

Timber Stand Improvement (TSI)

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More than two centuries ago, pioneers arrived in what is now Ohio to find deep forests stretching into the distant west. Those first settlers immediately began clearing the forest, first for their homes and fields, eventually to bake bricks, prop up mine roofs, and feed the sawmill and the iron furnace. By the early 1900s, forest cover in the state had been reduced to about ten percent of its total land area. Now, over a century later, that figure has just about tripled. In all that time, most landowners have cut and sold timber without any real knowledge of how to maintain healthy and productive woods. They have also allowed fire and livestock to run through the woods unchecked. Our forest land has been beaten down, mismanaged, abused, and neglected for decades. Consequently almost every forest landowner in Ohio owns woods that have been degraded in some way. Timber stand improvement (TSI) is one way of turning that around.

Why TSI?

You own land for a reason, probably for many reasons. Those reasons are your goals of ownership. No matter what your goals are, the best and quickest way of reaching them is to manage your woods. Management includes all kinds of activities, but when it comes to improving the quality, value, and productivity of your woods, few show such quick and lasting results as timber stand improvement or TSI. If one of your goals is to have better woods, TSI is for you.

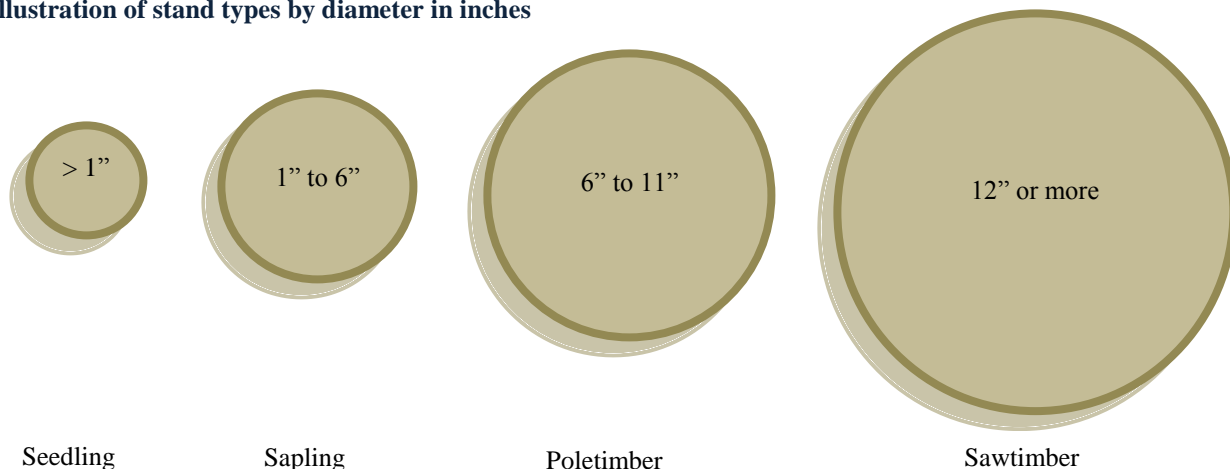
What is Timber Stand Improvement?

Timber Stand Improvement is a forestry term that encompasses the theory and practice of improving your woods by favoring desirable plants and removing or discriminating against undesirable plants. In most cases, TSI means you will be doing some cutting, so oil up your saw and sharpen your axe. Before you can begin, though, you should know something about the practices, techniques, and treatments you will be using. You should also know where and when to do TSI.

TSI--Different Practices for Different Stands

If you lump trees into categories based on their age and size, you can divide your woods into four basic stand types: seedling, sapling, poletimber, and sawtimber. Each type has its own characteristics and each should be treated differently when it comes to improving the woods. Practices, techniques, and treatments are described in the sections following this one. For guidance, check the prescription or recommendations in your forest management plan. For more information, see the publications listed at the end of this one. And for further advice and assistance, talk to a professional forester. ("Diameter" here means diameter-at-breast-height (dbh), measured at 4-1/2 feet above ground level on the uphill side of the tree.)

Illustration of stand types by diameter in inches



TSI in Seedling Stands



A seedling is a tree less than one inch in diameter and/or less than 4-1/2 feet tall. By this definition, trees of this size that have grown from seeds (also called seedlings) and from roots and stumps (called sprouts) are considered seedlings. As you can imagine, seedling stands are quite young, perhaps five years old or less. They develop in several ways: a) from a planting; b) from a clearcut; or c) in an open area that has been abandoned, such as an old field. In general, little management is needed in seedling stands because time and natural processes are doing most of your work for you.

There are exceptions:

In a planting:

- Control grass and broadleaf weeds as needed until seedlings are well established.
- Control other weed species, especially non-native, invasive species that threaten your seedlings. Japanese honeysuckle can be especially hard on small trees.
- Protect your seedlings from wildlife damage as best you can.
- Replant wherever the mortality rate is unacceptably high.
- Apply corrective pruning to high value species such as black walnut.

