



2000 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 decreased slightly from 111,148 acres with an average of 3.63 trees per acre in 1999 to 106,447 acres affected with an average of 2.88 trees per acre in 2000. Significant decreases in western white pine and ponderosa pine types were offset by slight increases in whitebark pine, sugar pine and lodgepole pine types.

Acres affected in the whitebark pine type increased slightly from 3,036 acres in 1999 to 3,607 acres in 2000. Approximately a third of the affected acres were mapped in the Eagle Cap wilderness of the Wallowa-Whitman National Forest. In this instance, ground checks indicated that white pine blister rust was responsible for the majority of the mortality. Another third of the acres were mapped on Forest Service lands on the Okanogan National Forest, approximately evenly split between general Forest lands and designated wilderness areas. Additionally, the trend in 2000 indicated an increase in affected acres mapped on private and state lands in Washington.

Acres mapped in the ponderosa type decreased on all ownerships from 17,641 acres in 1999 (1.11 trees per acre) to 6,847 acres (1.0 tree per acre) in 2000. The most heavily affected areas in the ponderosa pine type shifted from private lands to Forest Service lands within the Malheur, Umatilla, and Okanogan Reporting areas. The most significant decrease in acres affected in the ponderosa pine host type occurred on private lands in central Oregon and Northeast Washington.

Activity in sugar pine increased from 1,248 acres in 1999 to 1,714 acres in 2000, but at the same intensity (0.18 tree per acre). The majority of reported mortality occurred on Forest Service lands on the Rogue River and Siskiyou National Forests where mountain pine beetle continues to kill significant numbers of large, old sugar pines in overstocked mixed conifer stands.

Activity in western white pine decreased across all ownerships from 4,597 acres (0.64 tree per acre) in 1999 to 1,122 acres (1.15 trees per acre) in 2000. Most significant decreases were reported on Panhandle National Forest lands within the state of Washington.

Activity in lodgepole pine increased in reported acreage from 84,588 in 1999 to 93,145 in 2000, but at lower reported intensities (4.47 trees per acre in 1999 to 3.17 trees per acre in 2000). A reported decrease in acres affected occurred on the Deschutes National Forest (18,915 in 1999 to 7,478 in 2000). The infestation occurs primarily along the Cascades Lakes Highway between Elk Lake and Lava Lake. An increase in acres affected on the Fremont National Forest (214 in 1999 to 15,061 in 2000) was reported. Tree mortality was heavy on Winter Rim on the Paisley RD. Additionally, private lands within the Fremont reporting area went from 722 acres in 1999 to over 8,400 acres in 2000. Reported high

levels of mortality continued on the Okanogan National Forest with over 48,000 acres averaging 3.94 trees per acre killed.

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

Douglas-fir Beetle, *Dendroctonus pseudotsugae*

Hosts: Douglas-fir

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

Douglas-fir beetle activity, as expected, was detected on more acres, at somewhat greater intensities for the third straight year. Activity was reported on 127,970 acres with an average of 1.67 trees per acre in 2000 compared with 106,902 acres with an average of 1.41 trees per acre in 1999.

Increased levels of activity were detected on all ownerships except private lands and state lands in Oregon.

In Washington, reported acres affected on the Okanogan Reporting Area increased from 1,797 acres in 1999 to 10,593 acres in 2000 and affected acres on the Colville Indian Reservation and Colville Reporting Area nearly doubled over 1999 levels. Increased levels reported in these areas were due in part to improved sketchmapping capabilities of a digital sketchmapping system.

In Oregon, the Wallowa-Whitman Reporting Area reported twice as many acres, also due in part to a more detailed survey conducted with a helicopter. Other areas reporting greater than 10,000 acres included the Rogue River and Willamette Reporting Areas. Continuing activity in northeastern Oregon and in other parts of the Region is associated with either recent fires or with windstorm breakage or blowdown that has occurred the past couple of years. Douglas-fir beetle populations, though widespread on the northern portion of the Wallowa-Whitman NF, have been largely prevented from damaging several high value old-growth and late and old structure stands on the Pine RD through aggressive treatments with bark beetle pheromones. Treatment in stands will occur again in 2001. In addition, other bark beetle pheromone treatments in stands within the Galena Watershed on the Malheur National Forest the past two years have dramatically reduced new attacks on Engelmann spruce by spruce beetle, and on Douglas-fir by Douglas-fir beetle. These treatments will also occur again in 2001. Predisposing tree stresses caused by repeated years of defoliation by western spruce budworm, Douglas-fir tussock moth, drought, and overstocking may result in relatively high levels of Douglas-fir beetle activity in the next few years. Another year of slightly increased levels of Douglas-fir beetle caused mortality is expected for the summer of 2001.

