



## Pacific Northwest Region

# 2002 Forest Insect and Disease Conditions Report

### Indigenous 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.

Combined activity in all host types increased 168% from 2001 levels. In 2001, 211,129 acres with an average of 5.68 trees/acre (t/a) were reported compared with 354,541 acres affected with an average of 5.32 t/a in 2002. Significant increases across all ownerships were reported in all host types with the exception of a decrease in reported mortality in western white pine.

Acres affected in the whitebark pine type increased significantly from 18,891 acres (3.07 t/a) in 2001 to 32,881 acres in 2002 (3.40 t/a). A little more than half the affected acres were mapped in wilderness areas of Washington, primarily within the Pasayten (12,930 acres) and Alpine Lakes (2,690 acres) wilderness areas. An additional 10,500 acres were mapped on non-designated National Forest lands in Oregon and Washington. Ascertaining exact cause of damage is difficult from an aerial platform; however, many acres of mapped damage within the Okanogan, Wenatchee and Wallowa-Whitman Reporting Areas were also mapped as infected with white pine blister rust.

Significant increases of acres mapped in the ponderosa type occurred on all ownerships. In 2001, 36,341 acres (1.34 t/a) were mapped, compared with 103,958 acres (1.47 t/a) in 2002. Most significant increases were reported on the Okanogan, Deschutes, Ochoco, Yakama and Malheur Reporting Areas, accounting for more than 61% of the mapped damage Region-wide.

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.

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Activity in western white pine decreased from 16,362 acres (1.23 t/a) in 2001 to 4,087 acres (0.54 t/a) in 2002. Decreases occurred across all ownerships except for slight increases on State of Washington lands and within the Eagle Cap Wilderness. 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.

Tree mortality in lodgepole pine increased across all ownerships except for a slight decreases on State of Washington lands and on State of Oregon lands. Total reported affected acres increased for the fifth straight year from 137,516 (7.79 t/a) acres in 2001 to 208,948 (7.75 t/a) acres in 2002. The vast majority of mortality (98%) was reported on federal and tribal lands. Approximately 38% of the acres affected were reported on the Okanogan National Forest with mortality intensities averaging 10.8 t/a. On the Warm Springs Indian Reservation mortality intensities nearly tripled from 3.9 t/a in 2001 to 11.5 t/a in 2002 on 19,800 acres. Other heavily infested areas included the Deschutes (35,000 acres), Fremont (32,100 acres), Mt. Hood (11,500 acres), and Wenatchee (11,800) National Forests. Approximately 20% of the recorded affected acres were mapped within National Parks and Wilderness areas.

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

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### 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.

Douglas-fir beetle activity was detected on slightly fewer acres Region-wide, but at nearly half the intensity compared with 2001 levels. Activity was reported on 142,035 acres with an average of 1.49 t/a in 2002 compared with 147,123 acres with an average of 2.73 t/a in 2001. In Oregon mapped acres nearly doubled from 26,970 acres in 2001 to 50,693 acres in 2002, intensities were nearly the same as last year at an estimated 1.28 t/a. Decreases of significance occurred on all ownerships except private lands in Washington and Oregon, which had significant increases in reported mortality. Those areas with greater than 10,000 acres include the Wallowa-Whitman (29,419), Wenatchee (12,643) and Colville (23,204 National Forests, the Yakama Indian Reservation (10,581) and the Glenwood Reporting area (10,903). Areas with most significant increases from 2001 levels include Federal and Private lands within the Umatilla and Wallowa-Whitman reporting areas and private lands within the Glenwood reporting area. Predisposing tree stresses caused by repeated years of defoliation by western spruce budworm, Douglas-fir tussock moth, overstocking and droughty conditions may result in relatively high levels of Douglas-fir beetle activity in the next few years.

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### Fir Engraver, *Scolytus ventralis*

Hosts: True firs

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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.