In an opening:

- Ensure favorable reproduction and future growth in openings by:
 - cutting all trees more than two or three inches in diameter except for seed trees of preferred species;
 - killing undesired species that threaten to overtop or crowd out desired species; and
 - coppicing desired species so as to convert the stand to a more uniform seedling stand and to promote the growth of better stems.
- You can leave trees of desired species such as oak and hickory if they are vigorous and show potential of producing seed for the new stand.
- Control non-native, invasive species. Ailanthus or tree-of-heaven is one of the worse threats in an opening.
- Control grapevines.

In an abandoned area or old field:

- Control non-native, invasive species such as ailanthus or tree-of-heaven, bush honeysuckle, autumn-olive, and to a lesser extent Japanese honeysuckle.
- Control other weed species. As you can see, controlling non-native, invasive species is one of the most important things you can do for small trees.

TSI in Sapling Stands



Sapling stands are made up of trees between one and six inches in diameter. During the sapling stage, the crowns of individual trees begin to close in on each other. As competition for sunlight increases, trees that cannot keep up decline in vigor and eventually die. That is how a stand thins itself naturally. However, nature does not always make the decisions we would make. In general, the sapling stage is your first good opportunity to influence the development of a native stand by deciding for yourself which trees should stay and which should go. The idea is to: a) control weeds, and b) concentrate growth in your crop trees by discriminating against non-crop trees.

In a sapling stand, then, you should:

- Control non-native, invasive species, especially tree-of-heaven.
 - Control other weed species.
 - Control grapevines growing on crop trees.
 - Release crop trees from competition with non-crop trees.
- Thin wherever it is needed. Spacing in a sapling stand should be about six to 12 feet between trees.

In a stand of potentially high-value trees, especially a planting, prune for good form and quality. The first pruning can be either corrective pruning or pruning of side branches, depending on the form and quality of the tree. Depending on conditions and spacing, an initial thinning may also be needed for improved growth. If thinning and pruning are needed, thin first, then prune the remaining trees. If needed, favor the best sprouts growing from old stumps by cutting some of the poorer competing sprouts.

TSI in Poletimber Stands



Poletimber stands are dominated by trees between six and 11 inches in diameter. In general, the poletimber stage is the first in which the harvest of a commercial product is possible. Unfortunately, TSI in a poletimber stand seldom yields enough volume or value to make a commercial harvest possible. If possible, use what you cut for firewood, posts, and so on. Otherwise, you can look at cutting in a poletimber stand as an investment in the future of your woods.

In poletimber stands:

- Control non-native, invasive species, especially ailanthus or tree-of-heaven.
- Control other weed species.
- Control grapevines growing on crop trees.
- Release crop trees from competition with non-crop trees.
- Thin wherever it is needed. Spacing in a poletimber stand should be about 12 to 22 feet between trees.
- In a stand of potentially high-value trees, especially a

planting, prune for good form and quality. Pruning in a poletimber stand may be a second or third pruning. The objective is to prune trees to a height of at least 17 feet. Again, if thinning and pruning are needed, thin first, then prune.

- If necessary, remove cull trees.
- If possible, sell the trees you cut by way of a commercial harvest, or use them for firewood, posts, poles, etc.

TSI in Sawtimber Stands



Sawtimber stands are dominated by trees 12 inches in diameter and larger. As a stand enters the sawtimber stage, the potential for a commercial harvest increases. In any case, in a sawtimber stand:

- Control non-native, invasive species, especially ailanthus or tree-of-heaven.
- Control grapevines growing on crop trees.
- If possible, undertake a commercial improvement harvest in which you sell the trees you cut.

Applying the following practices may yield merchantable or saleable material:

- ✓ Crop tree release.
- ✓ Thinning.
- ✓ Cull tree removal.
- ✓ Even if the trees you cut are not enough to make a timber sale, you should undertake crop tree release, thinning, and cull tree removal. Crop tree release is needed less often in the sawtimber stage than in previous stages. Cull tree removal may be needed more.

TSI--General Principles

- ✓ Before beginning, seek the advice and assistance of a professional forester.
- ✓ Undertake TSI as part of an overall plan for managing your woods.
- ✓ Keep in mind that the purpose of any cutting in a stand before it reaches maturity should be to improve its quality, value, and productivity.
- ✓ If necessary, control non-native, invasive species before starting on other practices.
- ✓ Work in the best stands and on the best sites first.
- ✓ Favor your preferred species and discriminate against weed species.
- ✓ Favor crop trees, that is, the trees you want to grow to maturity because they help you reach one or more of your goals.
- ✓ Keep in mind that a well formed and vigorous tree of a less desirable species is often preferable to a poorly formed or otherwise defective tree of a desirable species.
- ✓ Grow the right trees in the right places.
- ✓ Apply the right practice and use the right techniques and treatments for every situation.
- ✓ Do not cut trees just because you have a saw in your hand. Cut them for a good reason.
- ✓ If you are in doubt about cutting a tree, walk on by. You can always come back another day.
- ✓ Be conservative in your cutting—do not cut too much.
- ✓ If possible, cut lightly with shorter intervals between cutting rather than cutting heavily with longer intervals between cutting.
- ✓ Cut lightly along the edge of the woods and in sensitive areas.
- ✓ Be sure to retain wildlife trees and maintain diversity in your woods.
- ✓ Implement forestry best management practices (BMPs) for erosion control and water quality.
- ✓ If possible, use or sell the trees you cut.
- ✓ Do not harvest timber without doing TSI before and after.
- ✓ At harvest time, work with a professional forester.
- ✓ Keep livestock out of the woods and prevent forest fire.
- ✓ Keep records of your expenses, including your time.
- ✓ Above all else, **BE SAFE!**

