



2001 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 and mortality may result. Some infestations have resulted in extensive mortality over large areas.

Combined activity in all host types doubled from 2000 levels. In 2001, 211,129 acres with an average of 5.68 trees/acre (t/a) were reported compared with 106,447 acres affected with an average of 2.88 t/a in 2000. Significant increases across all ownerships were reported in western white pine, ponderosa pine, whitebark pine and lodgepole pine types.

Acres affected in the whitebark pine type increased significantly from 3,607 acres (0.89 t/a) in 2000 to 18,891 acres (3.07 t/a) in 2001. A little less than half the affected acres were mapped in wilderness areas of Oregon and Washington, primarily within the Eagle Cap, Pasayten and Alpine Lakes wilderness areas. 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 6,847 acres (1.0 t/a) in 2000. Most significant increases were reported on the Okanogan, Fremont and Malheur Reporting Areas, accounting for more than 63% of the mapped damage Region-wide.

Activity in sugar pine increased for the third straight year from 1,714 acres in 2000 to 1,988 acres in 2001, but at a slightly lower reported intensity (0.14 t/a, compared with 0.18 t/a in 2000). 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 blister rust were mapped within these same Reporting Areas.

Activity in western white pine increased across all ownerships from 1,122 acres (1.15 t/a) in 2000 to over 16,300 acres (1.23 t/a) in 2001. Most significant increases were reported on Forest Service lands on the Okanogan, Colville and Panhandle National Forest Reporting Areas within the state of Washington.

Tree mortality in lodgepole pine increased across all ownerships except private lands. Total reported affected acres increased from 93,145 in 2000 (3.17 t/a) to 137,516 (7.79 t/a) acres in

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2001. A substantial increase in acres affected within the Okanogan (84,748) and Deschutes (15,498) Reporting Areas was recorded, accounting for approximately 72% of the Region-wide mapped mortality. General Forest lands of the Okanogan National Forest as well as lands within the Pasayten Wilderness Area continue to have the largest outbreaks.

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 that 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 more acres, at somewhat greater intensities for the fourth straight year. Activity was reported on 147,123 acres with an average of 2.73 t/a compared with 127,970 acres with an average of 1.67 t/a in 2000. Increased levels of activity were detected on all ownerships. Reported trees killed on the Colville Indian Reservation and Colville Reporting Area more than doubled over 2000 levels. Other reporting areas with significant levels of Douglas fir beetle activity included: Wallowa-Whitman, Wenatchee, Okanogan and Yakama Indian Reservation lands. Predisposing tree stresses caused by repeated years of defoliation by western spruce budworm, Douglas-fir tussock moth, and overstocking may result in relatively high levels of Douglas-fir beetle activity in the next few years.

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.

Fir engraver activity increased from 6,215 acres (0.79 t/a) mapped in 2000 to 20,291 acres (1.75 t/a) in 2001. Increases occurred across all ownerships with the exception of a slight decrease on state lands in Washington. The majority (64%) of mapped mortality occurred on Forest Service lands. Approximately 3,900 acres were mapped on the Yakama Indian Reservation and 2,200 acres on other private lands, the majority of which occurred in Oregon. Highest levels were reported within the Willamette and Wenatchee Reporting Areas. The Colville Indian Reservation was the only Reporting Area showing a significant decrease in acres of mapped mortality.

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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 2000 levels from only 247 acres to over 1,700 acres mapped in 2001. The majority of the mortality was mapped on the Rogue River and Okanogan Reporting Areas. Half of the affected acres mapped were private lands split between Oregon and Washington with the majority of the remaining acres mapped on Forest Service lands within the Okanogan and Wenatchee Reporting Areas.

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 from 6,993 acres (2.20 t/a) in 2000 to 18,602 acres (1.21 t/a) in 2001. Increases were noted mostly in large pines with relatively insignificant changes in pole-sized ponderosa pines from 2000 levels. Approximately 89% of the mapped mortality occurred in Washington. Areas most heavily affected on private lands were mapped within the Ochoco, Glenwood and Northeast Washington Reporting Areas. Forest Service lands most heavily affected were on the Ochoco, Okanogan and Panhandle National Forests. Approximately 4,200 acres on the Yakama and 1,400 acres on the Colville Indian Reservations were also mapped.

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 2001 was in Engelmann spruce. Reported acres affected increased for the third straight year from over 3,200 (1.18 t/a) in 2000 to approximately 24,900 (4.14 t/a) in 2001. Variability in foliar signatures and early needle drop combined with other mortality agents occurring in mixed stands creates difficult observational conditions. Due to these variables it is suspected that actual mortality is probably much higher

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than reported. The vast majority of mortality occurred on Forest Service lands within the Okanogan Reporting Area. Other reporting areas with significant mortality include, the Colville National Forest, Colville Indian Reservation and the Wenatchee National Forest. In other areas, spruce beetle activity was lightly scattered in the host type.

