IDAHO DEPARTMENT OF LANDS

Forest Pest Fact Sheet

Armillaria Root Disease
(Armillaria ostoyae)

Root Disease

Root diseases cause more growth loss and mortality than any other conifer disease in Idaho. Root diseases are caused by fungi that live underground and attack and kill the root systems of living conifers. There are different types of root disease, but *Armillaria ostoyae* is the root disease fungus that is the most common and widespread in Idaho forests. It is a native disease and has always been present to some extent in our forests, but it has become increasingly important because contemporary forests contain more of the susceptible tree species than historic forests in Idaho.

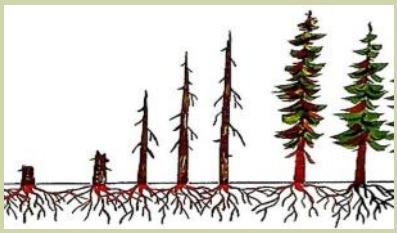

Figure 1. Root diseases spread underground through root-to-root contacts.

Life Cycle

Armillaria commonly spreads underground by root-to-root contact between infected and healthy roots. (**Figure 1**). Once the fungus infects healthy root systems, it grows along the root, killing and decaying it as it goes. When the fungus reaches the base of the tree, it rapidly girdles the tree and kills it. The fungus can survive for decades by decaying dead roots and stumps and acts as an infection source for the roots of adjacent trees and new regeneration (**Figure 2**).

Figure 2. Root disease mortality near an old stump.

Hosts

All conifer species are susceptible to Armillaria, especially below the age of 20. Tolerant species are less frequently infected, and if infected, they are not killed as rapidly.

Most susceptible:
Douglas-fir, grand fir, and subalpine fir

Moderately susceptible:
western redcedar, Engelmann spruce, and western hemlock

Tolerant (least susceptible):
Western larch, ponderosa pine, lodgepole pine, and western white pine

Figure 3. Scattered root disease-caused mortality.

Damage

Tree mortality can occur in single trees scattered throughout the forest (**Figure 3**) or in clumps of trees called mortality centers (**Figure 4**). Living trees stressed by root disease are often attacked and killed by bark beetles or wood borers. Since the disease spreads through root contact at a rate of 1-4 feet per year, disease centers often manifest as stand openings containing trees that have been dying slowly over time. These openings contain hardwood shrubs, some conifer regeneration, dying overstory trees, old snags, and standing and down trees. (**Figure 5**).

Figure 4. Root disease mortality center.

For more information: https://www.idl.idaho.gov/forestry/insects-and-disease/

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Armillaria Root Disease Management

Symptoms: Root disease symptoms usually affect more than one conifer species. Weakened root systems predispose infected trees to leaning and windthrow. Decayed wood that is light yellow or white, soft and spongy, and often stringy with numerous fine black zone lines may be visible in the base or roots of recently down trees. Early symptoms of infection include thin foliage (abnormal needle loss), yellow needles, and reduced leader and branch growth resulting in a rounded tree top. Severely infected trees will often have abnormal pitch flows or resin soaked bark at the base of the tree (**Figure 6**). White radial fungal fans are usually present under the bark at the **base** of severely infected or recently killed trees (**Figure 7**).

Figure 5. Stand with trees dying over time.

Disease Severity: The percent of tree canopy coverage killed by root disease is a good way to rate disease severity (**Figure 8**). The rating system below shows how to classify root disease severity based on above ground symptoms. In the **None** and **Low** classes, root disease is not a problem; in the **Moderate** class, disease is causing significant ecological or economic damage; and in the **High** class, disease is dominating the site and will continue to do so.

Figure 6. Basal pitch flow.

1-10% canopy reduction

11-50% canopy reduction

>50% canopy reduction

Figure 7. Fungal fans under Douglas-fir bark.

Basic Management Considerations:

1. Root disease is a disease of the site; once present it doesn't go away.
2. Disease spreads mainly by root-to-root contact.
3. No treatments are available that will kill or eradicate the causal fungus. Fire, spraying, and stump removal will not effectively suppress the disease.
4. Thinning and partial cutting that leaves susceptible species often increases tree mortality.
5. Mortality of susceptible tree species increases as trees reach pole size.

Management Recommendations for Severity Levels:

None: No treatment needed. If root disease is present in adjacent stands, consider favoring tolerant species when thinning and regenerating the stand.

Low Severity: No treatment needed. Favor disease tolerant species for crop trees when thinning and regenerating.

Moderate Severity: Thin to remove susceptible species if enough tolerant species will remain to meet management objectives. Don't thin and leave more than 30% susceptible species by stem count. Space susceptible species to avoid root-to-root contact (30+ ft. spacing). Cut susceptible species and regenerate with more tolerant species (pines and/or larch) that are adapted to site conditions. Establish an 80+ ft. wide buffer strip of tolerant species around active disease centers. When planting, don't locate seedlings around stumps (**Figure 2**).

High Severity: Manage for non-timber uses. Regenerate with a mixture of tolerant species that are adapted to site conditions. Avoid planting new trees near stumps (**Figure 2**).

Figure 8. About 40 % canopy cover loss.

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