Fir engraver activity increased from 20,291 acres (1.75 t/a) mapped in 2001 to 161,229 acres (0.91 t/a) in 2002. Increases occurred across all ownerships throughout the Region. Once again, the majority (56%) of mapped mortality occurred on Forest Service lands. Approximately 12% of the mapped acres were on tribal lands and 24% were on private lands within the Region. Most heavily affected areas include the Wallowa-Whitman (28,590 acres at 0.77 t/a), Umatilla (26,227 acres at 0.78 t/a), Wenatchee (19,175 acres at 0.73 t/a) and Colville (12,684 acres at 1.12 t/a) National Forests. Additionally, 16,403 acres (0.76 t/a) were mapped on the Yakama Indian Reservation (a four-fold increase from 2001). On private lands, highest levels of mortality were recorded on lands within the Umatilla, Wallowa-Whitman, Colville, Glenwood and Northeastern Washington Reporting areas.

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### 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.

Pine engraver activity increased over 2001 levels from 1,725 acres mapped to over 9,500 acres in 2002. The majority of the mortality (73%) was mapped on the Rogue River (3,552 acres), Yakama (1,827 acres) and Glenwood (1,605 acres) Reporting Areas. Fifty-three percent of the affected acres mapped were private lands of which two thirds were in Oregon and the remaining in Washington.

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### 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 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 for the third straight year from 18,602 acres (1.21 t/a) in 2001 to 39,000 acres (1.07 t/a) in 2002, the highest level in seven years. Increases were noted in both large and pole-sized pines. Approximately 77% of the mapped mortality occurred in Oregon, which accounted for only 11% of the Region-wide mapped mortality in 2001. Areas most heavily affected were mapped on BLM and private lands within

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the Rogue River Reporting Area. This accounted for 54% of the mapped acreage Region-wide. Other private lands with significant number of acres mapped were within the Glenwood reporting area (2,174 acres). Forest Service lands most heavily affected were on the Ochoco (992 acres), and Rogue River (1,080 acres) National Forests.

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### 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 increased for the fourth straight year from approximately 24,900 acres (4.14 t/a) in 2001 to over 27,600 acres (11.52 t/a) in 2002. The vast majority (76%) of mortality occurred on Forest Service lands within the Okanogan Reporting Area. Over 5,700 acres of the mortality was mapped in the Pasayten Wilderness. Other reporting areas with significant mortality included the Wenatchee National Forest and North Cascades National Park. In other areas, spruce beetle activity was lightly scattered in the host type.

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### Ponderosa Pine Needle Miner, *Coleotechnites* sp.

**Hosts:** Ponderosa pine

Reported needleminer damage declined for the fourth straight year following the 1998 outbreak of over 24,000 acres. In 2001 about 500 acres were mapped as compared to 15 acres in 2002. The 15-acre polygon was mapped on private lands in northeastern Washington.

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### 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.

The Douglas-fir tussock moth outbreak, which began in 1999, continued into 2002. During the 2002 aerial detection survey approximately 16,650 acres of defoliation were mapped, compared to 52,841 acres in 2001, and 219,774 acres in 2000. Most (98%) of the 16,650 acres of defoliation in 2002 occurred on the Umatilla and Wallowa-Whitman Reporting Areas. Mapped intensities varied from 12,329 acres in the light category to 4,211 acres in moderate and only 115 acres in the heavy category. The 290 acre outbreak detected on Tekoa Mountain in

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Northeast Washington in 2001 subsided with only 47 acres of defoliation visible to aerial surveyors in 2002.

Monitoring was continued in 2002 on the areas of the Wallowa-Whitman and Umatilla National Forests that were treated with TM BioControl-1 in 2000. Defoliation, top-kill, and mortality were nearly absent. All tree mortality was caused by a combination of defoliation and Douglas fir beetles or fir engravers.

Monitoring on the Okanogan National Forest continued in 2002 on the evaluation plots that were established prior to treatment with TM-BioControl-1 in 2001. One year after treatment sampling of larval populations on treated and untreated plots suggests that the tussock moth population crashed in 2002 due to natural causes. Defoliation, top-kill, and tree mortality were nearly absent in 2002.

The Douglas-fir Tussock Moth Early Warning System confirms that populations continued to decline in 2002. Trap catches dropped to endemic levels in most areas. Average number of moths trapped for the Region decreased from approximately 6 moths/trap to 1 moth per trap. The highest trap catches occurred in south central Oregon around the Fremont National Forest; however, these also represented a decline from an average of 14 moths/trap in 2001 to 6 moths/trap in 2002.