Ponderosa Pine Needle Miner, *Coleotechnites* spp.

Hosts: Ponderosa pine

Reported needleminer damage declined for the third straight year following the 1998 outbreak of over 24,000 acres. In 2000 about 1,900 acres were mapped as compared to slightly less than 500 acres in 2001. The majority of the mapped activity occurred on private lands in central Oregon. The crown symptoms of yellowing caused by larval mining seemed to be more pronounced along the edges of meadows and the surrounding lowland forests. Parasitoids are expected to continue to increase in number and eventually bring the needle miner population back in check.

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 2001. During the 2001 aerial detection survey approximately 52,840 acres of visible defoliation were mapped, compared to 219,774 acres mapped in 2000, and 21,180 acres mapped in 1999. Most of the 220,000 acres of defoliation in 2000 occurred on the Wallowa-Whitman Reporting Area. In 2001, the outbreak subsided in the Wallowa-Whitman Reporting Area where only 5,500 acres of defoliation were mapped: however, defoliation increased in new areas. Mapped intensities varied from 11,067 acres in the light category to 22,335 acres in moderate and 19,439 acres in the heavy category. Only 1,598 acres were mapped in the heavy category in 2000. The majority of the mapped acres were within the Umatilla Reporting Area; 17,579 acres on non-designated lands on the Umatilla National Forest, 27,180 acres in the Wenaha-Tucannon Wilderness Area and an additional 479 acres on private lands. Defoliation was also mapped on 900 acres of mixed ownership within the Okanogan Reporting Area and approximately 5,500 acres within the Wallowa-Whitman Reporting Area, the majority of which was on Forest Service lands. A new outbreak was detected and mapped on Tekoa Mountain in Northeast Washington (290 acres on private land)

Cocoon sampling and egg mass sampling in the fall of 2000 identified suboutbreak populations on portions of the Okanogan National Forest, and 16,690 acres were aerielly treated with TM BioControl-1, the viral insecticide of the DFTM. The treatment objectives were to prevent suboutbreak populations from reaching outbreak levels in 2002. Larval mortality in treated areas was 90.6% compared to 69.4% natural mortality in untreated areas. Defoliation did not exceed 10% in either treated or untreated areas. Monitoring will continue in 2002.

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Follow-up monitoring was done in 2001 on the areas of the Wallowa-Whitman and Umatilla National Forests that were treated with TM BioControl-1 in 2000. One year after treatment larval populations averaged 0.7 larval/1000 sq. in. in the treated areas compared to less than 3.0 larval per 100 sq. in. in the untreated areas. Defoliation, top-kill, and mortality were nearly absent in 2001 based on repeat monitoring of 2000 plots. No tree mortality occurred in treated and untreated analysis units on the Umatilla NF as a result of tussock moth defoliation in 2001. Tree mortality on the treated units on the Wallowa-Whitman NF amounted to 1.6% or less of re-sampled defoliation plot trees while tree mortality on untreated units was 0.2% or less. All tree mortality recorded on defoliation plots was caused by a combination of defoliation and Douglas fir beetles or fir engravers.

The Douglas-fir Tussock Moth Early Warning System indicates increases in trap catches in areas in south central Oregon, primarily within the Fremont National Forest.

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 on the east side 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 384,567 acres in 2000 to 272,114 acres in 2001. Approximately 100,606 acres were reported in the light category, 123,823 in the moderate and 47,685 acres in the heavy category. The increase in the light category and decrease in the heavy category from 2000 levels reflects a Northwest expansion of the outbreak toward Bumping Lake and the American River near the Yakima/Pierce county line in Washington State. Decreases occurred on all ownerships except within Mt. Rainier National Park, which went from 39 acres in 2000 to approximately 6,000 acres in the vicinity of Cowlitz Divide and Chinook River. New areas of visible defoliation were recorded in the Alpine Lakes and Pasayten Wilderness Areas. Reported acres of visible defoliation doubled in William O. Douglas and Norse Peak Wilderness Areas. Following are some noteworthy Reporting Area trends: Wenatchee 121,236 acres in 2000, 123,189 acres in 2001; Yakima 219,386 acres in 2000, 116,242 acres in 2001; Glenwood 13,113 acres in 2000, 4,880 acres in 2001; Gifford-Pinchot went from 29,763 acres in 2000 to 21,217 acres in 2001. Defoliation trends reported by land ownership in the Pacific Northwest are: Indian Nation lands reported 212,203 acres in 2000 compared to 115,648 acres in 2001; combined Federal lands increased for the third straight year from 125,892 acres in 2000 to 127,424 acres in 2001; State lands decreased from 18,448 acres in 2000 to 15,866 acres in 2001; and private lands decreased from 28,024 acres in 2000 to 13,176 acres in 2001.

