

# Annosum Root Rot

*Heterobasicon annosum*

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Windthrown diseased trees. Photo by Robert Anderson, US Forest Service.



Fruiting body on ponderosa pine root. Photo by Bob James, US Forest Service.



Pitch-soaked wood and sand. Photo by Robert Anderson, US Forest Service.

Annosum root rot is an important disease of conifers in temperate zones throughout the world. This disease, caused by *Heterobasicon annosum* (syn. *Fomes annosus*), can result in root rot, butt rot, reduced growth, and mortality of host trees. Partial cuts in conifer stands greatly increase the incidence of this disease, especially when environmental conditions are conducive to disease development.

In the southern United States Annosum root rot primarily affects southern pines (loblolly, slash, shortleaf, and longleaf pines) and eastern white pine. The disease is most often associated with thinned pine stands located on sandy, well-drained soils; but can be found on a variety of soils and forest conditions. This disease can cause significant losses in pine stands, orchards, and recreational sites.

## Symptoms and Life Cycle

A tree can be infected by the fungus and show no above-ground symptoms until at least half the root system or the root collar is infected. Above-ground symptoms of annosum root rot include dead and declining trees (often in groups), wind-thrown trees, and resin-soaking at the root collar. The decline of older trees can last for one year or several years before death. Declining trees can have sparse, chlorotic crowns with short needles. Other symptoms of decline include slowed growth and bark beetles attack. In young pines, mortality occurs quickly resulting in brown needles and chlorotic tufts of needles at the twig tips. Below-ground symptoms of annosum root rot progress from resin-soaking to white, stringy rot of tree roots. The decay can ap-

pear as white pockets of fungus that elongate until the wood is soft and stringy.

Signs of the fungus include irregular masses of white fungus that form between bark scales followed by leathery conks. The conks are brown with a white margin and a cream-colored lower surface. Spores are released from tiny pores located in the lower surface of the conk. These fruiting bodies usually form on the base of the tree in the duff layer. Conks are not always present on infected trees and stumps.

Annosum root rot develops in a stand, orchard, or recreation site following thinning or removal of individual trees. Spores released from conks can be transported by wind and rain to infect freshly cut stumps. The fungus then grows down the stump's root system and infects other trees through root graphs or root contact. Seedlings planted on a newly harvested site can be infected with the fungus from contact with infected old stumps and roots. In the South, infection centers of annosum root rot are active for about ten years before stabilizing.

### Impacts

Annosum root rot has caused significant losses of volume in managed southern pine stands on high hazard soils and eastern white pine in the mountains. Mortality and growth losses range from 2% to 25% of volume in managed high risk stands across the South. In recreation sites where pine is a major component, damage by annosum root rot has resulted in hazard trees that threaten people and property. Orchard managers routinely use stump treatments to prevent loss of seed trees.

### Ecologically

Annosum root rot rarely becomes a problem in un-managed pine stands. When the disease is found in an un-managed stand, it is often associated with weakened or damaged trees. The fungus colonizes living and freshly dead wood, persisting until the wood is completely decayed. The fungus does not replace other decay organisms in the wood. The

relatively fast decay of wood by other organisms in the South is why the disease stabilizes after 10 years and is not a big problem in regenerated pine stands. When forest managers partially cut pine stands, they significantly increase the probability of infection by the fungus. Thinning a pine stand on a high hazard soil increases the chance of severe loss from 75 to 85 percent. The risk decreases to 30 to 40 percent probability on moderate hazard soils. Thinned stands on low hazard soils have a 10 to 20 percent probability of severe loss.

### Management Strategies

Southern pine plantations and natural stands that are located on low hazard soil, and are free from annosum root rot, do not need to be managed for the disease. Stands located on medium to high hazard sites and stands of eastern white pine should be managed for the disease. All high value stands, including orchards, seed production, and recreation areas, also need to be managed for annosum root rot.

Stump treatment is the primary method to control annosum root rot in a partially cut stand. The only stump treatment currently available to managers is borax. Borax is used to prevent infection and must be applied to the stump surface immediately after the tree is cut. Once annosum root rot is established in a stand, borax may not be a suitable treatment. Foresters will need to consult with a plant pathologist to determine the appropriate management response for infected stands.