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### 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 aerially visible defoliation decreased from approximately 272,114 acres in 2001 to 58,463 acres in 2002. Approximately 32,200 acres were reported in the light category, 15,350 in the moderate and 10,900 acres in the heavy category. Most notable decreases were observed on the Yakama Indian Reservation, which plummeted from 116,242 acres in 2001 to approximately 1,200 acres in 2002. A decrease from 21,217 acres reported in 2001 to less than 2,600 acres in 2002 was reported for the Gifford-Pinchot Reporting area. Approximately 89% of the defoliation was recorded within the Wenatchee Reporting area: 32,552 acres in the William O. Douglas wilderness, 3,946 acres in the Norse Peak wilderness and 13,907 acres on non-designated Forest Service lands of the Wenatchee National Forest. New areas of defoliation were recorded on the Colville (246 acres) and Malheur (1,896 acres) National Forests.

### 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 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.

Areas of defoliation totaling 2,390 acres were detected in 2002, the first recorded outbreak since 1992, on: Alpine Lakes Wilderness, Wenatchee National Forest, Mt. Baker-Snoqualmie National Forest, and State and private lands within the Wenatchee reporting area.

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### Phantom Hemlock Looper, *Nepytia phantasmaria*

**Hosts:** Douglas-fir and western hemlock

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, compared with 2,320 acres in 2001. All of the defoliation occurred on the Mt. Baker-Snoqualmie reporting area between Spada Lake and Lake Roesiger in Snohomish county.

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### Western Hemlock Looper, *Lambdina fiscellaria lugubrosa*

**Hosts:** Western hemlock, and associated confers.

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

Acres defoliated in Washington State more than doubled from 17,352 acres in 2001 to over 35,200 acres in 2002 in the areas of Mt. Baker-Snoqualmie National Forest, North Cascades National Park, and State and private lands in the Mt. Baker-Snoqualmie reporting area.

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## Non-indigenous 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 in the Region. A total of 82,429 acres were affected in 2002, compared to 50,824 acres in 2001, and 6,300 acres in 2000. Total Acres by state were: Washington – 47,191 acres affected, and Oregon – 35,238 acres affected. Areas with the larger acreages were the Umatilla, Wallowa-Whitman and Wenatchee National Forests. In addition, over 5000 acres each were mapped for the Ochoco National Forest and the Olympic National Park. Smaller acreages were on the Gifford Pinchot, Mount Baker-Snoqualmie, and Mount Hood National Forests. Favorable environmental conditions during the winter and spring of 2001 and 2002 supported increased levels of activity. A change in aerial survey signatures may also have increased observer recognition.

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### 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.

In Washington, one Gypsy moth eradication project totaling 560 acres was conducted. No gypsy moths were caught in the treatment area in 2002. All gypsy moths caught elsewhere in the state in 2002 were single or double adults in a trap and were identified as the European strain. There are no eradication projects planned for 2003.

In Oregon, no eradication projects were conducted in 2002. However, during the pheromone trapping in 2002 one gypsy moth trap in Fisher, Oregon caught 3 males of the European strain. Subsequent ground searching found fresh egg masses on the nearest house. Oregon is

planning an eradication project in this area encompassing 706 acres of private and Siuslaw National Forest land.

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### Larch Casebearer, *Coleophora laricella*

**Hosts:** Western larch

After years of negligible occurrence, larch casebearer-caused defoliation of western larch slowly increased to 15,836 acres in 1999. Since then defoliation has declined to approximately 248 acres in 2002; three polygons totaling 241 acres were mapped on the Mt. Hood National Forest and an additional 7 acres were mapped on the Umatilla National Forest.