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 decreased from 34,791 acres (2.45 trees per acre) mapped in 1999, to 6,215 acres (0.79 tree per acre) in 2000. The majority of mortality occurred on federal ownerships. Approximately 800 acres were mapped on private lands, most of which occurred in Washington State. Highest levels were reported on the Umatilla and Wenatchee National Forests. The most dramatic decrease was reported on the Fremont reporting area (from 11,372 acres to just 19). Increased levels of activity may be expected in areas experiencing defoliation by Douglas-fir tussock moth and western spruce budworm.

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 decreased considerably from 3037 acres with 8,802 trees killed in 1999 to 247 acres with 255 trees killed in 2000. Practically all reported mortality was on the Okanogan National Forest.

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 decreased from 11,726 acres (1.51 trees per acre) in 1999 to 6,993 acres (2.20 trees per acre) in 2000. Decreases were noted in both large and pole-sized ponderosa pine throughout much of the Region. Roughly half of the mapped mortality was on private lands with the majority of the mortality occurring in pole-sized stands. Areas most heavily affected were mapped within the Malheur, Wenatchee and Northeast Washington Reporting Areas. Other areas with notable levels of mortality include: private lands within the Northeast Washington Reporting area and Indian Reservation lands within the Colville and Yakima Reporting Areas.

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 2000 was in Engelmann spruce. Reported trees killed increased from 1,769 in 1999 to over 3,800 in 2000. Field information from the Okanogan National Forest indicates that due to the timing of the survey a sizeable outbreak was missed on that Forest. The majority of mortality occurred on Forest Service lands within the Okanogan, Wenatchee, Umatilla and Wallowa-Whitman reporting areas. In other areas, spruce beetle activity was lightly scattered in the host type. Low levels of spruce beetle activity are due, in part, to the gradual removal of preferred host trees by previous infestations.

Ponderosa Pine Needle Miner, *Coleotechnites* spp.

Hosts: Ponderosa pine

Reported needle miner damage declined for the second straight year following the 1998 outbreak on over 24,000 acres. In 1999 about 2,800 acres were reported to be infested as compared to approximately 1,900 acres in 2000. The majority of the area affected was mapped in Northeast Washington and the Winema Reporting area compared with last year where most of the defoliation was mapped on the Ochoco National Forest.

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 eruptive outbreaks occur.

Since 1995 the Douglas-fir tussock moth early warning system has indicated a trend for increasing populations. This prompted a large-scale sampling effort in critical resource areas during 1999 and 2000, which helped identify the areas on the Umatilla and Wallowa-Whitman NFs where populations were highest or would be in outbreak in 2000. Portions of over 250,000 acres of high value areas with critical resource concern were sampled for tussock moth populations in 2000. In addition, suppression treatment of tussock moth populations with the viral insecticide, TM BioControl-1, occurred on over 39,000 acres of critical resource areas of concern on the Wallowa-Whitman and Umatilla National Forests in June and July of 2000 (see table below). Treatments effectively reduced tussock moth populations on areas treated. While damage from these outbreaks usually cannot be avoided entirely even with treatment, it can be limited to some extent by prompt action.

Other Forests with plots indicating sub outbreak or outbreak populations include the Malheur, Ochoco, Okanogan, and Wenatchee NF's. Larval sampling for Douglas-fir tussock moth was carried out extensively on the Ochoco and Winema NFs in order to determine if suppression would be necessary in 2001. On the Winema NF, larval populations were low. On the Ochoco NF, however, larval numbers were considerably higher, prompting an autumn cocoon survey in areas indicating suboutbreak populations. Results from the cocoon survey predict no tussock moth populations above the suboutbreak level in 2001 on the Ochoco. Although no tussock moth defoliation was noted in 2000, larval sampling will once again be conducted in critical areas on the Ochoco in the spring of 2001. Autumn cocoon surveys verified populations on the Okanogan NF, which indicate the need for further evaluation to determine the need for suppression in 2001.