Stump treatment is not necessary if a stand is clearcut. Management strategies to reduce future infections of new stands include: (1) plant trees on a wide spacing (10' x 10' or greater) to delay thinning, (2) use stump treatments for partial cuts of stands at high risk for disease, and (3) consider managing for tree species that are less susceptible to annosum root rot than loblolly, slash, and eastern white pine. Although longleaf pine is somewhat less susceptible than these species, it is not resistant

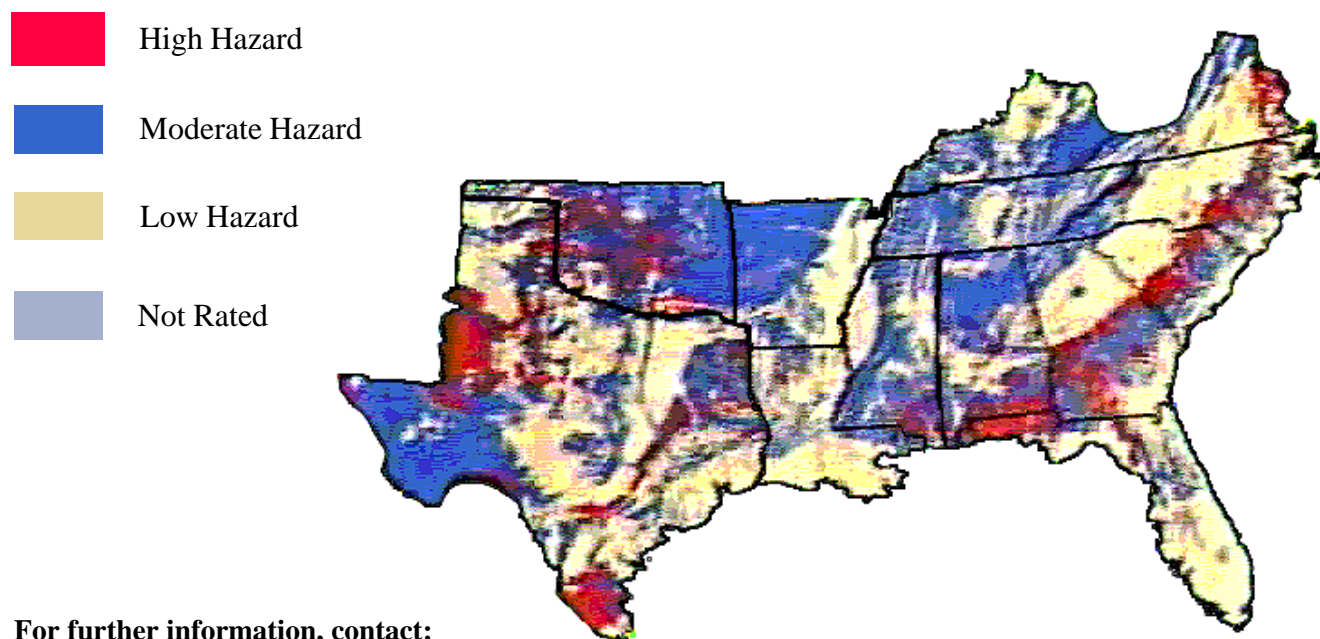
and will still require stump treatments for partial cuts on high hazard sites.

### Location

The following map shows the hazard rating for annosum root rot by the general soil type. Well-drained sandy soils are associated with a greater incidence of disease and are classified as high hazard. Moderately-drained soils that consist of loam or silt are considered a moderate hazard. Poorly-drained or clay soils are classified as low hazard. In the mountains, eastern white pine is very susceptible to infection by annosum root rot regardless of soil type.

### Rate of Spread

Above-ground symptoms of annosum root rot usually are not apparent for two to six years after a partial cut. The spread of the fungus can continue through root contacts and grafts for up to ten years. The growth rate of the fungus in the roots ranges from 0.5 to 2 meters per year. In a living tree root, the rate of spread by the fungus is reduced due to the host's attempt at resistance. The growth rate in a dead root is more rapid than in a living root.



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