INSECT AND DISEASE CONSIDERATIONS IN SMALL DIAMETER TIMBER

Paul T. Flanagan and Catherine G. Parks

ABSTRACT

Small trees have smaller root systems and smaller boles, less foliage, occupy different canopy positions, and are subjected to different stresses than large trees. As a result, bark beetles, defoliators, dwarf mistletoes, rusts, root diseases, needle disease, canker diseases, and stem decays impact small trees differently than large trees. An appreciation for these differences aids in management of stands composed of small trees.

Keywords: slash, suppression, understory, pruning

INTRODUCTION

Densely stocked stands of small diameter trees are often growing under stressed conditions that increase their risk to damage or mortality by insects and pathogens. Carefully timed and executed management activities are vital to promote desired future stand conditions.

BARK BEETLES

Bark beetles kill entire trees or the tops of trees by creating egg and larval galleries in phloem tissue. Blue stain fungi, which are symbiotically carried by many species of bark beetles, hasten the demise of trees by clogging primary xylem tissue. Ips spp. are the common beetles of small diameter trees, attacking many species of western conifers. The most commonly reported Ips species in the Northwest is the pine engraver (*Ips pini*), which readily infests ponderosa pine slash. Pine engravers are capable of producing three generations a year, and as a result they can build populations rapidly in green slash and subsequently kill adjacent small trees (Livingston 1979). Several methods have been successfully used to keep pine engravers from moving from slash piles into adjacent trees.

1) Timing—create slash from late August to December, so that the habitat is too dry the following spring. Avoid creating slash from January through July.
2) Green chaining—a method that provides slash throughout the summer. Emerging beetles that re-infest slash have low overwintering success.
3) Greenhouse effect—cover slash piles with clear plastic during the warm months, heating the material to temperatures unsuitable for developing larvae.
4) Chipping—small pieces are not host to *Ips pini*.
5) Burning—this is only effective when applied to green slash, which can be problematic unless a device such as a Terratorch® is available.
6) Scattering—disperse pieces smaller than 4 inches in diameter on hot sites so that they dry rapidly.
7) Mass trapping—deploy attractant pheromones in funnel traps that contain an insecticide in the cup at the bottom.

Myriad species of bark beetles infest branches and boles of small diameter trees. Examples are found in the genera *Scolytus, Dendroctonus, Pityogenes, Pityophthorus,* and *Pseudohylesinus*. These beetles are often referred to as secondary bark beetles, because although they can kill small diameter trees, they usually select suppressed, injured, or otherwise weakened individuals. Some of the tree pruning and mortality that results from their actions in the understory is beneficial. Recommendations to reduce bark beetle risk in small diameter trees are similar to those in large diameter trees: adequate growing space minimizes stress, allowing trees to allocate more resources to defensive compounds.

DEFOLIATORS

Many species of defoliating insects feed on small diameter trees, but not necessarily by preference. In an outbreak, smaller trees may be subjected to more intense defoliation than larger trees simply because of canopy position and because they have a smaller complement of foliage than mature trees. For example, western spruce budworms (*Choristoneura occidentalis*) and western hemlock loopers (*Lambdina fiscellaria*) feed voraciously on conifer needles during later instars, when larvae have dispersed and concentrated in the understory. Shade-tolerant conifers, the preferred hosts of both insect species, are often considered undesirable components in the understories of mixed species stands. Simplifying stand structure and reducing basal area of host conifers reduces the risk of defoliation.

DWARF MISTLETOES

Dwarf mistletoes are seed-bearing parasitic plants that sequester water and nutrients from the xylem, and divert carbohydrates from the phloem. Seeds are forcibly discharged from female plants. Most seeds land within 10 or 15 feet of the disseminating shoots (Hawksworth and Wiens 1996). Aerial shoots form several years after the initial infection occurs. Dwarf mistletoe spread is slower in dense stands than in open stands because dispersed seeds contact targets at shorter distances than in widely-spaced open stands

Dwarf mistletoes represent a potentially serious threat to small diameter trees. The stands with highest infection levels typically have infected trees in the overstory that have dispersed dwarf mistletoe seeds down onto the same conifer species in the understory. Heavily infected trees become stunted and never mature to become large individuals. Because most seeds land within 15 feet of the dwarf mistletoe plant, management of the disease focuses on prevention of spread. In mixed conifer stands this can mean the removal

Published in *Small Diameter Timber: Resource Management, Manufacturing, and Markets* proceedings from conference held February 25-27, 2002 in Spokane, Washington. Compiled and edited by D.M. Baumgartner, L.R. Johnson, and E.J. DePuit. Washington State University Cooperative Extension. (Bulletin Office, WSU, PO Box 645912, Pullman, WA 99164-5912. MISC0509. 268 pp.

of one conifer species, but in infected single species stands the objective is to maintain one healthy canopy where height growth exceeds upward spread of the parasite.

