

# Timber Stand Improvement



Most Southern forestlands are currently not producing up to their potential. This low productivity is especially severe on millions of acres of privately owned forestland where undesirable trees are growing on space that could be used for higher-quality trees. On average, undesirable or cull trees occupy one-third of the total growing space in pine-hardwood and hardwood stands of the South. Timber stand improvement practices are used to remove trees of undesirable form, quality, condition, growth rate, or species. Removing poor trees will stimulate the growth of more desirable trees and will increase profits to private, non-industrial forestland owners. It is very likely that your timberlands need timber stand improvement practices to maximize these profits.

## What Is TSI?

Timber stand improvement, or TSI, is a phrase used to identify forest management practices that improve the vigor, stocking, composition, productivity, and quality of forest stands. The improvement results from removing poor trees and allowing crop trees to fully use the growing space. The chief aim of TSI is continued production of more and better timber products. TSI practices can be used to convert assorted hardwood and pine stands into productive forests of desirable species. TSI can speed up growth and improve tree quality in your forest.

Different TSI practices may be needed at different times during the life of an established stand—from the start of a new crop of trees until the final harvest. Here are some basic TSI practices:

**Prescribed burning** in pine stands to remove undesirable hardwoods, to prepare seedbeds, to reduce the potential for wildfires, and to improve wildlife habitat.

**Cull tree removal** to make growing space available on areas occupied by deformed, defective, and undesirable trees. Some cull trees may be cut and sold; however, most must be killed with herbicides.

**Thinning** to relieve overcrowding and increase the growth rate of crop trees. Precommercial thinning in young, unmerchantable stands is a cost practice. Intermediate thinnings or improvement cuts in older stands may produce some income for landowners.

**Sanitation cutting** to remove trees that have been damaged by insects, diseases, wind, or ice.

**Release** of young, vigorous crop trees for faster growth and better quality by removing overtopping and competing trees.

## Trees to Remove in TSI

In pine, mixed pine-hardwood, and hardwood stands, remove trees that are financially mature or that interfere with the growth and development of more valuable stems. Removals should include these:

- suppressed trees that will not live until the next thinning
- trees too crooked, forked, or limby to make a No. 2 sawlog
- trees with fire scars and injuries from insects, disease, wind, or ice



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- trees on the wrong site (such as a water oak growing on a ridge)
- trees that are mature and slow-growing
- any tree that will not contribute to the net value of the stand at the next thinning
- wolf trees with large crowns that occupy too much growing space or shade out more desirable species

You will want to leave these trees in your timber stand:

- high-quality trees
- fast-growing trees
- some mast-producing and den trees for wildlife
- trees spaced so that all available growing space is used efficiently

Often people think TSI practices always involve out-of-pocket costs for the landowner. However, some TSI practices can produce immediate income. Thinning is a TSI practice that can produce income if trees being cut are merchantable. Research has shown that volume growth and financial returns will increase with each additional TSI treatment, if costs are reasonable and adequate markets are available. For example, a prescribed burn before the harvest of an old pine stand can increase volume growth in the new stand. Prescribed burning plus removing large hardwoods in a young pine stand can also provide a good investment return.

Ask a forester to assist you in choosing the right TSI practices that will produce the desired forest management results at the least cost. Some TSI practices are quite inexpensive, and some, such as thinning, may produce immediate revenue. All TSI practices will increase future income.

## Prescribed Burning

Fire, if properly used, can be a very effective TSI tool for forest improvement, maintenance, and protection of pine stands. It is often the cheapest management practice available to a landowner. Prescribed fire can be used for multiple purposes, including these:

- removing undesirable hardwoods in pine stands
- reducing wildfire hazard by controlling fuel build-up on the forest floor
- exposing the mineral soil seedbed for natural seed-fall and improved germination
- removing brush and logging slash before planting seedlings
- improving wildlife habitat by promoting annual legumes and desirable browse growth, by increasing the nutrient content of food plants, and by eliminating heavy brush on the forest floor
- controlling brown spot disease on young longleaf pine seedlings

Prescribed fire is usually not recommended for hardwood stands. Hardwoods have thin bark that is easily damaged by fire. Pines have thick bark that insulates the cambium (layer of growth cells under the bark) from heat damage. If you are interested in learning more about the use of prescribed fire, contact your county Extension agent or county service forester. Never attempt to use fire in your timber stands without the help of a forester. Fire is a management tool that must be applied regularly, at certain times of the year, during the right weather, and with proper equipment. A professional forester can assist you in developing a prescribed burning program for your timber stands.

## Cull Tree Removal

Cull tree removal involves cutting or killing undesirable weed trees or culls. A cull is any tree, pine or hardwood, whose quality is so poor that you cannot sell it. Cull trees often grow larger but lack quality. They take up needed growing space, shade more desirable trees, and harbor insects and disease. You will typically profit by removing them to make room for better trees. Occasionally, a less desirable tree may be left because of its wildlife value. Some low-quality trees may be used for firewood and low-value products, but most culls necessitate chemical or mechanical control. Methods of cull tree removal include these:

- cutting trees for firewood or leaving on-site
- injecting herbicides
  - ♦ hatchet and squirt bottle (“hack and squirt”)
  - ♦ tree injectors
  - ♦ hypo-hatchet
- basal spraying
- thin-line application
- cutting with stump treatment to prevent sprouting
- directed foliar sprays
- soil applications
  - ♦ dry pellets (by hand or air)
  - ♦ liquids (“spot gun” application)

Method effectiveness will vary with the technique used, herbicide used, size of the tree, time of the year, species, and other factors.

