in winter 2002 / 2003 and seedlings will be available for outplanting in the spring of 2004. Approximately 26,000 resistant seedlings will be planted in 2004, many of them in the 500,000 acre area burned in the 2002 Biscuit fire.

White Pine Blister Rust, *Cronartium ribicola*

Hosts: Western white pine, sugar pine, whitebark pine

Cronartium ribicola was introduced to the west coast in 1910. Its impacts include top-kill, branch flagging, and tree mortality. While much of the mortality associated with this disease occurred earlier in the century, its impacts are still great in wild populations of five-needled pines throughout their range. Locally, this disease, in combination with mountain pine beetle, still kills many host trees. Of particular concern are the effects of blister rust in whitebark pine at high elevations in the Cascades and in the Blue and Willowa Mountains and in sugar pine in southwest Oregon where about 45 percent of stands with host components are affected.

Insect and Disease Conditions - 2003

An attempt was made to identify areas symptomatic of blister rust through aerial survey beginning in 1994. Blister rust is known to occur extensively throughout the range of susceptible host type. Observers mapped approximately 13,500 acres in 2003, down from 19,000 acres in 2002. This includes major locations on the Wallowa-Whitman (5,083 acres), the Wenatchee (4,906 acres) and the Yakama Indian Reservation (1,830 acres). With the exception of blister rust in whitebark pine (which grows at higher elevations and in more open conditions), blister rust is very difficult to detect from the air. In Oregon, the most heavily mapped area was on the Wallowa-Whitman National Forest in whitebark pine, especially within the Eagle Cap Wilderness.

A rapid assessment method for estimating stem girdling rates to determine survival rates in young, rust-resistant western white pine plantations is planned for Regions 1 and 6.

Diseases of Unknown Origin

Sudden Oak Death, *Phytophthora ramorum*

Hosts: Hosts: tanoak, evergreen huckleberry, Pacific rhododendron

Phytophthora ramorum, the causal agent of Sudden Oak Death (SOD), was first discovered in Oregon by aerial survey in July 2001. As of January 2003, *P. ramorum* had been found at 21 forest sites (48 acres) near Brookings, Curry County, Oregon. During 2003, through numerous ground and aerial surveys, 12 new infested sites were discovered, and infected trees were found near the perimeter of 8 of the previously known infested sites. These new occurrences of *P. ramorum* added approximately 12 acres to the area undergoing eradication treatments. Most infected trees discovered in 2003 occurred within 200 meters of eradication sites. Three new infested sites were found 1.8, 0.8, and 0.25 miles from the nearest eradication site. Each year new sites tend to occur either very close to, or in a northerly direction from, previously known infestations (following the prevailing rainy season wind direction), suggesting aerial or vector spread. The infested sites occur on federal, private industrial and private non-industrial forestlands.

As a result of the 2003 surveys, the Oregon Department of Agriculture will increase the area under regulation for SOD from 9 mi² to 11 mi². The Oregon Department of Agriculture and the USDA Animal Plant Health Inspection service have established quarantines to protect areas within and outside of Oregon from the artificial spread of *P. ramorum*. Whole plants and some plant parts of the known affected species and associated soil are covered by these regulations.

Efforts to eradicate the pathogen from Oregon forests are continuing on approximately 60 acres of forest within this area. Infested areas delineated based on canker, tip blight, and leaf-spot symptoms. Treatment areas include a 50- to 100-foot buffer. All host materials are cut, piled and burned. Broadcast burns are done when feasible. On private lands, stumps are treated with herbicide to prevent sprouting. Extensive post-treatment monitoring is ongoing within the treated areas as well as in forests adjacent to treated sites.

Some nursery surveys for SOD have been completed in Washington, with no findings to date.

Animal Damage

Bear Damage, *Ursus americanus*

Hosts: Douglas-fir, western hemlock, Port-Orford-cedar

Loss of crop trees and reduction in value due to feeding by bears is a widespread problem in the Pacific Northwest. Bark peeling by black bear can kill trees, and result in stain, decay, breakage, and loss of value in trees that are not killed outright. Bears are attracted to thinned plantations and feed on trees from April to July. Bears tear off large patches of bark and feed on the cambium, and can damage many trees per day. Loss in merchantable volume in Douglas-fir trees that have suffered past bear damage can run 7 to 10 percent.

Acres with trees killed by bear as interpreted by aerial observers increased from 145,000 acres in 2002 to over 321,600 acres in 2003. This includes an increase in Oregon from 32,500 acres to 60,300 acres, and an increase in Washington from 112,500 acres to 261,300 acres. The vast majority of recorded damage was mapped in Western Oregon and Western Washington. The aerial survey only detects trees that have been recently killed by bear feeding. A ground survey on Quinault lands found that at least 3.5 times as many Douglas-fir trees are damaged as killed.