TSI Practices

Timber stand improvement is not just one practice, good for every occasion. Think of it instead as a toolbox containing a number of tools, each with its own purpose. Some can be used widely. For example, control of non-native, invasive species such as tree-of-heaven and bush honeysuckle is good for every part of your woods. Other practices--pruning for instance--are limited to certain trees or certain kinds of stands. Your management plan should have a prescription for each stand in your woods. Be sure to talk to your forester for advice and assistance.

Control of Non-Native, Invasive Species

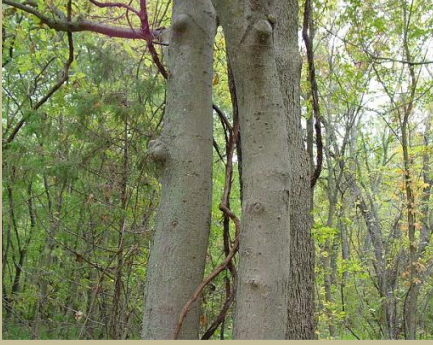
Non-native, invasive species are plants that belong somewhere far away, yet here they are, invading our woods, taking up space, using resources, and crowding out the natives. Some of the worst offenders are ailanthus or tree-of-heaven (*Ailanthus altissima*), bush honeysuckle (*Lonicera* species), and autumn-olive (*Elaeagnus umbellata*). Others include multiflora rose (*Rosa multiflora*) and Japanese honeysuckle (*Lonicera japonica*). Even garlic mustard (*Alliaria petiolata*), a plant of the forest floor, can have an effect on how trees grow.

Non-native, invasive species are a serious threat, and they can grow in every type of forest stand, especially stands that have been disturbed by construction, excavation, drilling, burning, farming, grazing, or heavy logging. They can be dealt with by a variety of techniques as simple as pulling them out of the ground or as complicated as cutting them and treating them with a mix of chemicals. See the section on techniques and treatments below. For more specific information see the publications in the section on further reading.

Control of Other Weed Species

Non-native, invasive species are weeds, but they are not necessarily the only weeds growing in your woods. As the landowner, you get to decide what you want to grow. If a particular species is interfering with your ability to reach your goals, you should consider cutting it, no matter where it is growing. Keep in mind that every native species contributes to the biological diversity and ecological quality of your woods. Think twice before you set about eliminating native species.

Grapevine Control



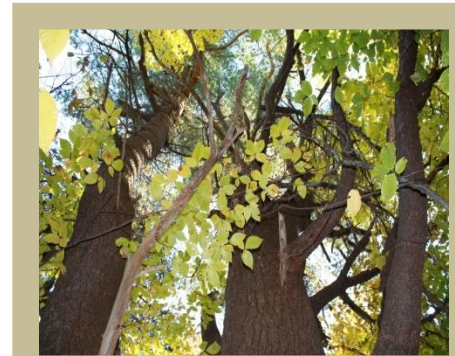
Wild grapevines (there are several species) often grow very aggressively over the tops of trees, especially high value species like black walnut and black cherry. In so doing, they block out sunlight. With their weight and tautness, grapevines can also cause severe mechanical damage, breaking out limbs and treetops. Grapevines are native and a good source of food for wild animals such as grouse, turkeys, and songbirds. Grapevines can also damage and destroy trees. Some foresters recommend cutting every grapevine in the woods. A grouse hunter might say leave them. As the landowner, you decide what is best. You can reach a middle ground by cutting the grapevines growing on your best and most highly valued trees and leaving them on scrub trees. You can also leave poison-ivy and Virginia creeper vines as they do little if any harm. Grapevines are most common on good growing sites, but they can grow even on hot, dry sites. They are also quite common in young stands, especially old-field stands overgrown with brush, briars, and small trees. When you cut grapevines, it is best to make two cuts in each vine, one high and one low.

Crop Tree Release

Crop tree release involves locating and identifying desired trees, then releasing them from competition with their neighbors. Unlike some other practices, with crop tree release, you look for trees to save, not trees to cut. In general, a crop tree is straight, tall, vigorous, and relatively free of defects. A crop tree can also be a tree of any native species, as long as the quality is good. By stretching the definition, you can even say that a crop tree is any tree that will help you reach your goals. In any case, crop tree release is most effective in sapling and poletimber stands where trees are young, vigorous, and likely to respond well to being released. Wait until the canopy has closed above your head before applying crop tree release in a given stand. That usually occurs when trees are at least three or four inches in diameter and 15 to 25 feet tall. To release crop trees:

Determine what your crop trees will be by careful consideration of your goals. Consult your management plan, and if necessary, seek the advice and assistance of a professional forester.