Douglas-fir tussock moth infested acres by analysis unit treated with TM BioControl-1 during the 2000 Douglas-fir tussock moth suppression project on the Wallowa-Whitman and Umatilla National Forests.

National Forest	Ranger District	Analysis Unit	Acres Treated
Wallowa-Whitman	Pine	Eagle	10,378
Wallowa-Whitman	Pine	Pine	15,204
Wallowa-Whitman	Pine	Imnaha	7,845
Umatilla	Pomeroy	Spangler	3,912
Umatilla	Walla Walla	Mill Creek	2,263
Total			39,602

During the 2000 aerial detection survey approximately 219,774 acres of visible defoliation were mapped, compared with 21,180 acres mapped in 1999. Mapped intensities varied from 193,703 acres in the light category to 24,473 acres in moderate and only 1,598 acres in the heavy category. The defoliation occurred in the Blue Mountains with the vast majority mapped on Federal lands within the Umatilla and Wallowa-Whitman Reporting Areas. Approximately 4,400 acres, however, were mapped on private lands in Oregon. In spite of ground observations of considerable defoliation, the aerial survey mapped very few acres of defoliation on the Okanogan 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 type. 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 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 increased from approximately 189,700 acres in 1999 to 384,567 acres in 2000. Approximately 78,200 acres were reported in the light category, 128,458 in the moderate and 177,900 acres in the heavy category. Increases occurred over all ownerships in the reported outbreak in Washington State. Two new infestations were reported on Forest Service lands within the Ochoco (513 acres) and Malheur (354 acres) Reporting Areas in Oregon. Following are some noteworthy Reporting area trends: Wenatchee increased from 10,726 acres in 1999 to 121,236 acres in 2000, Yakima increased from 152,302 acres in 1999 to 219,386 acres in 2000, Glenwood decreased slightly from 13,574 acres in 1999 to 13,113 acres in 2000. and Gifford-Pinchot increased from 13,111 acres in 1999 to 29,763 acres in 2000.

Modoc budworm, *Choristoneura retiniana*

Host: White fir

The Modoc budworm is found in the Warner Mountains of California and Oregon. They have feeding habits similar to and may be confused with western spruce budworm. Outbreaks occur sporadically and generally do not cause great damage. Modoc budworm activity declined on the Fremont NF in 2000.

Defoliation was recorded from the air on less than 300 acres, as compared to nearly 10,000 acres in the previous year.

Pandora moth, *Coloradia pandora*

Host: Ponderosa pine, lodgepole pine and Jeffrey pine

There is still lingering evidence of the pandora moth on the Winema NF. Populations have declined considerably from their high levels in the early 1990s, but some areas of fresh defoliation were noted, particularly along Highway 97, between 10 and 15 miles south of Chemult, and in spots along the Williamson River highway on the Chiloquin RD. Larval feeding was only noted on the lodgepole pine host in this area.

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 tips. 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 7,100 acres in 1999, compared with 6,300 acres in 2000. The majority of reported activity occurred within the Wenatchee, Mt. Hood and Deschutes Reporting Areas.

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. To date, a total of 1038 plots have been established in the two states. The ground survey was completed for the State of Oregon. This year's survey found BWA in all the northeast Oregon counties with forest land, a fact that had not been reported previously. Damaging BWA infestations were found in sub-alpine fir stands on the Umatilla National Forest; some include stem infestations on younger trees and obvious signs of crown deterioration on larger trees.

Two important results of trend/impact plots are: 1) BWA has nearly eliminated subalpine fir from sites where it is acting as a pioneer species in disturbed and harsh environments, such as old lava flows and avalanche tracks where subalpine fir is the only species capable of growing, and 2) Almost all grand fir in low valleys and coastal streams west of the Cascades has been affected and is disappearing from low elevation environments.