Noteworthy areas include: Southwestern Washington, 29,062 acres, 1.72 TA, Gifford-Pinchot, 91,635 acres, 2.19 TA, Mount Baker-Snoqualmie, 74,163 acres, 2.90 TA, Olympic, 37,079 acres, 1.49 TA, Northwestern Oregon, 23,446 acres, .78 TA, Willamette, 15,607 acres, .77 TA, and Quinault 11,905 acres, 2.15 TA.

Nursery Insects and Diseases

Black Vine Root Weevil, *Otiorhynchus sulcatus*

Hosts: Aspen, gooseberries, red-osier dogwood, roses, willow

Root weevil larvae were found in containerized stock from the 2002 crop during extraction in January 2003. All had been grown in the same area in one shadehouse. The 2003 monitoring program was expanded to include the shadehouse. Monitoring was conducted weekly from April through September, but no evidence of root weevils were found in any of the stock. When the stock was extracted for shipping, there was no evidence of root weevils. Infestation may have been avoided by increased attention to cleaning in the container growing area and less holdover stock than in previous years.

Cranberry Girdler, *Chrysoteuchia topiaria*

Hosts: Conifers

Insect and Disease Conditions - 2003

Monitoring for the girdler was done with the standard pheromone trap system. We did not have any counts through the season that exceeded the threshold of more than two moths per trap per day. Inspection of seedlings in the seedbeds did not reveal any damage on the plants at the end of the growing season. No chemical treatments were made. Douglas-fir and Abies seedlings packaged to date have had a very minimal amount of damage.

Lygus Bug, *Lygus hesperus*

Hosts: Conifers

Monitoring with yellow stick traps showed extremely high numbers of *Lygus* in early June. We began applying asana in mid June and made nine applications at 10 to 14 day intervals. All 1-0 conifer species were treated; as a result, *Lygus* damage was minimal.

Thrips

Hosts: Ash

Thrips caused damage to leaves of containerized ash seedlings growing in a shadehouse in early summer. Growth was inhibited during the infestation but there was no mortality. The affected seedlings were treated with Safer soap. Their vigor improved significantly after treatment.

Damping-off, *Fusarium* spp. and *Pythium* spp.

Hosts: Conifers

Damping-off diseases had a profound impact on diverse species being grown as bare root plants. Losses are estimated at about 40,000 trees in *Alnus*, *Cornus*, and *Betula* species. In conifers, Larch was heavily impacted by damping off. Damage is estimated at 400,000 trees.

Fusarium Root and Hypocotyl Rot, *Fusarium* spp.

Hosts: Conifers

Fusarium damage was evident in most conifer species late in the growing season. Damage levels appeared to be normal for our growing conditions. No reductions in net seedlings are anticipated.

Leaf Spots and Blights, *Alternaria* spp. and *Phoma eupyrena*

Hosts: Bitterbrush and mountain mahogany

Severe leaf necrosis occurred following a period of extremely hot weather during the summer. The opportunistic pathogenic fungi *Alternaria* and *Phoma eupyrena* were associated with leaf spots and large blotchy areas of dead tissue. Damage to leaf tissue caused by the heat, and possibly lack of water was believed to have created conditions that were favorable for disease. The damage was seen only in young, containerized stock growing in a shadehouse. Bare root and containerized stock growing outdoors were not affected.

Seed Orchard Insects and Diseases

Black Vine Root Weevil, *Otiorhynchus sulcatus*

Hosts: Western larch

O. sulcatus was found to be fairly wide spread in western larch growing in large containers causing tree stress and occasional mortality. Nematodes were applied in the spring for population control with limited success. Esfenvalerate was applied while adult weevils were active above ground. An attempt was made to obtain cryolite bait (A.I. – sodium aluminofluoride, a non-organic mineral) to compare treatment efficacy, but the material was out of stock and apparently produced infrequently.

Cranberry Girdler, *Chrysoteuchia topiaria*

Hosts: Whitebark pine

Cranberry girdler caused damage to white bark pine grown in 10 in³ containers in a greenhouse. Container racks were located on pallets on the floor. The incidence of damage was 2-3%.

Cone Worm, *Dioryctria* spp.

Hosts: Western white pine

Evidence of *Dioryctria* was evident in older western white pine rust runs which were being used for controlled crosses for resistance breeding. Year old control cross conelets were treated to prevent infestation. *Dioryctria* was also found on three year old white bark pine as a tip borer. Leader mortality was wide spread.

Grey Mold, *Botrytis cinerea*

Hosts: Port-Orford-cedar

Port-Orford-cedar seedlings growing in 10 in³ cells in a greenhouse have shown scattered pockets of *Botrytis*. These seedlings are used for testing resistance to the root disease caused by *Phytophthora lateralis* and therefore there is minimal tolerance for the occurrence of *Botrytis*. Cultural measures were employed to minimize the occurrence of the disease. Regular monitoring of seedlings occurred and seedlings were treated to prevent further development and spread if evidence of the disease appeared.