RUSTS

Conifer rust diseases are caused by fungi that infect living hosts through the needles and then spread to woody tissue. Most rust fungi are obligate parasites that alternate between the conifer host and an unrelated host plant to complete their life cycle. Disease transmission is by airborne spores. Rusts can cause bole deformation, branch brooming, growth loss, dead tops, tree mortality, and infection courts for other pathogens. Many rusts have specific humidity requirements for the successful spread of spores. Sites can be hazard-rated by elevation and habitat type for some rusts.

The two most important rusts affecting small trees in the Pacific Northwest are western gall rust (*Endocronartium harknessii*), which affects ponderosa pine and lodgepole pine, and an accidentally introduced rust, white pine blister rust (*Cronartium ribicola*) which affects five-needle pines. The most effective method of reducing the incidence of western gall rust infection is to avoid managing for susceptible pines on sites where gall rust incidence is high, but pruning can be effective in small trees. White pine blister rust infects needles in the fall, and during this period of the year high humidity is necessary for successful transmission of the disease. Because relative humidity is highest close to the forest floor, lower branch pruning has been shown to reduce the incidence of infection. Distal infections on long branches of mature trees are less threatening because the infection may not reach the bole.

ROOT DISEASES

Trees of all sizes are affected by root disease pathogens. The root diseases of greatest concern in the Pacific Northwest are armillaria root disease caused by *Armillaria ostoyae*, annosus root disease caused by *Heterobasidion annosum*, and laminated root rot caused by *Phellinus weirii*. Armillaria root disease and laminated root rot spread primarily by root-to-root contact of susceptible hosts. Annosus root disease spreads by root-to-root contact and by windblown spores.

Small trees are less effective in transmitting root disease than larger trees. If site conditions include large stumps from a previous stand some localized infection and mortality may occur. Spread within the small tree stand is low because the probability of small roots contacting infected roots is low, and because small root systems, when infected, do not provide a significant food base for root disease fungi.

NEEDLE DISEASES

Needle diseases are caused by fungi that cause the premature death of needles. Many of these species of fungi disproportionately affect needles close to the ground, therefore the diseases are most serious on seedlings and saplings. Examples of needle diseases with the potential to directly kill small trees, or indirectly kill shade-intolerant small trees are Douglas-fir needle casts (*Rhabdocline sp.*), Elytroderma needle cast (*Elytroderma deformans*) on ponderosa pine, brown felt blight (*Herpotrichia juniperi* and *Neopeckii coulteri*) on several conifer species, pine needle casts (*Lophodermella sp.*) on lodgepole pine and ponderosa pine, larch needle diseases (*Hypodermella laricis* and *Meria laricis*) on western larch, and swiss needle cast (*Phaeocryptopus gaumanni*) on Douglas-fir.

Because needles diseases are more pronounced in foliage near the ground, stand treatments that increase airflow and decrease humidity might be effective in reducing incidence and impact of needle diseases. Research on thinning and pruning is needed to evaluate the effectiveness of these treatments.

CANKER DISEASES

Two canker diseases that are vectored by airborne fungal spores are prevalent on small trees: Atropellis canker of pine caused by *Atropellis piniphila*, and *Phomopsis* canker of coastal Douglas-fir caused by *Diaporthe lokoyae*. Mortality occurs when stems are girdled by large or multiple cankers but most damage is a result of top-kill or girdling that results in poor growth form.

Atropellis canker damage causes reduction of value for both chips and finished wood products. The high resin content also interferes with penetration by wood preservatives. Most infections are found on tissue that is 10-30 years old. High levels of infection can occur in post-fire lodgepole pine regeneration (Allen et al. 1996).

STEM DECAYS

Stem decay or “heart-rot” fungi are significantly more important in larger trees than in small trees. Airborne spores produced by conks or mushrooms colonize freshly exposed wood at wounds or dead branch stubs. Some stem decay fungi infect small suppressed trees, remain dormant for decades, then when activated by tree stress form an extensive decay column.

The amount of heartwood is age-related; older trees have a higher ratio of heartwood to sapwood than do younger trees. Trees less than 90 years old usually have insignificant decay. With the exception of some grand fir communities, most managed forests have a lower incidence of stem decay than occurred prior to forest management.

LITERATURE CITED

Allen, E.A., D.J. Morrison, and G.W. Wallis. 1996. Common tree diseases of British Columbia. Canadian Forest Service, Pacific Forestry Centre, Victoria B.C. 178 p.

Hawksworth, F.G. and D. Wiens (eds). 1996. Dwarf mistletoes: Biology, pathology, and systematics. USDA Forest Service Agricultural Handbook 709. 410 p.

Livingston, R.L. 1979. The pine engraver, *Ips pini* (Say), in Idaho. Idaho Department of Lands, Report 79-3. 7 p.

Authors

Paul T. Flanagan
Wenatchee Service Center
Forestry Sciences Laboratory
1133 N. Western Ave.
Wenatchee, WA 98801
509-664-2749
pflanagan@fs.fed.us

Catherine G. Parks
Pacific Northwest Research Station
Forestry and Range Sciences Laboratory
1401 Gekeler Lane
LaGrande, Oregon 97850
541-962-6531
cparks01@fs.fed.us