

# Shortleaf Pine: An Option for Virginia Landowners



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VIRGINIA STATE UNIVERSITY

# Shortleaf Pine: An Option for Virginia Landowners

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Wayne Bowman, a forester with the Virginia Department of Forestry, inspects his young shortleaf pine planting. (James E. Johnson, Virginia Tech)

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## Why Shortleaf Pine?

- **Excellent wood properties and form**
  - **Tighter grain, smaller knots**
  - **Long-lived**
  - **Drought-tolerant**
  - **Provides high-quality wildlife habitat**
  - **High aesthetic value**
  - **Native species**
- 



Canopy of a recently thinned shortleaf pine stand.  
(James E. Johnson, Virginia Tech)

## Background

Shortleaf pine (*Pinus echinata* Mill.), also known as shortleaf yellow, southern yellow, oldfield, shortstraw, or Arkansas soft pine, is one of the four most important commercial conifers in the southeastern United States. The others are slash, loblolly, and longleaf pine. In Arkansas and Louisiana, shortleaf pine is the primary timber species. In Virginia, however, the acreage of shortleaf pine has steadily decreased since 1940 despite its adaptability to many different soil types and its value as a timber species (Table 1).

**Acres of shortleaf pine in Virginia**

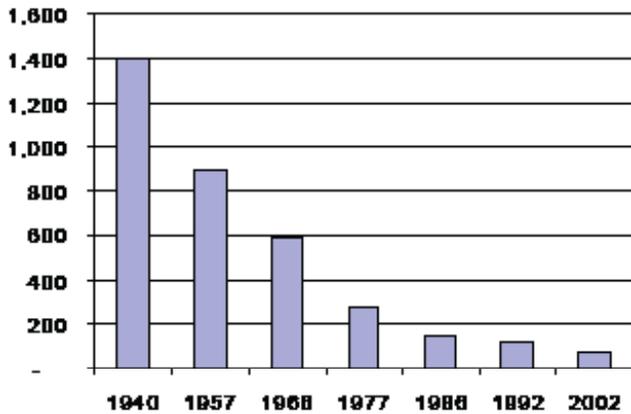


Table 1. Changes in acreage of shortleaf pine in Virginia since 1940. (USDA Forest Service, Forest Inventory and Analysis Published Virginia Forest Inventories, 1940, 1957, 1966, 1977, 1986, 1992, 2002)

Shortleaf pine acreage has declined for several reasons. In the late 1800s and early 1900s, most of the virgin shortleaf pine (both in pure and mixed stands) was harvested, leaving mainly understocked stands. In the absence of periodic disturbance, shade tolerant hardwoods began to dominate these stands, leaving only a scattering of the moderately shade-intolerant shortleaf pine. Shortleaf pine needs either natural (e.g., hurricanes, wildfire) or silvicultural (e.g., thinning, herbicide application, prescribed fire)



Numerous hardwood sprouts compete with shortleaf pine. (James E. Johnson, Virginia Tech)

disturbances to create a bare mineral soil seedbed for its germination and to control competing herbaceous and woody vegetation. Additionally, acreage was lost when loblolly pine was planted extensively throughout the Virginia Coastal Plain and Piedmont regions in many areas where shortleaf pine grew historically.

## How to Identify Shortleaf Pine

Eight pine species are commonly found in Virginia. Shortleaf pine can be identified by its needles, cones, bark, and form.

### Needles

Shortleaf pine needles are evergreen and remain on the tree for three to four years. Needles are bundled together by a papery-sheath called a fascicle. The number of needles contained in a fascicle is a good identi-



Needle arrangement along a branch. (Steven J. Baskauf, Vanderbilt University)



Close-up of shortleaf pine showing needles in two and three per fascicle. (John Seiler, Virginia Tech)

fication tool. Shortleaf pine has two to three needles in each fascicle. A single branch may contain needles in both twos and threes. The dark yellow-green needles are three to five inches long, flexible, and not twisted.