- Locate the crop tree.
- Look up into the crowns of the crop tree and the trees surrounding it. Wherever the crown of one tree is touching or overtopping the crown of another tree, competition is taking place.
- Release the crop tree from competition by cutting the competing non-crop trees. You should release crop trees on at least two sides.
- Cut any grapevines growing in the crop tree.
- Cut and/or treat non-native, invasive species and other weed species, regardless of their location or position.
- There is no need to cut trees or shrubs growing below the crop tree as long as they do not threaten to overtake it.
- If two crop trees are competing with each other, you can make the hard choice of cutting one, or you can think of them as one tree and release around them.



Thinning

Every growing site can support only so much production and no more. Trees in an overcrowded stand slow in their growth because of increased competition. On the opposite extreme is an open stand with few trees--an underutilized site. Your objective as a landowner should be to make the most of what you have by shooting for the middle ground--the optimum level of production between an overcrowded site and an underutilized site. If there are too few trees, you can either: a) promote the regeneration of trees by controlling weeds, vines, and brush; or b) you can plant. If the stand is overcrowded, you can thin it.

Unlike crop tree release (and harvesting timber to improve the woods), thinning is--in technical terms--less concerned with quality than it is with stand density. You may have heard of landowners thinning their planted white pine. The idea is to reduce the number of trees and increase the spacing between those that are left. As with crop tree release, thinning is most effective in young stands where trees are likely to respond well. The economic return of crop tree release and thinning is increased if these practices result in a more rapid transition from a stand of little or no economic value to a stand of higher value. In other words, the objective is to increase growth rates so that a sapling stand becomes a poletimber stand and a poletimber stand becomes a sawtimber stand in the shortest possible time.

With thinning, spacing between trees is your first criterion for deciding which trees should be cut and which should be left. You can use quality as a secondary criterion. In a planting, you can begin thinning when the canopy closes above your head. In pine plantings, you can thin by rows or by cutting individual trees from within each row. If your hardwood planting includes a nurse crop, such as

rows of pine alternating with rows of hardwoods, your first thinning would involve the removal of the nurse trees. In a planting of pure hardwoods, you should thin by making judgments on individual trees. Any weed trees should be first to go. For spacing, you can use this rule of thumb: a) Take the diameter of the average tree in the stand; b) Double it; c) Change inches to feet; d) Cut trees within that distance from the trunk of trees you want to leave. For example, let's say the average tree is four inches in diameter. If you double that figure and change inches to feet, you get eight feet. That is the maximum distance needed for thinning around the trunk of the tree you want to leave. For making judgments on quality, apply the same standards as with crop tree release and improvement harvesting.

The initial thinning in a young stand is likely to be non-commercial, meaning you do not sell what you cut because there is not enough value or volume. A second and third thinning--timed for the poletimber or sawtimber stages--may yield a merchantable product. In any case, because it is a more highly technical operation than crop tree release, thinning is a practice best applied with the advice and assistance of a professional forester. As always, if you are selling timber, you should get help from a forester.

Cull Tree Removal



A cull tree is a tree with little or no value due to some serious defect. If your goal is timber production, a hollow beech tree is an obvious example of a cull tree. If your goal is to provide wildlife habitat, you might leave the beech but cut the rotten red maple. Culls are common in unmanaged or mismanaged woods. They are a drag on the quality, value, and productivity of the woods because they compete with other trees for sunlight, space, and other resources. Cull tree removal is the practice of cutting or killing cull trees. "Removal" refers to the removal of the tree from the overstory, not necessarily its removal from the woods. Although a tree can be a cull as early as the poletimber stage (that is, once trees become potentially merchantable), cull tree removal is usually a practice applied to sawtimber stands. Ideally, you should sell or use any cull tree you cut. Usually, though, removing a cull tree means leaving it in the woods. Felling cull trees can be dangerous. They are often large, hollow, and rotten. Felling them can be altogether unpredictable. Girdling or other techniques or treatments that leave the tree standing in place are better options.

Pruning

With pruning, the tree you cut is also the tree you save. The purpose of pruning is to improve the form and quality of your desired trees. When it comes to forest trees, there are two kinds of pruning. Corrective pruning is a way of shaping and training a poorly formed tree. The objective is to get it to grow straight and tall by promoting the growth of a strong, central leader. Best results come when the tree is still young and pliable. Corrective pruning is not likely to work on a tree past the sapling stage.

Pruning of side branches has less to do with the shape of the tree and more to do with the quality of the wood. Removing side branches early on results in clear wood free of knots and other defects once the tree reaches maturity. That can be an effective way of improving the value of a tree. However, pruning is a time consuming and labor intensive practice. In economic terms, it pays only when applied to the most valuable species (such as walnut, oak, and perhaps cherry) and the most valuable future products (such as white pine grown for log cabin logs). You can prune other species and other trees of course, but doing so amounts to a hobby.

Pruning is usually applied only to seedlings, saplings, and pole-sized trees, and usually only in tree plantings. Some landowners will continue pruning white pine into the small sawtimber stage (trees 12 or 14 inches in diameter). However, you can prune any tree in the woods.

To prune trees:

Begin corrective pruning early. Often, corrective pruning is needed only in species such as black walnut, which tends to be bushy.

