

has focused on treating stumps to prevent or control annosum root disease. Dry granular borax has proved to be a successful chemical for use in the South and Northeast. Immediately after the tree is cut, borax powder is sprinkled liberally on the stump surface with a saltshaker-type applicator.

Summer thinnings below the fall line can reduce the risk from annosum root disease. Average daily temperatures over 70° F are likely to kill *H. annosum* spores. Summer thinnings may create a bark beetle problem in some areas of the state when beetle populations are high. Be sure to check the status of pine beetle activity in your area before thinning.

Since freshly cut stumps are the primary source of new infections, reducing the number of thinnings in a stand growing on a high-hazard site will reduce the incidence of annosum root rot.

Pine plantations severely infected with annosum should be clear-cut and regenerated. Salvage or improvement cuts in severely damaged stands can increase the incidence of annosum root disease, as well as leave the stand understocked.

Stands with a history of annosum root disease can be planted with pine immediately after harvesting because the diseased roots will rot before the new seedling roots spread and graft to them. When regenerating high hazard sites, a wider spacing should be used. This will delay the first thinning and ultimately reduce the total number of thinnings made during the rotation. Low hazard sites require no special planting treatments. Although all southern pines are susceptible to annosum root rot, longleaf pine apparently is less susceptible and should be considered for planting on appropriate high-hazard sites.

## Managing Established Stands



P. O. Box 819  
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# Annosum Root Disease



## References

Forest Insect & Disease Leaflet 76, US Department of Agriculture Forest Service. Annosum Root Rot in Eastern Conifers by Kathryn Robbins

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[www.forestryimages.org](http://www.forestryimages.org)

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## Introduction

Annosum root disease can be a serious problem in pine plantations that have been thinned one or more times. All southern pines are susceptible, but loblolly and slash pine are the most vulnerable. The disease is caused by the fungus *Heterobasidion annosum*, which sets off decay in the root system. This makes them susceptible to butt rot, windthrow, decreased growth, and death. Bark beetles can become established in diseased trees and spread out to healthy ones. Failure to identify high risk sites and take appropriate measures to reduce potential infection from annosum could prove costly to a landowner.

## Means of Spread

The fungus usually enters a healthy stand by infecting freshly cut stump surfaces. Airborne basidiospores of the fungus land on a stump's surface, germinate, and produce filaments (mycelia), which colonize the stump and its root system. The fungus then spreads to adjacent trees by root grafts or contacts (fig. 1).

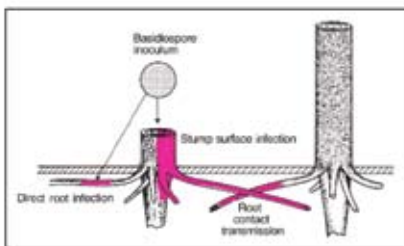


Figure 1. Tree-to-tree spread of annosum by root contact usually results in a more or less circular infection center. After a stand is thinned, the process of infection of stump surfaces, spread through the roots, and death of the remaining, previously healthy trees may occur within 2-3 years.

## Symptoms

Damage from annosum root disease may be scattered throughout a stand or occur in pockets of dead and dying pine trees called "infection centers" (fig.2). Mortality is sometimes preceded by thinning and yellowing of the crown (fig. 3); however, some trees simply turn red and die.

Trees in various stages of dying or death may suffer windthrow. Infected roots exhibit resin or pitch-soaking (fig. 4) and

*Cover photo - Crown symptoms: Dead trees (left), fading trees (right). Photo by Edward L. Barnard, Florida Dept. of Agriculture and Consumer Services.*

stringy root decay (fig. 5). Occasionally the fungus will develop fruiting bodies of conks (fig.6) at the base of living and dead trees or stumps. These conks are hard to see because they are frequently formed below the litter layer around the tree or stump base, and are most prevalent during the cool wet winter months.



Figure 2. Pockets of dead trees. Photo by Garland N. Mason, USDA Forest Service.



Figure 3. Thinning and yellowing of crowns. Photo by Andrew J. Boone, South Carolina Forestry Commission.



Figure 4. Pitch soaked root. Photo by Mark Raines, Georgia Forestry Commission.

## Hazard Sites

Annosum root disease is found throughout Georgia on most forested sites; however, the most perilous areas are located on deep, sandy ground along the fall line of the state. It is best to consult with a soil scientist or forester for a more detailed



Figure 5. Stringy root decay. Photo by Mark Raines, Georgia Forestry Commission.



Figure 6. Conk at base of tree.

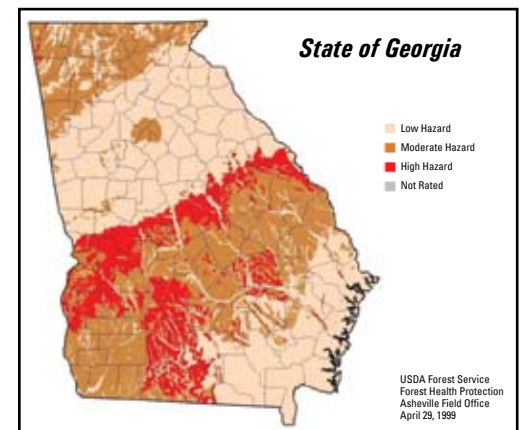


Figure 7. Map of Georgia shows soils with high hazard for annosum root disease.

description of a particular site. Figure 7 shows a broad classification of sites for possible root rot occurrence.

## Control

Before thinning, pine stands should be checked to determine the site's susceptibility to annosum root disease. Soil texture can be evaluated with soil maps or by onsite examination of the soil. The connection between thinning and subsequent infection