Non-indigenous Insects

Balsam Woolly Adelgid, *Adelges piceae*

Hosts: True firs

The balsam woolly adelgid (BWA) 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 was observed on 50,824 acres in 2001, a significant increase compared with the reported 6,300 acres in 2000. Favorable environmental conditions during the winter and spring of 2001 supported increased levels of activity. Reporting areas with significant acreage of mapped damage include: Gifford-Pinchot in the vicinity of Mt. Adams, Mt. Baker-Snoqualmie, Okanogan, Umatilla, Wallowa-Whitman, Wenatchee, Willamette, Yakama Indian Reservation, Mt. Rainier and Olympic National Parks. Regionally, the vast majority of reported, visible activity occurred in subalpine fir stands of federally owned lands.

In 1998, a Forest Health Monitoring ground survey was initiated to confirm its occurrence and distribution in the host type throughout WA and OR; and determine effects on host species and changes in local ecosystems. A set of permanent plots indicate that environment plays a significant role in the fluctuations of BWA populations; and that BWA can result in significant ecological impacts on some sites over time by eliminating host species. The BWA survey has been completed in Oregon. Additional surveys in Washington are planned for 2002.

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 eradication project totaling 15 acres was conducted using ground applications of *Bacillus thuringiensis* var *kurstaki* (Btk). The gypsy moth survey in 2001 resulted in trap catches of 27 individuals. All were identified as the European strain. An aerial eradication project using Btk is planned for 2002 at one site with an estimated 560 acres.

In Oregon, two eradication projects were conducted using three aerial applications of Btk. One site in Ashland, encompassing an estimated 160 acres was treated in 2001 for European gypsy moth, and one 900- acre area in Portland was aerielly treated for Asian gypsy moth. No gypsy moths were caught in 2001 in the eradication areas. Seven European gypsy moths were trapped in 2001. No eradication projects are planned for 2002.

New introductions are expected to continue as long as European gypsy moth populations in the eastern United States persist and people move from the generally infested area to the Pacific Northwest. Asian gypsy moth introductions are expected to occur as trade increases with countries in the Pacific Rim.

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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 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 occurs in late July through early September. Approximately 4,500 acres were mapped in 2001 compared to 7,000 acres mapped in 2000. The vast majority of the observed damage in 2001 was mapped within the Wallow-Whitman (1,244 acres) and Warm Springs Indian Reservation (3,055 acres) Reporting Areas. In contrast, Mt. Hood (5,524 acres) and Colville (833 acres) Reporting Areas had the highest levels of reported activity in 2000.

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 re-foliate 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 surveys in early June (rather than later in the summer when region-wide survey is done).

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 sub alpine 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 that 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.

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 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.

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. 1830 acres of this complex were mapped during 2001 in the northern Oregon Cascade Mountains on the Willamette National Forest. Incidence was associated with mature noble fir stands located near ridgetops, 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 Mountains 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 Cascades, 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 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

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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 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 2001, 221,000 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, 1997, 1998, 1999 and 2000. 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 a survey in 2001. The USDA Forest Service conducted a special survey on lands managed by the Quinault Indian Nation. Approximately 16,000 acres were mapped in the severe category and 4,000 acres mapped in the moderate category. The USDA Forest Service conducted all surveys using a digitally assisted sketchmapping system under development. Special surveys for Swiss needle cast are in the planning stages for Oregon; no surveys are planned for Washington at this time.

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 declined from 10,539 acres reported in 2000 to approximately 5,600 acres in 2001. The Wallowa-Whitman, Colville, Wenatchee, and Warm Springs Indian Reservation Reporting Areas accounted for over 80% of the recorded activity Region-wide. Over 55% of reported activity occurred on private lands with the remaining areas mapped on federally managed lands. 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. Over 75% of the trees with heavy discolorations of the lower crowns of lodgepole pine, typical of lodgepole pine needle cast, were detected on the Wenatchee, Colville, Yakima, and North Cascades National Park Reporting Areas. Areas mapped as affected by lodgepole pine needle cast in 2001 totaled 5,235 acres, down from the 9,863 acres in 2000.