### **Cones**

Shortleaf pine has the smallest cones (one and one-half to two and one-half inches long) of all the pines found in Virginia. They are oblong (egg-shaped), reddish-brown, and usually grow in clusters. The scales on the cones have small prickles (umbos); in fact, the species name *echinata* comes from the Greek word *echinos*, which means hedgehog (a prickly animal). The cones are somewhat persistent and may remain attached to branches for three to four years after seedfall.



(Left) One-year-old female cone after fertilization. (Right) Persistent cones following seedfall. (Steven J. Baskauf, Vanderbilt University)

### **Bark**

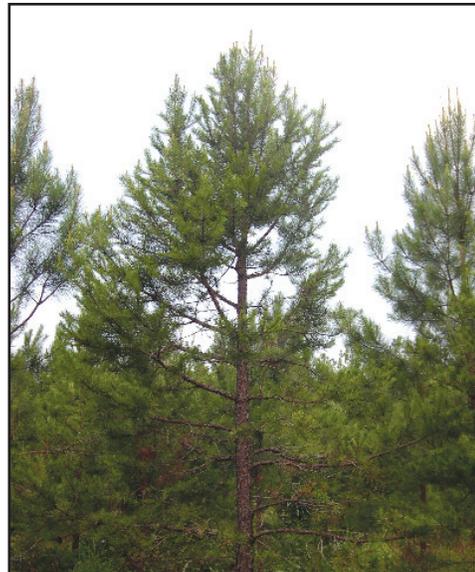
Young bark is dark and scaly; older bark is reddish-brown and broken into rectangular plates. Small resin pockets should be apparent on the plates of mature trees.



Bark of a mature shortleaf pine. (Chris Evans, Univ. of Georgia)

### **Form**

The crowns of shortleaf pine tend to start out conical; then, as the trees age, the crown becomes open and pyramidal. This species is a medium to large tree, reaching over 100 feet in height. The trunks are generally straight and well pruned.



Conical crown of a juvenile shortleaf pine. (James E. Johnson, Virginia Tech)

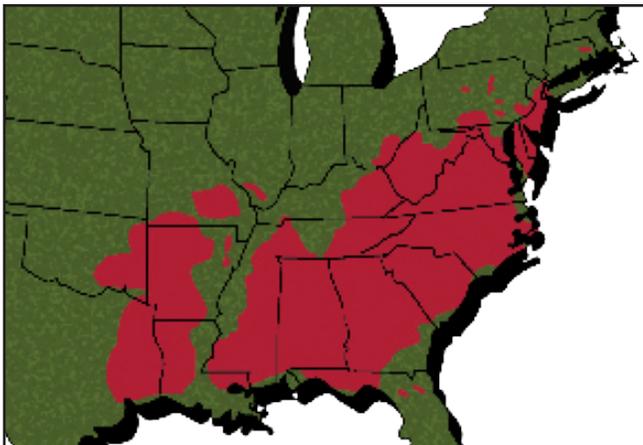


Crown of mature shortleaf pine. Note the open structure. (David Stephens)

## Native Range and Associated Vegetation

Shortleaf pine occurs naturally throughout most of the Southeastern United States, and tolerates a wide range of temperatures (average annual temperatures of 48° to 70°F), moisture regimes (40 to 60 inches annually), and elevations (1,000 to 2000 feet). This species is most competitive on drier sites with poorer soils.

Shortleaf pine is a major component of three forest-cover types: pure shortleaf pine, shortleaf pine–oak, and loblolly–shortleaf pine. It is also a minor component of at least 15 other forest-cover types. Shortleaf pines have thin crowns and, depending on the management system used, may have open canopies which allow enough light for robust understories of: blueberries, huckleberries, deerberry, Japanese honeysuckle, greenbriers, Virginia creeper, poison ivy, grape, panicum and bluestem grasses, and sedges.



Range map showing the distribution of shortleaf pine across the southeastern United States.