If corrective pruning is not needed, begin pruning side branches early, as early as the seedling stage if necessary. Keep in mind that certain species (yellow-poplar, eastern white pine) are good at self-pruning. Once their branches become shaded out, they usually die and the tree sheds them. Other species (black walnut, oak species) do not always prune themselves well.

1. If branches are small, use pruning shears or lopping shears and make a single clean cut just beyond the branch bark collar, an area of raised tissue around the base of the branch where it meets the main trunk.
2. Be sure to make your cut at a right angle to the main axis of the branch.
3. If branches are too large for shears, use a pruning saw or other hand saw and make three cuts on every branch you cut:
4. Cut about one-fourth or one-third of the way through the underside of the branch, several inches away from where it joins the main trunk.
5. Cut through the branch from above, an inch or two beyond the undercut and in the direction of the undercut. The branch will fall away nicely as if it were on a hinge, without tearing the bark on the underside and without binding your saw blade.
6. Remove the resulting stub by cutting through it from above just beyond the branch bark collar. Be sure not to cut the branch flush with the main trunk.
7. Prune dead branches as you would live ones. If the dead branch is a stub with little weight, you can make a single cut just beyond the branch bark collar.
8. Prune before branches reach two inches in diameter. Try not to prune branches four or more inches in diameter.
9. Do not remove more than one-fourth of the live crown of during any one year.

In general, you can prune any time of year.

If your goal is to improve the form and quality of your trees, prune to a height of at least nine feet, preferably to a height of 17 feet. You may have to prune your trees more than once.

Do not use paint, tar, or other dressings on pruning wounds.

Do not make topping cuts on any tree, regardless of whether it is in your woods or in your yard. You don't want your trees to look like city trees growing under a power line.

Coppicing

As with pruning, the purpose of coppicing is to improve the form and quality of a desired tree. The difference is that a coppice cut is made at ground level. The objective is to stimulate the growth of a high quality sprout to replace the original tree. Coppicing is best applied to saplings and pole-sized trees. Trees larger than 12 inches in diameter may not respond well. Very large trees may not respond at all. Keep in mind that coppicing works only on hardwoods, not on pine or other conifers. Also, coppicing is likely to work only where there is enough sunlight for the resulting sprouts to thrive. Finally, coppicing is a practice generally applied soon after a timber harvest, especially a clearcut.

You can make a coppice cut with a saw. If necessary, make three cuts, the first two of which are to fell the tree, the third, to remove the stump. A true coppice cut is made close to the ground so that the resulting sprouts grow from ground level and not from a high stump. Sprouts that grow too high on a stump may be weak or poorly formed.

TSI--Mechanical Techniques

Cutting or severing the stem

Directions: Using a chainsaw, hand saw, axe, or other blade, sever the stem at whatever height is safe and convenient for you. For defective trees of preferred species, you can make a coppice cut, but be aware that most trees need at least partial sunlight in order to survive. For grapevines, make two cuts, one high and one low.

Use: Use on vines, shrubs, saplings, and pole-sized trees. Can be used on larger trees, but felling large trees can be dangerous, especially if they are weak, rotten, hollow, unbalanced, etc.

Advantage: Severing the stem is a surefire way of removing a plant, although deciduous plants are capable of sprouting from stumps and roots.

Disadvantage: Can be dangerous; labor intensive on larger trees; requires special knowledge in the use of equipment and in felling trees; can result in sprouting from the stump and the roots.

Girdling

Directions: Using a chainsaw or axe, cut through the bark and into the tissue under the bark to a depth of 3/4 to 1 inch, completely encircling the stem. If you are using a chainsaw, a single girdle may be enough, but a double girdle is more likely to do the job. If you make a single girdle, an application of herbicide may be needed for a good kill. Double chainsaw girdles should be about 3 or 4 inches apart. Although it is not necessary, you can also remove the bark and underlying tissue between two chainsaw girdles using an axe. If you girdle trees only with an axe, make the girdle several inches wide. Again, cut through the bark and into the underlying tissue in a complete circle around the tree. Make all cuts at a safe and convenient height.

Use: Use on trees, especially large trees.

Advantage: Generally quicker and safer than severing the stem, especially on large trees.

Disadvantage: Can be labor intensive; not always successful in killing the top of the tree.

Pulling or digging

Directions: Using your hands, a shovel, weed wrench, or chain attached to a piece of equipment, pull or dig up the plant.

Use: Use on herbaceous plants and shallow-rooted shrubs such as bush honeysuckle.

Advantage: Can be very effective in removing a plant; a good option for organic farmers.

Disadvantage: Very limited in its application.

TSI--Chemical Treatments

Cut-stump treatment

Directions:

Step 1. Sever the stem.

Step 2. If you are using a water-based chemical, treat the cut surface immediately; or

Step 3. If you are using an oil-based chemical, treat the cut surface immediately; or

Step 4. If you are using an oil-based chemical, you can come back later and treat only the sapwood on the cut surface and the bark on the stump, root flares, and exposed roots.

