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By Sue Hagle
US Forest Service

Management Guide for

Root Disease

Topics

Key Points

- Manage for least susceptible species.
- Avoid partial harvests that leave susceptible species as crop trees
- Precommercial thinning may improve growth and survival of pines and larch
- Untreated root disease patches often develop into long-term brush fields.

Consider Root Diseases in your management plan

Root diseases are the most damaging group of tree diseases. They are most common in Douglas-fir, grand fir and subalpine fir in Montana and Idaho. In Utah forests, Engelmann spruce, lodgepole pine and piñon pine are more likely to be damaged.

Economic losses from insects and diseases are a function of land management objectives. In areas where maintenance of big game habitat is of high priority, openings created by root diseases may provide extensive browse and, therefore, be beneficial. However, in developed recreation areas, root diseases may reduce site desirability by killing trees and making them hazardous to people and property. In commercial forest stands, root diseases affect yields by killing trees and causing decay. Forest land may also be rendered nonproductive when disease centers regenerate with susceptible tree species that are subsequently killed before they reach merchantability. Procedures proposed for dealing with root diseases in developed sites and recreation areas are similar to those for hazard tree reduction in general.

Mortality from root diseases is common in northern Rocky Mountain forests.

Forest management practices affect root disease spread and intensification. Some practices, like repeated partial harvests and sanitation-salvage cutting, can result in severe losses, even the loss of the site for timber production. On the other hand, treatments that establish and maintain disease-tolerant, site-suited tree species can reduce losses. See Table 1 on the following page.

There is no cure, but prevention can be very effective

Root disease prevention is especially important. Once established, root pathogens persist for decades in the roots of stumps and dead trees, and kill trees that are planted or that seed in naturally. Site rehabilitation may be impractical. Thus, it is most desirable to avoid treatments that unduly intensify pathogen buildup in tree and stump root systems.

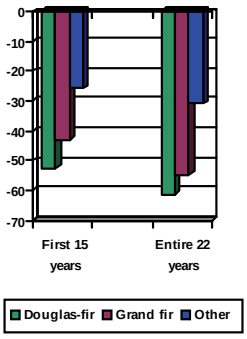
Probably the most common cause of root disease proliferation is regenerating infected sites with disease-susceptible species (Table 2).

Partial harvests such as commercial thinning which leave susceptible trees on site can also intensify root disease. See “Thinning” on page 2.

An individual tree may be attacked by several root pathogens and beetles at once.

Table 1. Common Root Diseases in the Northern Rockies

Location	Forest type	Pathogens	Notes
Western Montana, North Idaho	Douglas-fir, grand fir, subalpine fir	*Armillaria ostoyae, Heterobasidion annosum, Phellinus weirii*	Highly significant losses in these forest types. Important consideration in management plans.
Eastern Montana	Douglas-fir, subalpine fir	*Armillaria ostoyae, Heterobasidion annosum, Phaeolus schweinitzii*	Scattered heavily impacted stands. Not generally distributed.
South Idaho	Douglas-fir, subalpine fir	*Armillaria ostoyae, Phaeolus schweinitzii*	Minor impact overall, Significant decay or defect from butt rot on some sites.
Southern Idaho, Utah, Nevada	Engelmann spruce, lodgepole pine, piñon pine	*Inonotus tomentosus, Leptographium wageneri*	Locally important on some sites. *L. wageneri* especially damaging on piñon pine.



Permanent plots on the Panhandle National Forest. Percent change in number of leave-trees following commercial thinning. The "other" species were western larch, western hemlock, ponderosa pine and western white pine.

Thinning may be a poor option in mature forests

Disease intensification in commercially thinned or other partially-harvested stands appears to be due to the rapid colonization of the stumps and roots after infected trees are cut. Infested stumps then serve as effective food bases for the pathogens enabling them to infect and kill other nearby trees.

Only a fraction of the root disease infected trees can be detected by above-ground symptoms at any given time. So, it is virtually impossible to remove all root disease afflicted trees from a stand. Whenever possible, disease-tolerant species should be favored if root disease affected stands are thinned. Douglas-fir and grand fir often die within a few years after thinning, having produced little or not additional growth. See the chart at left comparing 22-year results of thinning Douglas-fir and grand fir stands.

Precommercial thinning can help

Root disease mortality is often evident by 10-15 years of age in a stand. Depending on the pathogen and stand composition, damage may continue to worsen for a century. Species selection during precommercial thinning can provide a much better outcome than ignoring the problem. Leaving apparently healthy, rapidly growing, susceptible species, can be a powerful temptation. In most stands of Douglas-fir or true firs, mortality rates will not peak until trees are 40 or 60 years of age, but by that time much will have been invested in trees that may have little potential to yield an economic harvest. However, precommercially thinned stands of pines, larch, and cedar are generally highly productive.

Root pathogens are fungi

Several root pathogens are damaging to stands in the northern and central Rocky Mountains. Three, *Armillaria ostoyae* and *Phellinus weirii*, and S-type *Heterobasidion annosum* are associated with most tree mortality.

Root diseases are caused by fungi that spread from the roots of diseased trees to those of healthy ones. Spread may be through root grafts, root contact, or short distance growth of the fungus through the soil. Tree- to-tree spread results in enlarging "pockets" or "centers" of dead and dying trees. The radius of a center increases at an average rate of about 1-2 feet per year in fully stocked stands of susceptible species. Still, the area occupied by root disease in a stand can double every 10 years.

It is common for two or more root pathogens to be active at the same location, and the effects of both must be considered. For example, *A. ostoyae* involves and kills trees weakened by *P. schweinitzii*. Root- systems of these dead trees then serve as food bases allowing *A. ostoyae* to kill regeneration that occupies the openings.

Most root pathogens reproduce via mushrooms or conks.

Managing for disease-tolerant species is usually the most effective and cost efficient means of overcoming root disease.

Table 2. Conifer species susceptibility to common root pathogens

Pathogen	Least Susceptible	Moderately Susceptible	Highly Susceptible
Armillaria ostoyae	Larch, pines, cedar	Spruces, hemlocks	Douglas-fir True firs
Heterobasidion annosum (S-type)	Larch, pines	True firs, hemlocks, cedar	Douglas-fir, Subalpine fir
Heterobasidion annosum (P-type)	All other species	Western white pine	Ponderosa pine
Phellinus weirii	Larch, pines	Cedar, hemlock, subalpine fir	Douglas-fir, grand fir
Phaeolus schweinitzii	All other species	Ponderosa pine	Douglas-fir
Leptographium wageneri	All other species	Lodgepole pine, Douglas-fir	Piñon pine, ponderosa pine
Inonotus tomentosus	All other species	Douglas-fir	Spruces, lodgepole pine

Annosus root disease may increase significantly from one generation to another of susceptible hosts.

Bark beetles may be an indication of root disease.

Root pathogens and bark beetles often work together

Bark beetles are able to detect trees which are damaged by root disease long before they are visibly weakened. Larger declining trees are often attacked and killed by bark beetles. Beetles may significantly shorten the lives of root disease-afflicted trees.

Douglas-fir beetles, fir engraver beetles and western balsam bark beetles may utilize root disease weakened trees to maintain endemic population levels.

Thinning for beetle control could exacerbate root disease problems.

Other Reading

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Forest Health Protection and State Forestry Organizations

Assistance on State And Private Lands	Assistance on Federal Lands
Montana: (406) 542-4300	US Forest Service Region One Missoula: (406) 329-3605 Coeur d'Alene: (208) 765-7342
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