(Virginia Tech Landowner Fact Sheets – shortleaf pine)

## Life History and Ecology

Shortleaf pine begins seed production around age 20, although viable seeds have been produced by trees as young as nine years old. The most prolific seeders generally have diameters greater than 12 inches. In Virginia, heavy seed crops occur once every three to ten years; heavy seed crops are more frequent further south.

Male strobili (or catkins) develop in late March through early April and often are found at the base of newly developing shoots on the lower lateral branches. Female strobili (conelets) form near the tops of the crowns shortly after the male strobili. Following pollination, the scales of the female cones close and the embryos slowly develop. Fertilization takes place early in the

second growing season, after which there is rapid development. Seeds take two growing seasons to mature and each cone will contain 25 to 38 viable seeds. The seeds are winged and fall in late October through early November with most landing in the vicinity of the parent tree.

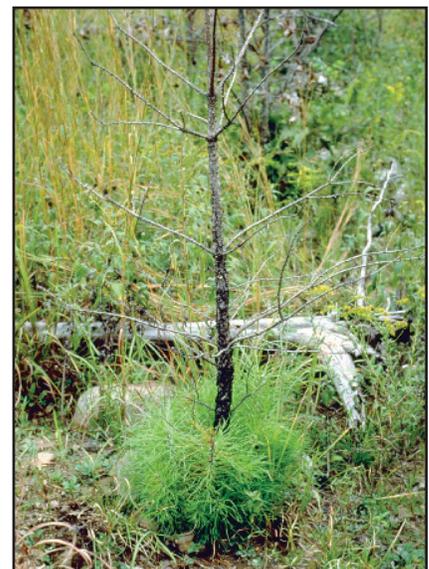


Young planted seedling.  
(James E. Johnson, Virginia Tech)

The seeds overwinter in the duff on the forest floor, where they are subject to heavy predation from birds, rodents, and small mammals. Those that survive the winter and make contact with bare mineral soil should germinate in the spring. During the first few years, seedlings allocate most of their resources to root growth; once they reach the sapling stage, average growth is 1 to 3 feet, annually. Since shortleaf pine is a shade-intolerant species, early growth can be accelerated by controlling competing woody vegetation. However, seedlings can survive in shaded conditions, and will respond to release.

One interesting growth trait of shortleaf pine seedlings is the development of a j-shaped crook in the stem at ground-line.

Associated with this crook are lateral buds, which will elongate if the top is killed. This ability to sprout, which continues for about 10 years after germination, is rare among conifers, and may, perhaps, be an adaptation to fire.



New sprouts on a young top-killed shortleaf pine seedling. (Robert F. Wittwer, Oklahoma State University)

## Management

Shortleaf pine occurs naturally in pure (single species) even-aged (one-aged) stands and mixed (pine and hardwood) uneven-aged (multiple-aged) stands. Traditional shortleaf pine management has focused on pure shortleaf pine plantations (created and maintained using clearcut and seed tree silvicultural systems) and uneven-aged loblolly and shortleaf pine stands with intensive hardwood control measures (created and maintained using a selection silvicultural system). Although not a traditional management system, the idea of maintaining and managing mixed shortleaf pine and hardwood stands, which are common on private land in Virginia, has gained popularity in recent years. The following sections focus on management of these mixed forest types and include a description of the clearcut silvicultural regeneration system, which may be used on lands where mixed forests of shortleaf pine and hardwood are desired. The selection of a silvicultural regeneration system should be based on your goals and objectives, as well as the existing condition of the stand. A professional forester can help you make this decision.

### Mixed Shortleaf Pine – Hardwood Forests

In existing mixed stands, management activities should be focused on maintaining a healthy stand with the desirable mix of species, favoring shortleaf pine if it lacks abundance. Normal thinning activities can take place, as shortleaf pine generally responds quite well to release, even at older ages. Unhealthy trees and undesirable species can also be removed in thinning operations.

