

Declining Loblolly Pine Stands: Symptoms, Causes, and Management Options

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By the early 1960s over 1.9 million acres of pine plantations had been established on private lands in the south as a result of both the Conservation Reserve Program and an increase in industrial forest management in the region. Because of its rapid growth and ease of establishment, loblolly pine (*Pinus taeda* L.) quickly became the commercial tree species of choice for southern forestry. However, as time passed, reports of declining loblolly health began to be reported throughout Alabama and the South. Symptoms included trees with short, yellow-green needles, sparse crowns, and reduced radial growth at approximately 40-50 years of age. Mortality usually occurred two to three years after symptoms appeared. Early recommendations were to reduce rotation age of loblolly pine from 70 to 60 years on these sites, maintain a basal area of 60-70 square feet per acre, and convert these stands to longleaf pine (*Pinus palustris* Mill.), the historic tree species in much of the area.

Pine decline, or die-back, continues to impact forest stands. Loblolly pine is currently planted on 80 percent of all southern pine plantations, and is the primary forest type on almost 7 million acres of forestland acres in Alabama. Therefore it is very important that landowners are aware of symptoms and causes of pine stand decline, as well as management options, should their pine stand begin to show signs of decline. Although there are many factors that can affect forest tree health, declines have been associated with soil and weather conditions, deterioration of fine roots, root-feeding insects, and

the presence of fungi such as *Leptographium spp.* in the primary roots. Fire history, previous agricultural practices, lower vegetation density, and landform are factors that are also associated with declining trees.

Symptoms

Symptoms expressed by declining loblolly pines include sparse tree crowns with heavy cone crops, and short, yellow-green needles (figure 1). Trees also often have limited stem

diameter growth.

Unlike mortality caused by southern pine beetles (*Dendroctonus frontalis* Zimmermann) – where trees are attacked in groups, pitch tubes are visible on the stem of the tree, and trees usually die within a few months – mortality on declining stands appears to be more random in nature often impacting individual trees across the stand. Decline symptoms occur primarily in trees above 30 years of age, although trees as young as 12 years of age may also be affected. Mortality can occur within as little



Figure 1. Declining loblolly pine

as two to three years after the first expression of symptoms. Symptoms expressed by loblolly pines declining on upland sites may be confused with littleleaf disease. However, littleleaf disease primarily affects shortleaf pine (*Pinus echinata* Mill.), and site conditions associated with these trees are different.

Potential Causes of Declining Tree Health

Site Conditions - One way to determine if a southern forest stand is at risk for several root diseases is by evaluating soil and

site characteristics. For example, deep, well drained soils are associated with annosum root disease, and, poorly drained, heavy clay soils with littleleaf disease. However, soils on sites where pine decline has been observed are predominately sandy loam, loam, or sandy clay loam, and are moderately well-drained to well-drained (figure 2). Soil nutrient levels may also differ between sites hosting healthy versus declining loblolly pine. Some studies have suggested that low levels of soil nitrogen may lead to stand dieback.



Figure 2. Soil characteristics, moderately well-drained soil.

Disturbance/Stressors - Ongoing research also suggests that disturbance history of affected sites appears to have significant effect on the expression of decline. Fire regimes, wind events, drought, and a variety of other stress factors likely play major roles in causing premature decline of trees (figure 3). Soil and root disturbance caused by silvicultural treatments such as thinning can also hasten decline. In addition, areas with a past history of farming and subsoil hard-pan may be more susceptible. Effects may be direct such as physical injury and stress, or indirect including increased attraction of, or susceptibility to secondary insects such as the bark beetles (*Hylastes* spp.). However, the exact roles and possible interactions among disturbances, fungi, and associated insects in the premature decline of loblolly pine remain unclear, and are still being researched.

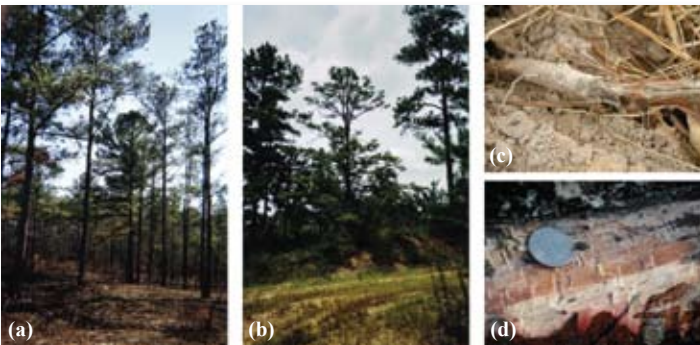


Figure 3. Examples of disturbance which affect tree vigor: (a) fire; (b) erosion/compaction; (c) hog rooting; and (d) root feeders.