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, two eradication projects totaling 26 acres were conducted using ground applications of *Bacillus thuringiensis* (Bt). An area (725 acres) where an Asian gypsy moth adult and a new eggmass were found was aerially treated three times with Bt. The gypsy moth survey in 2000 resulted in trap catches of 92 individuals. All were identified as the European strain. An eradication project is planned for 2001 at one site with an estimated 29 acres.

In Oregon, one eradication project was conducted using two ground applications of Bt on 19 acres. Eight European gypsy moths were trapped in 2000 in Oregon. One site in Ashland, encompassing an estimated 160 acres is proposed for eradication in 2001 using three aerial applications of Bt followed by mass trapping. In 2000, one Asian gypsy moth was trapped in the Forest Park area of Portland, Oregon. A 910 acre eradication project surrounding that capture site is proposed for 2001.

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.

Larch Casebearer, *Coleophora laricella*

Hosts: Western larch

After years of negligible damage, larch casebearer-caused defoliation of western larch slowly increased in the late 1990's to 15,836 acres reported in 1999. Ideal timing for larch casebearer surveys in the Pacific Northwest is in June, however, most of the surveys in larch type occurs in late July through early September. Approximately 7,000 acres were mapped in 2000. The majority of the observed defoliation was mapped within the Mt. Hood (5,524 acres) and Colville (833 acres) Reporting Areas.

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.

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.

S-Type annosus continues to occur throughout the subalpine fir and grand fir type, especially in stands that have a history of partial cutting. For the last 12 years, many vegetation treatments in northeastern Oregon have required the treatment of stumps with borax as part of the contract specifications. A 2000 survey of 15 grand fir stands with past harvest activity on the Yakama Indian Reservation found 80% of sampled stumps had been colonized by *H. annosum*. 19% of grand fir trees in 1/100 th acre plots centered around sampled stumps were infected.

P-Type annosus of ponderosa pine tends to occur in cases of planted offsite stock, severely compacted soils, and poor growing sites. Most annosus in ponderosa pine is found on the Malheur National Forest in the southern Blue Mountains associated with xeric poor quality sites. The incidence of P-Type annosus is expected to decline in the future with improved management guidelines and decline of large tree harvest.

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 expected to be 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 limiting spread and mortality.

Blackstain Root Disease, *Ophiostoma wageneri*

Hosts: Douglas-fir, ponderosa pine

In southwestern Oregon, blackstain 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.

Blackstain 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. Blackstain root disease is seen infrequently in eastern Washington. Relationships with natural and prescribed fire, vector insects, and management strategies are being investigated by Pacific Northwest Research Station scientists.

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.

Swiss Needle Cast, *Phaeocryptopus gaumannii*

Hosts: Douglas-fir

Swiss needle cast, a fungus disease of Douglas-fir foliage, continues to infect Douglas-fir west of the Cascade Mountain. Over the last several years, a distinctive yellowing of foliage, needle loss, and growth reduction have been observed in coastal Douglas-fir plantations in Oregon and Washington. A combination of favorable climate, plantation age, and genetics may be the cause of severe disease symptoms seen in recent years. In the spring of 2000, 283,000 acres of Douglas-fir forest along the Oregon coast and 410,000 acres in Washington, with obvious symptoms of the disease, were mapped during a special aerial survey. Although this is a decrease of about 12,000 acres in Oregon from the 1999 survey, it would be premature to say that the epidemic there has peaked. Estimates of affected acreage vary from year to year for many reasons including timing of the survey flight and annual variations in disease development due to weather conditions. The 2000 survey mapped a significant increase of symptomatic trees south of Florence, Oregon, compared to the results of 1999. Ground surveys indicated that Swiss needle cast was present in all Douglas-fir stands throughout the survey area at various levels.

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

Hosts: Western larch

Larch needle blight and larch casebearer, which are reported as a complex because of their similar signatures as viewed from the air, declined from 15,836 acres reported in 1999 to less than 7,000 acres in 2000. Larch needle cast increased from 1,924 acres in 1999 to 10,539 acres in 2000, still well below the approximately 65,000 acres reported in 1998. The Mt. Hood and Wenatchee National Forests and the Warm Springs Indian Reservation accounted for over 97% of the reported acres affected by larch needle cast. 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. Heavy discolorations of the lower crowns of lodgepole pine, typical of lodgepole pine needle cast, were detected on the Winema National Forest (accounting for over 91% over the reported acres). The causal agent was not verified, but the symptom was fairly widespread, covering over 9,800 acres in 2000, down from over 17,200 acres reported in 1999 and over 55,000 acres reported in 1998.