Use: Use with vines, shrubs, saplings, and pole-sized trees. Can be used on larger trees, but felling large trees can be dangerous, especially if they are weak, rotten, hollow, unbalanced, etc.

Advantage: Can be very effective; chemical is applied directly to the unwanted plant with little if any effect on surrounding plants.

Disadvantage: Same as the mechanical technique of cutting or severing the stem.

Frilling

Directions:

Step 1. Using a hatchet or an axe, girdle the tree with downward-angled cuts, making a “frilly” appearance.

Step 2: Apply chemical to the cuts.

Use: Use on trees, especially large trees.

Advantage: No special advantage over girdling as a mechanical technique (except that you can use an axe instead of a chainsaw) or over hack-and-squirt as a mechanical/chemical treatment.

Disadvantage: Labor intensive; may stimulate the growth of root sprouts.

Hack-and-squirt

Directions:

Step 1. Make several downward-angled cuts with a hatchet or axe through the bark and into the tissue under the bark, leaving a small cup that will hold herbicide. Do not girdle the tree, but be sure to make your cuts all around the tree. A tree with its top still connected to the roots is less likely to sprout from the roots. Make at least two cuts on small saplings, more on pole-sized and sawtimber-sized trees. A rule of thumb is to make one cut for every inch in diameter. For example, if the tree is six inches in diameter, make six cuts around the tree.

Step 2. Apply chemical to each cut.

Use: Use with any size tree above the seedling stage, but best used on large trees. Small trees can be treated with a cut-stump treatment.

Advantage: Safer than the cut-stump treatment; does not require special knowledge or skill in the use of a chainsaw or felling of trees; good control of herbicide.

Disadvantage: May need a second treatment.

Girdling and chemical treatment

Directions:

Step 1. Girdle the tree using a chainsaw, axe, or hatchet.

Step 2. Apply chemical to the resulting wound.

Use: Use with trees larger than the sapling stage.

Advantage: Same as mechanical girdling.

Disadvantage: Same as mechanical girdling. May need a second treatment.

Basal bark treatment

Directions: Apply chemical to the lower 12 to 14 inches of the trunk, including root flares and exposed roots.

Use: Use with trees of all sizes.

Advantage: Quick and efficient; done correctly, results in an excellent rate of success; does not involve any cutting.

Disadvantage: Can be expensive, but the efficiency and potential success of this method argue in its favor.

Foliar application

Directions: Spray or otherwise apply chemical evenly to leaves and green stems.

Use: Use with shrubs and small trees only when leaves and stems are green.

Advantage: Quick and convenient for the control of small trees and shrubs.

Disadvantage: Lack of control in application can result in damage to non-target plants.

Injection

Directions: Use the injection tool as directed by the manufacturer.

Use: Use with trees of all sizes; not recommended for very small trees.

Advantage: Can be very effective in killing plants.

Disadvantage: Requires highly specialized and costly equipment.

Other treatments

Burning

Although burning can be used to control certain plants, it is seldom practicable. It can be dangerous and may be illegal. Also, burning requires special training and skill, ideal conditions, and a sizable work crew for success. Failure can be a disaster.

TSI Operations--Three Special Cases

Harvesting Timber to Improve the Woods



When foresters talk about TSI, they are usually talking about a non-commercial operation. A non-commercial cutting is one in which you do not sell the trees you cut. In other words, there are costs but no revenue. The benefit of non-commercial cutting comes with improved quality, value, and productivity in the woods. If you sell what you cut, you have made a commercial cutting. A commercial cutting aimed at removing low value, low quality timber from the woods is called an improvement harvest. The advantage of an improvement harvest over non-commercial cutting is that it generates revenue at the same time it improves the woods.

Most of the woods in Ohio have been abused, mismanaged, and neglected for decades. The result is an overabundance of defective trees and weed trees. In order to improve the woods, you should discriminate against these trees. If you can sell what you cut, you'll help offset your costs of improving the woods. The problem is that low value timber can be hard to sell. In any case, if you are selling timber, you should consult your management plan and always work with a professional forester.

Completing an Opening

Very often, when landowners sell timber, they sell by a so-called "select cut." In a "select cut," only "select" trees are cut, as opposed to a clearcut, in which all trees are cut. Select cutting has its attractions to landowners, mostly because there are trees still standing after the harvest. However, select cutting in the commonly used sense of the word is really just a thinly disguised form of high-grading, and it results in woods in need of improvement.

What is high-grading?

If you have ever heard the phrase "cut the best and leave the rest," you might already have an idea of what high-grading means. High-grading is an all-too-common practice in which the best and most valuable timber is cut, leaving low value and low quality timber behind. In a "select cut," the best and most valuable timber is cut, sometimes quite heavily. Large gaps or openings with scattered scrub trees may be a result. Those scrub trees are often damaged, poor in form, lacking in vigor, or otherwise undesirable. Poorly managed gaps or openings are not very well primed for future production.

So what do you do in this situation? The answer is simple: you complete the opening by cutting everything that remains. Remember that the best, most vigorous trees in the woods are those that are forced to grow in competition with others. A tree left in the open develops a short trunk and a wide-spreading crown. A large, spreading tree (sometimes called a "wolf tree," although that term has become outmoded) is good for a park or lawn, but is less suited to production in the woods. A tree in competition with other trees on the other hand is forced to grow straight and tall. Competition does far more towards improving your woods than you will ever be able to do. In short, you should promote competition where it is useful to you, such as in a planting or an opening in the woods.