The other trees in the stand can be various hardwood species, depending on the site, available seed bank, and existing mature species. On the poorer-quality sites, chestnut oak, black oak, scarlet oak, and black gum may be common. On the better quality sites, yellow poplar, white ash, and possibly black cherry and walnut may be found. Crop tree release beginning at age 15 may be used to adjust the tree spacing and species composition; however, this treatment is noncommercial and may cost as much as \$100 per acre. After about age 35, depending on the site quality and growth rate, commercial thinnings may be possible.

Creating mixed shortleaf pine–hardwood stands following harvest is a little more problematic. First, shortleaf pine is not a prolific seeder. Adequate seed crops may occur as infrequently as one year out of seven. Rely-

ing on seedfall to produce an adequate crop of seedlings following harvest is risky. Building up a pool of advanced seedlings over time may be a useful strategy, but the seedlings grow slowly at first and are very susceptible to shading by hardwood brush, which is quite competitive. For landowners in this situation, using the clearcut system and artificial regeneration may be the best approach.

### Silvicultural Clearcuts

Shortleaf pine is shade-intolerant, so clearcutting is an effective means of regenerating the species. Clearcuts remove all the overstory vegetation from a site, maximizing the amount of light reaching the forest floor. Shortleaf pine seedlings are intolerant to competition, so careful site preparation to reduce logging slash and remove competing woody vegetation (e.g., herbicide application or prescribed fire) is needed to improve the growth and survival of seedlings.



Aerial forest view.  
(James M. Guldin, USDA Forest Service)

Clearcuts can be regenerated using either natural regeneration (if enough viable seed trees are present around the site) or artificial regeneration (direct seedling or planting seedlings). However, to maximize survival, planting is recommended.

Two-year-old bare-root stock should be planted in late February through early March to ensure high survival. The USDA Forest Service recommends planting 300 to 360 shortleaf pine seedlings per acre, with the hope that 250 to 300 will survive to age three. Pines should be thinned to about 50 to 100 pine crop trees per acre on better quality sites (site index greater than 70, which means that on average, at age 50, the trees will be 70 feet tall). On lower quality sites with a site index less than 70, 100 to 200 pine crop trees per acre are recommended. Planting at this density will allow many hard-

wood trees to also grow and compete with the pines, which is important if a mixed pine–hardwood stand is desired. However, hardwood competition control will be required initially to allow the pines to gain dominance; if a pure shortleaf pine stand is desired, longer-term hardwood control will be necessary.

Silvicultural clearcuts can be used to create both pure shortleaf pine forests and mixed pine–hardwood forests. This system is suitable for landowners who do not currently have shortleaf pine on their property but do have mature timber that is ready for commercial harvesting.

## Advantages of Mixed Shortleaf Pine – Hardwood Forests

Having a mix of pine and hardwood species helps to buffer forests against serious insect and disease pests, since most pests do not attack both hardwoods and pines simultaneously. For example, mixed pine and hardwood stands are less likely to be attacked by southern pine beetles. And, while the gypsy moth prefers to defoliate oak, it is unlikely to feed on pine unless the moth population is extremely high. Mixed stands also provide a wider variety of ecological benefits. The oaks provide acorns for wildlife, as well as wood for timber.

Mixed stands provide a blend of commercial timber of various species, moderate to good growth potential, and enhanced ecological values. Mixed timber also provides a buffer against weak prices, since a wider mix of products may be harvested, such as hardwood and pine sawtimber, hardwood and pine pulpwood, hardwood fuelwood and pine plywood logs.

Managing for mixed shortleaf pine–hardwood stands may be best for landowners who already have this forest type on their land. However, planting shortleaf following a clearcut and the initial use of competition control measures can also be used to create this forest type.

## Growth and Yield

Only a limited amount of data is available for shortleaf pine, and the numbers were developed based on information from Arkansas, Alabama, and Mississippi (the states where shortleaf pine is the prime timber species). No data on shortleaf pine growth rates in Virginia are available. In naturally regenerated shortleaf pine stands in Missouri, the presence of hardwoods reduced growth and yield of the stands by 8 percent to 12 percent; however, landowners choosing to manage mixed shortleaf

pine–hardwood stands generally have other objectives which are higher priorities than timber production.