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-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 over 6,300 acres (0.8 trees/acre) in 2001 up slightly from the 5,200 acres (1.0 tree/acre) observed in 2000. 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* is showing very promising results.

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.

An attempt was made to aerially identify areas symptomatic of blister rust beginning in 1994. Blister rust is known to occur extensively throughout the range of susceptible host type. Observers mapped approximately 14,800 acres in 2001 compared with 3,153 acres in 2000. Blister rust symptoms are difficult to distinguish from the more easily observed effects of mountain pine beetle. 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. Over 70% of the reported acres mapped in 2001 fell within the Wenatchee and Willowa-Whitman National Forests. Lands within the Yakama Indian Reservation and Okanogan National Forest made up another 20% of the reported affected areas. An on-going study of

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whitebark pine stands in eastern Washington has found that 81 percent of the trees are alive, most mortality is more than 10 years old, and in trees greater than nine inches DBH. Thirty-four percent of the mortality is attributed to blister rust. The Colville National Forest is pruning western white pine plantations to reduce the incidence of lethal blister rust infections. Ground surveys indicate that blister rust is common in whitebark pine communities in the Seven Devils (Idaho), Elkhorn, and Wallowa Mountains, but scarce in the Strawberry Mountains, and other areas of northeastern Oregon. A recent survey of whitebark pine along the Pacific Crest National Scenic Trail on the Umpqua National Forest estimated that 50 percent of the whitebark pine was infected by white pine blister rust. Ninety percent of the infected trees had potentially lethal cankers. Topkill caused by blister rust was common.

Disease Origin: Unknown

Sudden Oak Death, *Phytophthora ramorum*

Hosts: 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 totaling approximately 40 acres and located in a 5-square-mile area two to three air-miles northeast of Brookings, Oregon have been confirmed. The sites, ranging in size from less than one acre to approximately 11 acres, include federal, private industrial, and private non-industrial forestlands. Tanoak (*Lithocarpus densiflorus*), evergreen huckleberry (*Vaccinium ovatum*), and Pacific rhododendron (*Rhododendron macrophyllum*) are affected.

A cooperative program involving state and federal agencies as well as private landowners is currently underway to eradicate *Phytophthora ramorum* from the known sites. Diseased and susceptible plants in the infested areas and a buffer zone surrounding each of the infested areas are being cut, piled and burned. Extensive post-treatment monitoring of infested sites and surrounding host type is being done.

The Oregon Department of Agriculture has established regulations to reduce the risk of artificial spread of sudden oak death. Movement of host material is prohibited from the infested Curry County properties and a buffer zone around them. Approximately 9 square miles are currently regulated. All plant and plant parts of the known affected species as well as those plant species that are found to be susceptible in the future and any associated soil are covered by this regulation. Host materials from any of the infested California counties are prohibited from coming into Oregon unless they have been kiln-dried, heat-treated or sterilized. Plant products from affected species that originate in counties adjacent to those infested also must be treated or inspected and certified as disease-free. Oak or other susceptible species products coming into Oregon from any other parts of California must have a certificate of origin supplied by the California Department of Food and Agriculture.

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.

On Quinault Indian Nation lands in northwestern Washington, the 2001 special aerial survey indicated that 40 percent of Douglas fir stands, and 26 percent of Douglas-fir acres, have various numbers of trees girdled by bears. Where bear-caused mortality occurred, it ranged from 0.4 to 118 trees per acre, with an average of 4 trees per acre. 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.

Nursery Insects and Diseases

Animal Damage -- Rabbit

Hosts: Conifers

There was no appreciable rabbit damage at the nursery this season.

Aphids

Hosts: Conifers

Monitoring detected a high level of aphids feeding on Port-Orford-cedar container seedlings at the Dorena tree improvement center (DTIC). Seedlings were treated with three successive treatments of Safer Soap.

Black Vine Root Weevil, *Otiorhynchus sulcatus*

Hosts: Engelmann spruce

Monitoring detected adult weevils around containerized stock adjacent to the shadehouse at the J. Herbert Stone Nursery (nursery) and in one lot of containerized Engelmann spruce. The infested spruce, plus all stock in the shadehouse and adjacent area were treated twice with Asana to prevent the adult weevils from laying eggs. The damage level detected at packing was significantly less than in 2000.

Insect and Disease Conditions - 2001

Botrytis Gray Mold, *Botrytis cinerea*

Hosts: Conifers

The nursery experienced a *Botrytis* infection that required treatment this season. In recent years *Botrytis* has been successfully controlled through cultural methods and fungicides have not been needed. This season the nursery sprayed once with a combination of Benlate and Botran. The percentage of cull due to *Botrytis* damage was very small.