Douglas-fir Needle Cast, *Rhabdocline pseudotsugae*

Hosts: Douglas-fir

There has been above normal occurrence of Rhabdocline needle cast in Douglas-fir in northeast Washington for the past 2 to 3 years, especially the northern half of the Colville National Forest and the Little Pend d' Oreille National Wildlife Refuge.

Non-indigenous Diseases

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

Hosts: Port-Orford-cedar

Port-Orford-cedar root disease causes mortality of Port-Orford-cedar in southwestern Oregon. Where it has been introduced, the disease causes extensive mortality on sites favorable for infection and spread of its waterborne spores, especially along creeks, in low-lying areas, and below roads where water is channeled.

The annual aerial survey reported evidence of the disease on over 4,300 acres (1.48 trees per acre) in 1999, compared with over 5,200 acres (0.97 tree per acre) in 2000. Within these areas, mortality was distributed in scattered pockets or individual trees. On National Forest System lands, slightly less than 10 percent of all Port-Orford-cedar is infected.

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 Blue and Willowa Mountains, and in sugar pine in Southwest Oregon where about 45 percent of stands with host components are affected.

Attempts have been made to aerially identify areas symptomatic of blister rust beginning in 1994. Although blister rust is known to occur extensively throughout the range of susceptible host type, observers mapped approximately 3,100 acres in both 1999 and 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. The bulk of the reported 3,100 acres mapped in 2000 fell within the Wenatchee and Okanogan National Forests.

An on-going study of 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. Ground surveys indicate that blister rust is common in whitebark pine communities in the Seven Devils (Idaho), Elkhorn, and Willowa Mountains, but scarce in the Strawberry Mountains, and all 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.

The Colville National Forest is pruning western white pine plantations to reduce the incidence of lethal blister rust infections.

Nursery Insects and Diseases

Cranberry Girdler, *Chrysoteuchia topiaria*

Hosts: Conifers

Trapping for adult moths at the nursery showed significant numbers above the threshold. Both the true fir and Douglas-fir were treated with one application of chlorpyrifos. The treatment was made earlier in the season, and was more effective than in previous years. Damage levels detected at packing for this species were less than 5%.

Lygus, *Lygus Hesperus*

Hosts: Conifers

Trapping at the nursery showed high numbers of adult lygus insects, and damage thresholds were reached. Three treatments of Pydrin were made on the 1+0 crop from late June through July. After this, bug-vac treatments were repeated every 7-10 days until late September. Lygus damage at the time of packing was negligible.

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

Hosts: Conifers

The nursery experienced less than 5 percent mortality to damping-off. 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 Root and Hypocotyl Rot, *Fusarium spp.*

Hosts: Conifers

The nursery experienced a slightly higher incidence (5+ percent) of mortality due to root and shoot Fusarium infections during the 1+0 year due to high temperatures during the growing season. Cooling by irrigation helped to limit losses. Two seedlots of western white pine were severely diseased, because non-fumigated soil was inadvertently mixed into the seedbeds by the bedformer at the time of sowing.

Phytophthora Root Rot, *Phytophthora* spp.

Hosts: Douglas-fir

At the nursery and tree improvement center, *Phytophthora* damage was not notable this growing season.

Cypress canker, *Seiridium* spp.

Host: Port-Orford-cedar

Cypress canker caused stem cankers and branch mortality on several Port-Orford-cedar at the tree improvement center. All the infected trees were destroyed.

Botrytis gray mold, *Botrytis cinerea*

Hosts: Conifers

There were no significant losses at the nursery or tree improvement center due to *Botrytis*.

Storage Molds

Host: Port-Orford-cedar

There were no significant storage mold incidences noted during the past season. Freezer storage is recommended for most clients.

Animal Damage, Rabbit

Host: Conifers

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

Abiotic Damage, Scorch

Host: Conifers

At the tree improvement center, three-year old seedlings on the south side of rust test blocks were scorched from heat and drought during the summer.