## Wildlife, Biodiversity, and Aesthetics

Shortleaf pine–hardwood forests provide high-quality habitat for both game and non-game species. Deer browse on young hardwood sprouts and turkeys eat seeds and acorns. More open, even-aged shortleaf pine stands can provide habitat for bob white quail and nesting trees or foraging areas for red-cockaded woodpeckers.



Diverse vegetation in the understory of an open-canopied shortleaf pine forest. (James M. Guldin, USDA Forest Service)

These forests also support diverse overstory and understory vegetation. In the fall, the senescing hardwood leaves provide color, and in the winter the pines provide color and cover for wildlife.

## Health Issues

Shortleaf pine is resistant to fusiform rust, a major problem in slash pine and loblolly pine plantations. Managing for mixed shortleaf pine and oak stands will also help prevent complete stand destruction from any one agent. However, shortleaf pine is susceptible to some diseases and insects. The following section covers the most common and damaging ones.

### Littleleaf Disease

This is the most serious disease affecting shortleaf pine. Although the disease has the greatest impact in Alabama, Georgia, and South Carolina, cases are found throughout shortleaf pine's range in Virginia.

### Causes

- Tree age (generally infects trees over 20 years old; infections increase in severity as trees age)
- Low soil nitrogen
- Poor soil drainage

- Presence of nematodes
- Presence of certain soil fungi

### Progression of Symptoms

- Yellowing and shortening of needles
- Decreased shoot growth
- Thin and tufted crowns
- Short needles clustered near branch tips (rest of branch bare)
- Branch die-back from bottom of crown up
- Decreased diameter growth
- Prolific production of smaller than normal cones a few years prior to death.



Stand affected by littleleaf disease. Note the proliferation of cones on the tree to the right. (James E. Johnson, Virginia Tech)

### Control

- Avoid planting shortleaf pine in areas where the disease is present on mature trees.
- Break up any brick-like compact layer of clay in the soil to promote drainage.
- Interplant pines with legumes which can increase soil nitrogen.
- Remove infected trees.
- Fertilize to delay the appearance of symptoms for up to four years – recommended one ton of 5-10-5 fertilizer plus 0.5 ton of ammonium sulfate per acre; generally only practical for high-value trees or ornamentals.

### Annosus Root Rot

Root rot generally kills infected trees; survivors are more susceptible to other damaging agents. Since it infects a stand through freshly cut stumps, recently thinned stands are very susceptible.

### Causes

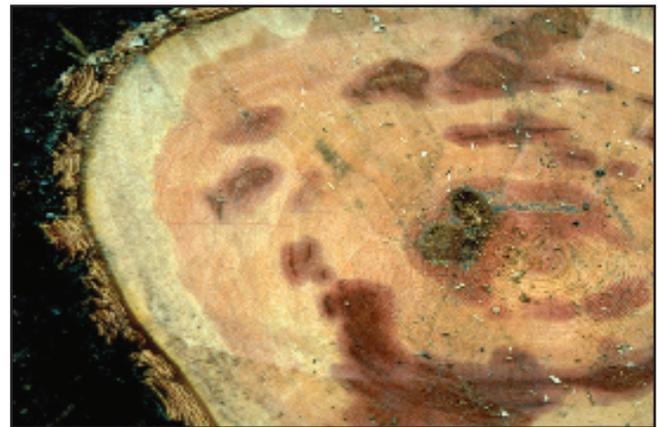
- Presence of freshly cut stumps

### Progression of Symptoms

- Appearance of fruiting bodies (conks) on root collars of stumps and living trees
- Conks are light-gray, gray-brown, or reddish-brown on top and creamy white underneath
- Conks range in size from one-eighth to several inches long
- Thin crowns, short needles
- Decreased height and diameter growth
- Mortality occurs in groups

### Control

- Reduce the number of thinnings per rotation.
- In areas with known infection, conduct prescribed burns at least two times before thinning.
- If root rot is not currently present, treat all freshly cut stumps with dry granular borax.