Cranberry Girdler, *Chrysoteuchia topiaria*

Hosts: Conifers

Trapping for adult moths at the nursery did not show significant numbers above the threshold, however significant damage was observed on Douglas-fir and true fir seedlings. Both the true fir and Douglas-fir were treated with one application of chlorpyrifos. Damage levels detected at packing for these species were less than 5%.

Damage on western white pine detected in June 2001 at the DTIC that was initially thought to be caused by *Phytophthora* appeared to be caused by cranberry girdler. A monitoring program was implemented to detect adults in the future.

Cypress Canker, *Seridium cardinale*

Hosts: Port-Orford-Cedar

Cypress canker caused some additional stem cankers and branch mortality on Port-Orford-cedar at the DTIC. The infected material was removed by pruning and the trees were treated with chlorothalonil to prevent further infections. A series of trials are underway to determine precisely when infection is taking place and to evaluate the efficacy of fungicides for treatment.

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

Hosts: Conifers

The nursery experienced a little more than 5 percent mortality due to damping-off. This was probably due to climatic conditions during the early development of the seedlings. Spring 2001 was warmer and drier than normal. Fumigation, early sowing, deep watering and delayed fertilization helped control damping-off. *Pythium* damage was seen in a small patch of sugar pine plug+1's.

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

Hosts: Conifers

Insect and Disease Conditions - 2001

Several seedlots of western white pine that became infected in 2000 showed severe damage. The infection occurred when non-fumigated soil was inadvertently mixed into the seedbeds by the bedformer at the time of sowing. Douglas-fir and grand fir container stock at the nursery and seed orchard also experienced some losses due to *Fusarium*.

Larch Needlecast, *Meria laricis*

Hosts: Larch

Small cankers and branch dieback caused by *Meria* damaged a small number of plug+1 western larch at the DTIC.

Lygus Bug, *Lygus hesperus*

Hosts: Conifers

Trapping at the nursery showed high numbers of adult lygus bugs, and damage thresholds were reached. Five treatments of Pydrin were made on the 1+0 crop from late June through August. Lygus bug damage at the time of packing was negligible.

Phytophthora Root Rot, *Phytophthora* spp.

Hosts: Douglas-fir

At the nursery and DTIC, *Phytophthora* damage was not notable this growing season.

Rusts, *Puccinnium* 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.

Spider Mite, *Tetranychus* sp.

Hosts: Aspen

A late-summer infestation of spider mites damaged containerized aspen seedlings at the nursery. Safer Soap, three applications of Kelthane and one application of Hexagon (an ovicide) were used to control the mites.

Summary Table

Insect or Disease	State	Ownership	Acres Infested	Volume Killed (m3)	# Trees Killed
Douglas-fir Beetle	OR	federal	23,200	4,205,500	30,800
		state	1,500	258,200	800
		private	2,200	423,600	1,800
	WA	federal	62,900	24,609,000	217,100
		state	35,700	10,366,800	92,400
		private	21,300	6,873,100	58,700
Fir Engraver	OR	federal	8,200	858,200	11,700
		state	400	18,000	200
		private	1,300	48,400	600
	WA	federal	4,700	341,400	6,000
		state	4,400	855,100	15,400
		private	1,100	76,100	1,400
Mountain Pine Beetle	OR	federal	62,800	3,902,400	271,100
		state	4,200	110,900	6,000
		private	9,300	133,100	10,000
	WA	federal	121,400	13,323,200	853,700
		state	4,500	391,900	25,500
		private	8,900	430,300	32,300
Western Spruce Budworm	OR	federal	200	0	0
		state	0	0	0
		private	0	0	0
	WA	federal	121,200	0	0
		state	121,700	0	0
		private	29,000	0	0

Insect and Disease Conditions - 2001

Insect or Disease	State	Ownership	Acres Infested	Volume Killed (m3)	# Trees Killed
Western Pine Beetle	OR	federal	1,700	108,800	1,000
		state	600	28,900	400
		private	1,100	71,200	1,100
	WA	federal	3,000	408,800	4,000
		state	5,900	446,700	8,100
		private	6,200	584,600	7,800
Root Diseases* (aerial survey data)	OR	federal	300		
		state	200		
		private	4,900		
	WA	federal	100		
		state	0		
		private	900		
Dwarf Mistletoe (no aerial survey data)	OR	federal			
		state			
		private			
	WA	federal			
		state			
		private			
Douglas-fir Tussock Moth	OR	federal	28,500	0	0
		state	0	0	0
		private	600	0	0
	WA	federal	23,100	0	0
		state	0	0	0
		private	600	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 actually acres affected are much higher.