These species are relatively easy to control:

- birch
- blackgum
- box-elder
- cherry
- sycamore
- ironwood
- oak
- plum
- sassafras
- sumac
- sweetgum
- willow

These species can be difficult to control:

- ash
- beech
- cedar
- privet
- dogwood
- hackberry
- sugarberry
- hickory
- holly
- maple
- poison ivy
- honeysuckle
- kudzu
- yaupon

## Thinning

Thinning overcrowded stands increases diameter growth of residual trees and decreases losses from natural mortality. Larger diameter trees are more valuable as sawtimber, plywood, and veneer than are smaller trees that are used for pulpwood, firewood, or fence posts. Thinning does not increase the total volume or fiber yield of a stand, but it substantially increases the yield of lumber, plywood, and poles and decreases loss from natural mortality.

### *Marking Trees for Thinning*

You can learn how to mark your own pine stands for thinning. All you need is help from a forester, a thinning guide that gives the number and spacing of trees at various ages, and practice. MSU Extension offers pine thinning workshops intended to teach private landowners the basics of performing thinning operations. Contact your county Extension agent if you are interested in attending one of these workshops. However, selective marking of hardwood stands requires the expertise of an experienced forester.

**Precommercial thinning** is cutting in young, dense stands where the trees are too small to sell as wood products. This type thinning produces no immediate income for the landowner, but the cost may be justified by the value of increased future growth. The purpose of precommercial thinning is to reduce competition and improve the growth rate of remaining trees. Unwanted trees can be removed with herbicides, mechanical equipment, or by cutting. Thinning can sometimes be delayed until trees are large enough to make fenceposts or firewood if a market is available. Precommercial thinning plus cull tree removal of large hardwoods can result in an investment return of 10 to 20 percent in young pine stands.

**Commercial thinning** of merchantable size trees produces some income for the landowner, depending upon the quantity, size, and quality of trees being removed. A commercial thinning is often referred to as

an improvement cut if the very poor-quality trees being removed are marketable. From an economic standpoint, there should be sufficient volume to justify a harvesting operation by the buyer. The money a landowner receives for standing trees, called stumpage, decreases as the cost of harvesting increases. Harvesting cost decreases as tree size, quality, and volume per acre increase. You may want to delay thinning until trees are large enough to make an economical harvest, even though increased growth of crop trees will also be delayed.

### *Pine Beetle Prevention*

You can reduce the likelihood of southern pine beetle attack in your pine timber through thinning. Overstocked stands are more susceptible to beetle attack. Overcrowding weakens the ability of trees to repel insect penetration. Healthy trees can often “pitch out” a beetle with increased resin flow. Also, cutting slow-growing, overmature trees during thinning operations reduces the chance of beetle attack. On rare occasions, residual crop trees damaged during thinning may be killed by black turpentine beetles. However, the potential danger of southern pine beetle infestation in an overcrowded stand far exceeds the loss of a few isolated trees to black turpentine beetles.

## Sanitation Cutting

Sanitation cutting is normally performed during thinning operations so that trees damaged by insects, disease, fire, wind, or ice can be sold along with good trees. Sanitation cutting is included in the practice of “thinning from below” where trees with damaged or deformed stems are cut first regardless of their crown position. You must decide whether or not to remove each tree based on its condition and likelihood of surviving until the next scheduled thinning. Some good, healthy trees may also be cut to achieve desired crown spacing (thinning from above). Sanitation cutting may not be economical unless it is done during a commercial thinning operation. If you cut only deformed trees, you may have difficulty selling them. If the trees cannot be sold, use the cheapest means of cull tree removal rather than sanitation cutting. Sanitation cutting alone is profitable only after a natural disaster, such as a hurricane, wind storm, or ice storm, where numerous valuable trees are damaged.

## Release

Release is a TSI practice that can be used to regulate species composition and improve the quality and growth of very young stands of trees. A new crop of trees can become established by natural seeding or sprouting under a canopy of overtopping trees. Unless these new trees are released from shading, they probably will not survive. The overtopping trees may be of

desirable species, or they may be low-quality or culls. Undesirable, competing species may also be growing among the young trees. You can harvest overtopping and competing trees if they can be sold, or remove them with a herbicide if they are unmerchantable. You can inject or aerially spray hardwoods growing over young pine trees. If chemical site preparation was not performed or successful, woody release can be used to control hardwoods in established pine stands. If deemed necessary, woody release should be performed in years two to five. After this point, the competitive impact of undesired stems has a permanent negative effect on pine growth and rotation length.

Release operations can still be performed later in the rotation, but they should be implemented in conjunction with some other technique like thinning. Exercise caution when releasing desirable hardwood trees in hardwood stands because herbicide sprays can kill both desirable and undesirable hardwoods. Usually the most appropriate method for release in hardwood stands is that of injection. However, while not typical, injected herbicides can be translocated through root grafts to adjoining crop trees. Get professional help from a forester before using herbicides for overstory or understory release of young trees.

## Tax Considerations

Timber stand improvement practices may qualify for deduction as annual expenses from your ordinary income. Keep good records of your TSI costs. Contact your county agent for more information on forest taxation, management, marketing, and multiple use.

For more information and publications on forest management, marketing, and protection, contact your county Extension office.

## More Information

The following publications provide more detailed information on topics related to timber stand improvement. Copies are available from your county Extension office.

IS1573 Tree Injection with Reduced Labor  
P1588 Direct Seeding  
P1612 Forestry/Wildlife Myths and Misconceptions  
P1816 Natural Regeneration Using Seed Trees  
P1834 Evaluating High-Graded Hardwood Stands  
P2004 Bottomland Hardwood Management  
P1532 Weed Control Guidelines for Mississippi  
(See Woody Plants section.)

Also, check out our Extension Forestry site at <http://www.ext.msstate.edu/anr/forestry/>.



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