A cross section of a pine infected with annosus root rot. (John W. Schwandt, USDA Forest Service)

## Pales Weevil

Pales weevil is the most serious pest of shortleaf pine seedlings. The insects lay eggs on recently cut stumps and, once hatched, the larvae feed on the wood just under the bark.

### Causes

- Presence of freshly cut stumps

### Progression of Symptoms

- Patches of bark removed
- Crystallized resin near branch tips
- Flags of red needles
- Twig mortality

### Control

- Under normal conditions, native parasites keep the moth under control.
- Delay planting for one to two years after a site is harvested.
- Treat seedlings with insecticides at or before time of planting.



Pales weevil.  
(Clemson University, USDA Cooperative Extension Slide Series)



Needle damage caused by a Pales weevil.  
(Eric R. Day, Virginia Tech)

## Southern Pine Beetle

The southern pine beetle is one of the biggest insect pests in southern forests. Populations can grow rapidly, resulting in large areas (up to hundreds of acres) of dead pines. Shortleaf is among the pine species most preferred by this insect.

### Causes

- Stressed trees (planted off-site or crowded)

### Progression of Symptoms

- Discolored needles (first yellow, then red, then brown)
- Small yellowish-white masses of resin on the bark
- Reddish dust in bark or around base of tree
- S-shaped galleries under bark



Galleries created under the bark of a tree by southern pine beetles.  
(Ronald F. Billings, Texas Forest Service)



Southern pine beetle damage in a forest.  
(James B. Hanson, USDA Forest Service)

### Control

- Keep trees growing vigorously.
- Plant trees on appropriate sites.
- Thin over-crowded stands.
- Remove stressed trees.
- Harvest infected trees plus a 40- to 70-foot-wide buffer of healthy trees around the most recently attacked trees.



Planted shortleaf pine.  
(James B. Hanson, USDA Forest Service)

## Conclusion

Shortleaf pine is a native Virginia tree that is adapted to a wide range of climates and elevations, making it a suitable choice for non-industrial private landowners in all areas of the state. Where does it fit best? Where quality wood products are a priority, longer rotations are acceptable, mixed stands are desirable, and long-term value is more important than short-term volume. Mixed stands of shortleaf pine and oaks can offer a multitude of ecological and economic benefits, including biodiversity, wildlife habitat, aesthetics, and timber income. If you are interested in managing these types of forests, contact your county forester or a professional forester (see sources of assistance below).

## Sources of Assistance

- **Virginia Tech Department of Forestry and Virginia Cooperative Extension:** Folks at these agencies can answer your questions about shortleaf pine management or other natural resource questions; they can also direct you to sources of additional information. Websites: <http://www.cnr.vt.edu/forestupdate/> and <http://www.ext.vt.edu>.
- **Virginia Department of Forestry (DOF):** The department can provide technical assistance **and** has a limited supply of seedlings for sale. In 2005, the DOF produced 300,000 shortleaf pine seedlings (enough to forest 1,000 acres). The DOF is developing two new shortleaf pine seed orchards to increase the availability of seedlings. Website: <http://www.dof.virginia.gov/>.

- **Professional Foresters:** Professional foresters are employed by government organizations, forest industry, and private consulting companies. Professional foresters offer a full range of services to private landowners, including management planning, timber appraisals, timber-sale preparation and administration, and site preparation and reforestation. Landowners are advised to check references and professional affiliations before choosing a forester. These references include membership in organizations such as the Association of Consulting Foresters (ACF) and the Society of American Foresters (SAF). Lists of professional foresters are available on the DOF website (listed above). Websites: ACF: <http://www.acf-foresters.org//AM/Template.cfm?Section=Home> and SAF: <http://www.safnet.org/>.

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