Timber Stand Improvement

Most Southern forests are currently not growing at their potential. Low productivity is especially severe on millions of acres of privately owned forestland where undesirable trees are growing either off-site or in an unmanaged state. Undesirable or cull trees can occupy significant portions 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 these trees will stimulate the growth of more desirable stems and will increase timber profits to forestland owners. It is very likely that your timberlands need timber stand improvement practices to maximize these profits.

What Is TSI?

Timber stand improvement (TSI) is a phrase used to identify forest management practices that improve the vigor, stocking, composition, productivity, and quality of forest stands. Improvement results from removing lower quality 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. These practices can be used to convert lower quality stands into faster growing and more productive forests of desirable species.

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. Cull trees should be cut or killed with herbicides. Tree species that are undesirable to your current management goals are not necessarily culls, so it may be possible to harvest and sell them; however, if they are unmarketable, they should be treated as cull trees.
- **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
- off-site trees (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
- cull (a.k.a. "wolf") trees with large crowns that occupy too much growing space or shade out more desirable species

Leave these trees in your timber stand:

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

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

Ask a forester to assist you in choosing the right TSI practices to produce your desired forest management results at the lowest cost. Some TSI practices are quite inexpensive, and some, such as thinning, may produce immediate revenue.

Prescribed Burning

Fire, if used properly, can be a very effective TSI tool for forest improvement, maintenance, and protection of pine stands. Depending on your goals, it may be the cheapest management practice available. Prescribed fire can be used for multiple purposes, including these:

- reducing the number of undesirable hardwoods in pine stands
- reducing wildfire hazard by controlling fuel build-up on the forest floor
- exposing the mineral soil seedbed for natural regeneration efforts
- improving planting quality by 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 reducing the amount of 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, easily damaged bark. Conversely, 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. Unless you are familiar with the use of prescribed fire in forestry, never attempt to use fire in your timber stands without the help of a forester. Fire is a management tool that should 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 forestry needs.

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 can take up growing space, shade more desirable trees, and often harbor insects and disease. For timber production purposes, your stand will be improved if you remove them. Sometimes, low-quality trees can be left for their wildlife value, and some can be used for firewood and low-value products; however, most culls need chemical or mechanical control. Methods of cull tree removal include:

- cutting trees for firewood or leaving on-site
- injecting herbicides
- hatchet and squirt bottle (“hack and squirt”)
  - hypo-hatchet
  - basal spraying
- cutting and using a 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, tree size, 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
- eastern baccharis
- 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.

Marking Trees for Thinning

You can learn how to mark your own pine stands for thinning (see Mississippi State University Extension Publication 2832, "Thinning Pine Trees by the Leave Tree Method"). 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. Due to the biological complexities inherent to hardwood forests, selective marking in these systems 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. Precommercial thinning with 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 by using proper thinning practices. Overstocked stands are more susceptible to beetle attack. Overcrowding weakens the ability of trees to repel pine beetle 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 scheduled 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. Sanitation cutting may not be economical unless it is done during a commercial thinning operation. If you cut only deformed trees, you may not be able to sell 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. You should remember that in the event of extreme weather, downed timber will be damaged. This will be reflected by lower prices when your timber is sold.

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 overtopped by faster-growing species or residuals from the previous stand. Unless these new trees are released from shading, they probably will not survive. The overtopping trees may be of a 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 you can remove them with an 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. For more information on using injection for timber stand improvement, please see Mississippi State University Extension Publication 2942 "Tree Injection for Timber Stand Improvement."

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)
P2832 Thinning Pine Trees by the Leave Tree Method
P2942 Tree Injection for Timber Stand Improvement

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Revised by **Brady Self**, PhD, Associate Extension Professor, Forestry, from earlier editions by Andrew J. Londo, PhD, and Thomas A. Monaghan, PhD.

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