Some principles of completing an opening in the woods:

The trees you find scattered through an opening after a harvest are usually not high value or high quality trees. They are typically defective, weedy, lacking in vigor, or otherwise undesirable. They also have an extreme advantage over the seedlings and sprouts that will develop in the opening and will cast shade upon them for years to come. Also, trees left in an opening are not likely to get any better. They are subject to developing branches along the main trunk, being scalded by the sun, or being blown over or damaged by the wind. Your best future stand is in the youngest trees, not in the oldest.

- You can eliminate the advantage held by the oldest trees by cutting all or most those standing in the opening.
- You can leave some trees if they are your preferred species and if they show some potential for future growth and production, especially if they produce large seeds such as acorns, hickory nuts, walnuts, and persimmons. Species with light seed carried by wind or birds (yellow-poplar, maple, ash, cherry, etc.) will colonize openings on their own. They don't need any help.
- Cut all or most of the trees larger than two or three inches in diameter within the opening.
- Control non-native, invasive species, especially ailanthus or tree-of-heaven.
- Control native weed species as well. Some species (red maple for example) can be very aggressive in an opening. Control may require chemical treatment.
- Control grapevines.
- Make coppice cuts on smaller trees of desired species so as to promote the growth of stump sprouts.
-

The objective in completing an opening is to promote the regeneration of the stand and to convert it from a stand with trees of varying heights to a stand of trees of equal heights. In other words, you will be converting the stand to a uniform stand of seedlings. Foresters call an opening like this a *regeneration opening* or *group opening*.

Make your openings large enough to allow full sunlight to reach the ground for some extended period during the day. A rule of thumb is to make the opening at least twice as wide as the height of the surrounding trees. For example, if the surrounding trees are 75 feet tall, the opening should be at least 150 feet wide.

Rehabilitating the Woods after High-Grading

Most woods in Ohio have been repeatedly cut over and high-graded. The new landowner is usually forced to deal with the consequences. If you come into possession of high-graded woods, you have three options:

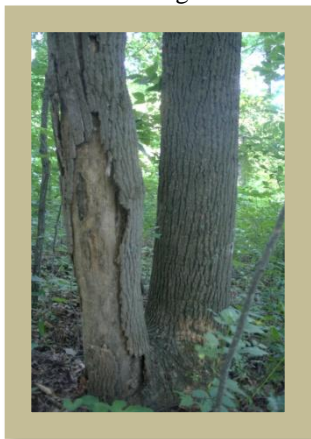
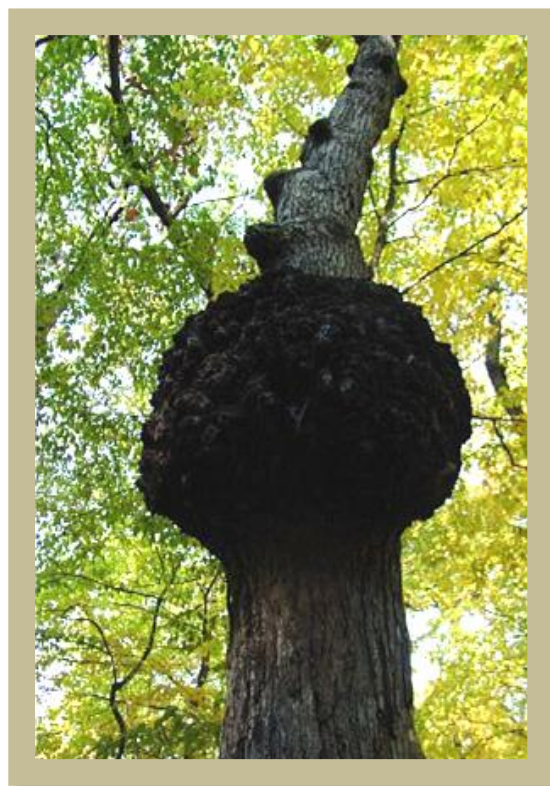
- a) Do nothing--always the least-cost option in the short term. However, doing nothing usually means that you are not making the most of your woods. Also, you will end up paying the price with reduced revenues at harvest time.
- b) If there are enough good trees left, rehabilitate the stand through TSI.
- c) If there are not enough good trees left, clearcut the stand and start again. A professional forester is the person best qualified to decide what your course of action should be.

High-graded stands are usually still in the sawtimber stage, even after the removal of large numbers of sawtimber-sized trees. The appropriate management is described in the section on sawtimber stands above. There may also be numerous openings that could be converted into true regeneration openings or group openings following the procedure in that section. In any case, candidates for removal include trees that are:

- ✓ Heavily damaged, broken, scraped, etc.
- ✓ Spring poles, that is, sapling- or pole-sized trees with their tops pinned to the ground by the tops of larger trees.

Warning: Spring poles can be extremely dangerous. Cut them only if you have sure knowledge in how to do it. If a spring pole is a desired species, finish your cutting with a coppice cut.