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## Indigenous Diseases

### Annosus Root Disease, *Heterobasidion annosum*

**Hosts:** True firs, ponderosa pine, western hemlock

Annosus root disease causes losses in many partially cut white and grand fir stands in southern and eastern Oregon and eastern Washington. Damage is often especially severe in subalpine fir, and is associated with smaller stumps than other true fir species. Mortality is high where annosus root disease and fir engravers operate as a complex. The Region Six Current Vegetation Survey requires examination of cut stumps. This has led to increased reporting and awareness of annosus root disease on many national forests. In eastern portions of the Region, where many stands were cut 10-20 years ago, trees surrounding cut stumps are dying. Disease severity is expected to increase with time. Annosus root disease was observed with increasing frequency in stands, which are predominantly ponderosa pine on drier sites in eastern Washington and Oregon, and in true fir species in mixed conifer, and true fir stands throughout southwest Oregon.

Reports of the disease in mountain hemlock and Pacific silver fir in high-elevation stands in the Cascade Range are also increasing. Annosus root disease in low-elevation western hemlock stands primarily causes butt rot. Impacts are considered low unless stands are managed at rotations greater than 120 years.

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### Armillaria Root Disease, *Armillaria ostoyae*

**Hosts:** Conifers

The most serious losses from this disease have occurred east of the Cascade Range in mixed conifer stands. Armillaria root disease continues to be the most severe root disease in northeastern Oregon. It is also the most commonly encountered root disease in eastern Washington. Mortality continues in both disturbed and undisturbed stands. True firs and



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Douglas fir sustain the most losses. However, in localized areas, ponderosa pine mortality is significant.

Disturbance and conversion to more susceptible hosts have caused this root disease to increase in occurrence and severity over historic conditions. The world's largest known root disease clone has been confirmed on the Malheur National Forest in eastern Oregon and is about 2400 acres. This clone and the adjacent associated Armillaria root disease complex is being investigated by scientists with the Pacific Northwest Research Station, and Oregon State University. A number of other large concentrations of Armillaria root disease are known throughout the Blue Mountains.

In mid- to high-elevation stands in the Cascades of southwestern Oregon, Armillaria root disease causes mortality of several conifer species. Mortality on lower slopes west of the Cascades and in the Coast Range is usually confined to younger, stressed trees. 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 controlling spread and mortality.

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### 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.

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### 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

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

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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. 2,309 acres of this complex were mapped during 2002, down from 4,341 acres mapped in 2001. All of the aerially detected damage occurred within the Rogue River and Siskiyou Reporting areas with all but 82 acres mapped on federal lands

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### 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.

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### 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 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.

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### Swiss Needle Cast, *Phaeocryptopus gaumannii*

**Hosts:** Douglas-fir

Swiss needle cast, a fungus disease of Douglas-fir foliage, is endemic in Douglas fir west of the Cascade Mountain crest. Over the last 15 years, distinctive yellowing, needle loss, and growth

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reduction have been observed in coastal Douglas-fir plantations. A combination of favorable climate, plantation age, and genetics may be the cause of severe disease symptoms seen in recent years.

In spring 2002, approximately 387,000 acres of discolored Douglas fir along the Oregon coast were mapped by a special aerial survey. Surveys were also conducted during the springs of 1996 through 2001. An overall decrease in affected acreage and intensification of the affected areas has been detected. Estimates of affected acreage for all years, however, are conservative since mapped acres represent only those areas with obvious symptoms; ground surveys indicated that Swiss needle cast was present in all Douglas-fir stands throughout the survey area.

Following three years of special surveys for Swiss needle cast, Washington Department of Natural Resources elected not to conduct surveys in 2001 and 2002. Although the timing for Swiss needle cast surveys was not optimum, over 87,300 acres were mapped: which probably represents only some of the most severely affected stands.

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### Larch Needle Cast & Larch Needle Blight, *Meria laricis* & *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, declined from 5,600 acres reported in 2001 to approximately 260 acres in 2002. Fifteen acres were mapped on the Ochoco National Forest; 133 acres on the Wallowa-Whitman National Forest, 61 acres in the Strawberry Mountain Wilderness of the Malheur National Forest and 52 acres were reported on private lands within the Wallowa-Whitman Reporting Area. 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.