Larch Needlecast, *Meria laricis*

Hosts: Larch

The incidence of *Meria* on western larch growing in large containers was greatly reduced through cultural means, namely protection from spring rains during and following bud burst. There were scattered occurrences of the disease along the edges of containerized seed orchard trees subjected to rain drift. Because of the limited distribution and spread potential, no treatment was deemed necessary.

Needle Cast, *Lophodermium* spp. and *Lophodermella* spp.

Hosts: Western white pine and sugar pine

Needle cast was wide spread in three year old and older western white pine and sugar pine growing in rust frames. In some cases this caused difficulty in scoring disease resistance to *Cronartium ribicola*. Due to the large build up of inoculum on site in older trees, new grafts destined for R6 field seed orchards and young rust resistance runs were treated to prevent disease spread from older trees.

Phytophthora Root Rot, *Phytophthora* spp.

Hosts: western white pine and sugar pine

The occurrence of *Phytophthora* root rot was limited in 2003, occurring in only a few rust frames and causing minimal mortality.

Strawberry Vine Weevil, *Otiorhynchus ovatus*

Hosts: Port-Orford-cedar

Insect and Disease Conditions - 2003

Root damage attributed to *O. ovatus* was found sporadically in Port-Orford-cedar seedlings grown in 10 in³ containers in a greenhouse. No action was taken due to their limited occurrence. Some of the damage may have been caused by cranberry girdler.

Stem Canker, *Seiridium cardinale* and others

Hosts: Port-Orford-Cedar

Several groups of Port-Orford-cedar growing in large containers in one shadehouse were severely damaged by stem cankers. Pathogens associated with the damage included *Seiridium cardinale* and possibly an unidentified species of *Phomopsis*. Several periods of extremely hot weather during summer combined with overhead watering may have created conditions conducive for disease. The affected plants were removed and destroyed.

Unidentified Defoliator

Hosts: Port-Orford-Cedar

Defoliation occurred on newly germinated Port-Orford-cedar seedlings grown in the greenhouse. Significant to severe mortality occurred in several families being grown for disease resistance screening. Examination of the seedlings found only one 2 mm long inchworm-like caterpillar which was never identified. Due to the developing severity of the defoliation, affected and adjoining tables were treated and no further defoliation was observed.

Tip Blight, possibly *Sphaeropsis sapinea* and *Phoma eupyrena*

Hosts: Western white pine

Three-year-old containerized western white pine seedlings were damaged by tip blight, possibly caused by *Sphaeropsis sapinea* and *Phoma eupyrena*. The symptoms became apparent in early spring as terminal buds were opening. The diseased seedlings were scattered among healthy trees in the planting. Seedlings of other ages and species were not affected. The seedlings were treated by removing diseased shoots.

Summary Table

Insect or Disease	State	Ownership	Acres Infested	Volume Killed (m3)	# Trees Killed
Douglas-fir Beetle	OR	federal	12,200	1,745,400	9,900
		state	300	80,200	300
		private	2,300	316,400	1,600
	WA	federal	43,200	10,983,800	93,000
		state	16,900	3,152,400	25,000
		private	22,800	4,177,300	33,900
Fir Engraver	OR	federal	205,300	11,341,500	202,700
		state	14,800	610,700	8,300
		private	88,800	3,628,100	75,500
	WA	federal	126,500	13,358,000	241,800
		state	44,000	3,698,000	71,100
		private	126,700	11,264,300	216,900
Mountain Pine Beetle	OR	federal	130,300	3,673,900	259,500
		state	32,700	1,844,000	112,100
		private	23,000	247,000	18,100
	WA	federal	160,800	13,248,400	909,100
		state	29,700	3,112,100	235,100
		private	33,100	1,646,200	116,500
Western Spruce Budworm	OR	federal	4,300	0	0
		state	100	0	0
		private	200	0	0
	WA	federal	127,400	0	0
		state	7,600	0	0
		private	3,800	0	0

Insect and Disease Conditions - 2003

Insect or Disease	State	Ownership	Acres Infested	Volume Killed (m3)	# Trees Killed
Western Pine Beetle	OR	federal	3,100	235,600	1,600
		state	1,800	109,000	1,000
		private	1,400	73,300	600
	WA	federal	9,900	507,300	8,900
		state	56,900	4,973,900	73,700
		private	56,700	3,753,100	58,400
Douglas-fir Tussock Moth	OR	federal	100	0	0
		state	0	0	0
		private	700	0	0
	WA	federal	0	0	0
		state	0	0	0
		private	0	0	0