Forest Pest Association - Four *Leptographium* species of fungi have consistently, and frequently, been recovered from the roots of declining southern yellow pines (loblolly, shortleaf, and Summer 2009

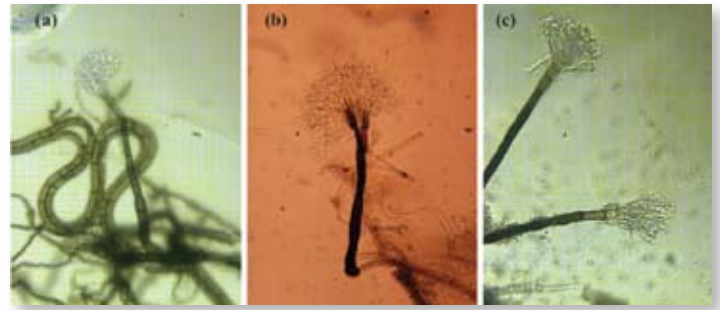


Figure 4. Three examples of *Leptographium* species: (a) *L. serpens*; (b) *L. terebrantis*; and (c) *L. procerum*.

longleaf pines) (figure 4): *L. procerum* is consistently recovered from deteriorating fine roots and primary roots while *L. terebrantis*, *L. serpens*, and *L. huntii* are only recovered from primary roots.

Leptographium species are commonly associated with various species of root-feeding bark beetles, which attack stressed trees. Therefore, bark beetles may serve as vectors introducing these fungi into tree roots or as wounding agents creating infection courts, which permit the infection by these fungi.

The predominant root-feeding insects associated with an increased incidence of *Leptographium* spp. fall in two groups: root weevils (*Hylobius pales*, *Pachylobius picivorus* and possibly others) which consistently carry *L. terebrantis* and *L. procerum*; and bark beetles (e.g., *Hylastes salebrosus*, *H. porculus*, *H. tenuis*, *H. opacus*, *D. terebrans*, and possibly others) that are often associated with *L. terebrantis*, *L. serpens* and *G. huntii* (figure 5). Both groups may introduce fungi into wounds on the roots, and the bark beetles may also spread fungi during feeding and gallery construction.



Figure 5. Vector insects of *Leptographium* species: (a) *Hylastes salebrosus*; (b) *Hylastes tenuis*; (c) *Hylobius pales*; and (d) *Dendroctonus terebrans*.

Management Options

As a landowner, there are management options to help prevent and manage stand decline on your property. Although there is little that can be done to treat forest pests such as *Leptographium* directly, by following basic management guidelines you can potentially increase stand health and prevent or limit attacks by forest pests.

Prevention on Existing Sites

- Limit equipment entry to sites – Especially in wet months, limit the use of heavy equipment on your property to prevent soil and root compaction. Also, be sure that you have a good timber management/harvesting plan that outlines location skid trails as well as location and size of log landing sites, both of which can cause increases in soil compaction.
- Consider fertilization – Although it can be expensive, fertilization of your high-risk sites can pay off in the end.

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Contact your local Alabama Cooperative Extension System agent to have your soil tested for nutrient deficiencies.

Establishing New Stands

- Subsoil during site preparation – Because past management practices can cause soil compaction on decline-susceptible sites, subsoiling as part of your site preparation can help break up hard-pans and increase soil permeability.
- Consider other pines - Initial studies suggested planting pine species other than loblolly on past decline sites. One pine to consider replanting on upland sites is longleaf. Longleaf pine, while less common than loblolly pine across the southeastern United States, is better adapted to anthropogenic disturbance. Longleaf pines tend to exhibit less decline and susceptibility to both environmental and forest pest-related stress. It is important to remember that no tree species is completely immune to stress and disease, but when planted on proper sites, chances for success are much greater.

Managing Stands in Decline

- Reduce rotation age – Maximum rotation age of loblolly pine in high-risk areas should be limited to age 40.
- Stands greater than age 40 – Stands in this age class that are showing signs of decline should be clearcut harvested and converted to longleaf or other appropriate species.

- Stands 25-40 years old – These stands should be select thinned using a salvage harvest to remove scattered diseased/dying trees. Fertilization may also increase the productivity of these stands.
- Stands 15-25 years old – Keep these stands healthy using a typical management regime of thinning and fertilization. Limit soil compaction of equipment by reducing number of passes across the site when thinning.

Summary

Loblolly pine is currently planted on 80 percent of all southern pine plantations, and landowners continue to be impacted by loblolly decline on their forests. Dieback and premature decline of southern pines is a serious problem that deserves urgent attention. It is likely to be associated with interactions among many factors, with the key factors listed in this article. Active management and careful monitoring of forest stands should help landowners detect pine decline early and therefore mitigate the effects on their forest investment.

Current studies are focused on site factors and stressors which may play a role in preconditioning pines to these reported problems, as well as the effects on southern pines. More research is needed to determine host-insect-fungal interactions and relationships between disturbance and silvicultural activities. 🌲

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