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### 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. Over 78% of the trees with heavy discolorations of the lower crowns of lodgepole pine, typical of lodgepole pine needle cast, were detected on the Gifford-Pinchot and Mt. Hood Reporting Areas, the bulk occurring on federal lands. Areas mapped as affected by lodgepole pine needle cast in 2002 totaled 7,006 acres, up from the 5,235 acres reported in 2001.

## 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.

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## Non-indigenous 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 5,971 acres (1.2 t/a) in 2002, down slightly from the 6,300 acres reported in 2001, (0.8 trees/acre). All of the reported mortality occurred within the Rogue River, Siskiyou and Coos-Douglas Reporting Areas. 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.

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### 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.

Observers mapped approximately 19,000 acres of symptoms in 2002 compared with 14,800 acres in 2001. 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. Approximately 89% of the reported acres mapped Region-wide fell within the Wenatchee, Okanogan and Gifford-Pinchot National Forests. In Oregon, the most heavily mapped area was on the Wallowa-Whitman National Forest, especially within the Eagle Cap Wilderness.

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## Diseases of Unknown Origin

### Sudden Oak Death, *Phytophthora ramorum*

**Hosts:** tanoak, evergreen huckleberry, Pacific rhododendron

Sudden oak death, caused by *Phytophthora ramorum*, was detected in Curry County Oregon in July 2001 during a special aerial survey. Nine sites, ranging in size from less than one acre to approximately 12 acres and totaling 40 acres were confirmed northeast of Brookings, Oregon. The Oregon Department of Agriculture designated a 9-square mile regulated zone around the confirmed sites. The affected area includes federal, private industrial, and private nonindustrial forestlands. Tanoak (*Lithocarpus densiflorus*), evergreen huckleberry (*Vaccinium ovatum*), Pacific rhododendron (*Rhododendron macrophyllum*), Oregon myrtle (*Umbellularia californica*), cascara (*Rhamnus purshiana*), salmonberry (*Rubus spectabilis*), and poison oak (*Toxicodendron diversiloba*) are confirmed hosts in Oregon.

In 2002, two aerial surveys were done to detect recent tanoak mortality. The survey in July covered the majority of the tanoak type in Oregon; approximately 1.8 million acres were flown. The survey in October was targeted to high risk tanoak forests close to the coast; 250,000 acres in Oregon were covered. Ground reconnaissance associated with treating sites found in 2001 was also done. All recent tanoak mortality was examined. The presence of *Phytophthora ramorum* was confirmed using both standard isolation techniques and molecular probes. Twelve infested acres inside the regulated area were identified from the 2002 ground and aerial surveys. New finds were closely associated with sites identified in 2001. Sudden oak death was not identified outside of the regulated area established in 2001.

A cooperative program involving state and federal agencies as well as private landowners is currently underway to eradicate *P. ramorum* from the known sites. Sites are delineated based on canker, tip blight, and leafspot symptoms. Treatment areas include a 50- to 100-foot buffer. All host materials are cut, piled and burned. Broadcast burns are done when feasible. Extensive post-treatment monitoring is ongoing within the treated areas as well as in forests adjacent to treated sites.

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.

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## Animal Damage

### Bear Damage, *Ursus americanus*

**Hosts:** Douglas fir, western hemlock

Tree wounds caused by black bear result in stain, decay, and loss of value in trees that are not killed outright by girdling. Loss of crop trees and reduction in value due to feeding by bears is a widespread problem in the Pacific Northwest. Bears are attracted to thinned plantations and feed on trees from about April to July. Bears tear off large patches of bark and feed on the cambium, and can seriously damage many trees per day. Heavily damaged trees can suffer mortality directly, or growth loss and subsequent breakage. Loss in merchantable volume in Douglas-fir 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 68,937 acres in 2001 to over 145,000 acres in 2002. 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.

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## Nursery Diseases

### Aphids

**Hosts:** Conifers

Aphids were evident on Port-Orford cedar greenhouse plug stock at the tree improvement center beginning in late July. Seedlings were successfully treated with several applications of Safer soap. Little to no damage was evident at the end of the growing season.