- ✓ Forked
- ✓ Multi-stemmed
- ✓ Rotten
- ✓ Cracked or split
- ✓ Bent
- ✓ Crooked
- ✓ Twisted
- ✓ Bowed
- ✓ Root sprung, meaning, they have become partially uprooted
- ✓ Lacking in vigor, stunted, spindly, suppressed, or slow growing
- ✓ Diseased or malformed by disease
- ✓ Extremely branchy, especially if the branches are small, numerous, and emerging from one spot, like a witch's broom (called epicormic sprouting or epicormic branching)
- ✓ Weedy, especially if they are non-native, invasive species
- ✓ Overmature, meaning, they have passed maturity and are in decline
- ✓ Competing with better trees or more desired species
- ✓ Inferior trees are a byproduct of high-grading. They're the trees that should have been cut if the woods had been well managed by the previous owner. Your goal as the new owner should be to undo the damage caused by high-grading



Timber Stand Improvement--A General Prescription



- 1) Eradicate the worst non-native, invasive species, including ailanthus or tree-of-heaven and bush honeysuckle
- 2) Control other non-native, invasive species such as autumn-olive, Japanese honeysuckle, and multiflora rose.
- 3) Control other undesired or weedy species as determined by your goals or as outlined in your forest management plan.
- 4) Control grapevines growing on the best and most valuable trees in your woods. There is no need to cut every grapevine in the woods, nor is there a need to cut poison-ivy or Virginia creeper vines.
- 5) Favor crop trees and discriminate against the non-crop trees that are competing with them. A crop tree is any tree that you want to grow to maturity because it will help you meet your goals.
- 6) Maintain your land at an optimal level of production by thinning in overstocked areas and favoring reproduction in understocked areas.
- 7) Consider cutting trees that are rotten, hollow, crooked, bent, twisted, forked, multi-stemmed, or otherwise seriously defective
- 8) You can retain trees that help you meet your goals, regardless of their condition.
- 9) Also, you should leave a minimum number of wildlife trees per acre and maintain diversity where you can.
- 10) In very poor stands, consider regenerating the stand by cutting all or most trees larger than two or three inches in diameter.
- 11) If possible, undertake an improvement harvest in which you sell the trees that you and your forester have determined should be cut to improve your woods.
- 12) Talk to your accountant about the tax considerations for any management activity in your woods, including TSI.

For advice and assistance on TSI and other management activities, contact:

Ohio Division of Forestry

2045 Morse Road
Building H1
Columbus, OH 43224
(877) 247-8733

Rural Action, Inc.

P.O. Box 157
Trimble, OH 45782
(740) 767-4938

USDA Service Center

Includes Farm Service Agency (FSA), Natural Resources Conservation Service (NRCS), and Soil and Water Conservation District (SWCD)

See the government pages of your phone book.

You can also contact a private, consulting forester, but be aware that a consulting forester charges for his or her services. A list of consulting foresters is available through the Ohio Division of Forestry, the Society of American Foresters (SAF), the Association of Consulting Foresters (ACF), or your local soil and water conservation district (SWCD), located at the U.S. Department of Agriculture (USDA) Service Center.

Further Reading

- *Controlling Undesirable Trees, Shrubs, and Vines in Your Woodland* by Randall B. Heiligmann, Ohio State University Extension, F-45-97, 1998.
- *Corrective Pruning of Black Walnut for Timber Form* by Walter F. Beineke, Purdue University, FNR-76, no date.
- *Crop Tree Management: A New Tool to Help You Achieve Your Woodland Goals* by David K. Apsley and Randall Heiligmann, Ohio State University Extension, F-50-02, 2002.
- *Forest Improvement Handbook* by Ron Rathfon, Mike R. Saunders, and Don Stump, Purdue University and Indiana Department of Natural Resources, FNR-IDNR-414, 2009.
- *Herbicides Commonly Used for Controlling Undesirable Trees, Shrubs, and Vines in Your Woodland* by Randall B. Heiligmann, Ohio State University Extension, F-45-Supplement-06, 2006.
- *How to Prune Trees*, USDA Forest Service, NA-FR-01-95, no date.
- *How to Release Crop Trees in Precommercial Hardwood Stands*, USDA Forest Service, NE-INF-80-88, 1989.
- *Improve Your Woodlot by Cutting Firewood*, USDA Forest Service, NA-GR-6, no date.
- *Timber Stand Improvement: A Guide for Improving Your Woodlot by Cutting Firewood* by Bruce Palmer, Missouri Department of Conservation, F00035, 2004.
- *Woodland Management: Helping It Grow* by William E. Kidd, Jr., and H. Clay Smith, West Virginia University Extension Service, 1989.

About the Author: Terence E. Hanley is a consulting forester living in Athens Ohio. He is the Owner of Professional Forestry LLC. Mr. Hanley has a degree in Forestry from Purdue University and worked for many years as a service forester in Indiana, Missouri and Ohio prior to his current work. He can be contacted at professionalforestry@yahoo.com about forestry consultations.

All photos by: Susi Rankis



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