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### Black Vine Root Weevil, *Otiorhynchus sulcatus*

**Hosts:** Engelmann spruce, western red cedar, aspen, roses, gooseberries, willow, dogwood

Monitoring at the nursery detected adult weevils around containerized western red cedar adjacent to the shadehouse and in one lot of containerized Engelmann spruce. The infested stock and adjacent area were treated twice with Lorsban to prevent the adult weevils from laying eggs. At packing additional damage was found in containerized aspen, roses, gooseberries, willow and dogwood that were grown in the shadehouse. The monitoring program will be expanded to the shadehouse in 2003.

Root weevil populations are normally a huge problem in the western larch containerized seed orchards at the tree improvement center. In 2002, beneficial nematodes were applied to potted

## Insect and Disease Conditions - 2002

stock in several greenhouses in the spring (during the larval stages). The treatment was fairly successful, with losses due to root damage of less than one percent in those greenhouses. However, with the mild winter this year, a more intense program of controlling both larvae and adults will be undertaken in the spring of 2003.

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### Cranberry Girdler, *Chrysoteuchia topiaria*

Hosts: Conifers

During the 2002 growing season, trapping of adult moths at the nursery did not yield significant numbers above the threshold. Seedling monitoring did not show significant damage on Douglas-fir or true fir species. No chemical treatments were made for girdler control this season. Damage levels observed during packing for these species were minor.

The monitoring program for cranberry girdler at the tree improvement center is not yet at maximum potential. Cranberry girdler damage in the western white pine and sugar pine rust runs was minimal in 2002. However, damage was evident in whitebark pine plug seedlings grown in a greenhouse close to a grassy area. There was approximately one to two percent loss in the crop. Seedlings are not normally grown in this greenhouse and the affected lots were moved to the normal seedling growing area toward the end of the season.

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### Lygus, *Lygus hesperus*

Hosts: Conifers

Trapping at the nursery showed high numbers of adult lygus insects, and damage thresholds were reached. Five treatments of Pydrin were made on the 1+0 crop from late June through August. The bug vac was not used this season because of time constraints and manpower availability. Lygus damage at the time of packing was negligible.

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### Botrytis Gray Mold, *Botrytis cinerea*

Hosts: Conifers

Botrytis was found contaminating one lot of incense cedar seed at the nursery. In the future incense cedar seed will be surface sterilized with bleach prior to sowing.

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### Cypress Canker, *Seiridium cardinale*

Host: Port-Orford-cedar

A few new stem cankers were found on containerized Port-Orford-cedar growing outdoors at the tree improvement center. Healthy stock is being moved indoors to avoid infection. Trials are continuing to evaluate the efficacy of fungicides for treatment.

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

Hosts: Conifers

The nursery experienced a very low rate of mortality. Conditions this spring favored the early development of the seedlings. Fumigation, early sowing, deep watering and delayed fertilization helped to control damping-off.

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### Fusarium Rot and Hypocotyl Rot, *Fusarium* spp.

Hosts: Conifers

A few seedlots of 1+0 bareroot Douglas-fir at the nursery showed losses due to *Fusarium* late in the growing season. Damage was estimated at an incidence rate of less than three percent. The disease was probably in response to wrenching and high temperatures during the growing season. Cooling by irrigation helped to limit losses. In addition, there were some losses due to *Fusarium* in eastside Douglas-fir, western red cedar and larch container stock.

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### Larch Needlecast, *Meria laricis*

Hosts: Larch

All western larch containerized stock is now kept under cover in greenhouses at the tree improvement center. In addition, one or two preventive treatments with chlorothalonil and propiconazole were done during the spring. *Meria* infection was still present, but at much lower levels as compared to the prior ten-year period.

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### Leaf Spots, *Marssonina* spp. and *Septoria* spp.

Hosts: Aspen

Leaf spots caused some damage to containerized aspen seedlings at the nursery. Aeration, sanitation and if necessary, fungicides, will be used to control these diseases in the future.

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### Needle Casts, *Lophodermella arcuata* and *Lophodermium nitens*

Hosts: Sugar Pine

Needle casts were abundant at the tree improvement center in 2002 and required treatment with chlorothalonil to prevent needle spotting and premature needle loss that would interfere with blister rust inoculation trials.

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## Phytophthora Root Rot, *Phytophthora* spp.

Hosts: Douglas-fir

Due to the continued lack of a treated water system at the tree improvement center, *Phytophthora* remains a problem in the western white pine and sugar pine rust runs. In 2002 there were minor infections in the 2+0 stock, but no treatment was undertaken. The area is being closely monitored and infection does not seem to be spreading.

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## Root Deterioration

Host: Sugar pine and western white pine

Deteriorated roots were found in some 2+0 sugar and western white pine seedlings at the nursery during the packing operation. Affected seedlings had few lateral roots, and corky basal swellings on the taproot just below the soil line. Existing lateral roots were often decayed. Affected western white pine seedlings were often stunted, chlorotic or dead, but sugar pines often had no aboveground symptoms. *Cylindrocarpon destructans* and *C. didymum* have been consistently associated with this damage but more testing will be needed to determine if these fungi are the cause of disease.

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## Rusts, *Puccinium* spp.

Hosts: Grasses

The nursery treated several species with propiconazole (Tilt) to control rust. Grasses are monitored through the growing season and treatment is made once pustules appear on the blades. Severe rust infections can destroy entire grass seed crops. Some seedlots of certain species can be treated up to three times during the course of a season.

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## Tip Blight, *Phoma* spp.

Hosts: Eastern and western white pines

Eastern white pine seedlings and newly grafted western white pines at the tree improvement center were damaged by tip blight, probably caused by *Phoma eupyrena*. The affected seedlings were treated with chlorothalonil and by removing diseased shoots and fallen needles. They will be treated with chlorothalonil again prior to outplanting.

## Summary Table

Insect or Disease	State	Ownership	Acres Infested	Volume Killed (m3)	# Trees Killed
<b>Douglas-fir Beetle</b>	OR	federal	39,600	6,740,000	51,900
		state	1,200	635,000	1,800
		private	9,800	1,367,800	11,100
	WA	federal	38,400	10,373,500	91,400
		state	21,800	2,828,700	21,500
		private	30,600	4,219,600	34,600
<b>Fir Engraver</b>	OR	federal	55,600	2,549,500	50,600
		state	3,700	191,200	2,400
		private	19,100	748,200	12,400
	WA	federal	34,800	2,001,400	37,300
		state	21,200	951,500	17,400
		private	26,800	1,438,100	26,900
<b>Mountain Pine Beetle</b>	OR	federal	124,100	6,724,400	456,200
		state	33,600	4,117,400	252,500
		private	24,600	614,900	47,200
	WA	federal	130,400	13,937,400	1,044,900
		state	26,100	744,500	55,800
		private	15,700	404,500	31,100
<b>Western Spruce Budworm</b>	OR	federal	1,400	0	0
		state	100	0	0
		private	400	0	0
	WA	federal	53,600	0	0
		state	1,800	0	0
		private	1,200	0	0
<b>Western Pine Beetle</b>	OR	federal	4,200	279,300	2,400
		state	13,700	1,204,400	15,500
		private	12,000	990,900	11,800
	WA	federal	1,200	63,400	1,300
		state	3,300	235,000	3,800
		private	4,500	457,400	6,700

Insect and Disease Conditions - 2002

<b>Insect or Disease</b>	<b>State</b>	<b>Ownership</b>	<b>Acres Infested</b>	<b>Volume Killed (m3)</b>	<b># Trees Killed</b>
<b>Root Diseases* (aerial survey data)</b>	OR	federal	300		
		state	200		
		private	5,600		
	WA	federal	100		
		state	100		
		private	600		
<b>Dwarf Mistletoes (no aerial survey data)</b>	OR	federal			
		state			
		private			
	WA	federal			
		state			
		private			
<b>Douglas-fir Tussock Moth</b>	OR	federal	8,800	0	0
		state	100	0	0
		private	500	0	0
	WA	federal	7,100	0	0
		state	0	0	0
		private	100	0	0

\* Note: Includes aerially detected areas of Port-Orford-cedar root disease, and generally defined "root disease" pockets as interpreted by the aerial observer. Signatures are difficult to discern, therefore actual acres affected are much higher.