Photo: WDNR

The how and why of forest improvement

By Nancy Pywell

Timber stand improvement (TSI) is a necessity in most previously unmanaged forest stands. Decades of poor forest practices, including grazing, overcutting and high grading, have resulted in forest stands stocked with poor quality trees.

Where owners or loggers have removed only the most valuable trees for market (high grading), less valuable species and individual trees have reproduced and occupied the space. Overcutting may have resulted in open areas where branchy "wolf" trees, less valuable tree species, or shrubs have taken over space needed by less aggressive but more valuable timber species.

To prepare these stands for future harvests of high-quality timber, and to increase their visual and wildlife qualities, improvement cuttings are essential. Timber stand improvement is basically weeding a forest and preparing it for productive use. If the quality of a stand has deteriorated beyond a certain point, a regeneration cut or stand conversion may be in order. If that point has not been reached, one or more well-designed improvement cuttings should put the stand back on a productive course.

Look for this logo on stories that are introductory to forest management.

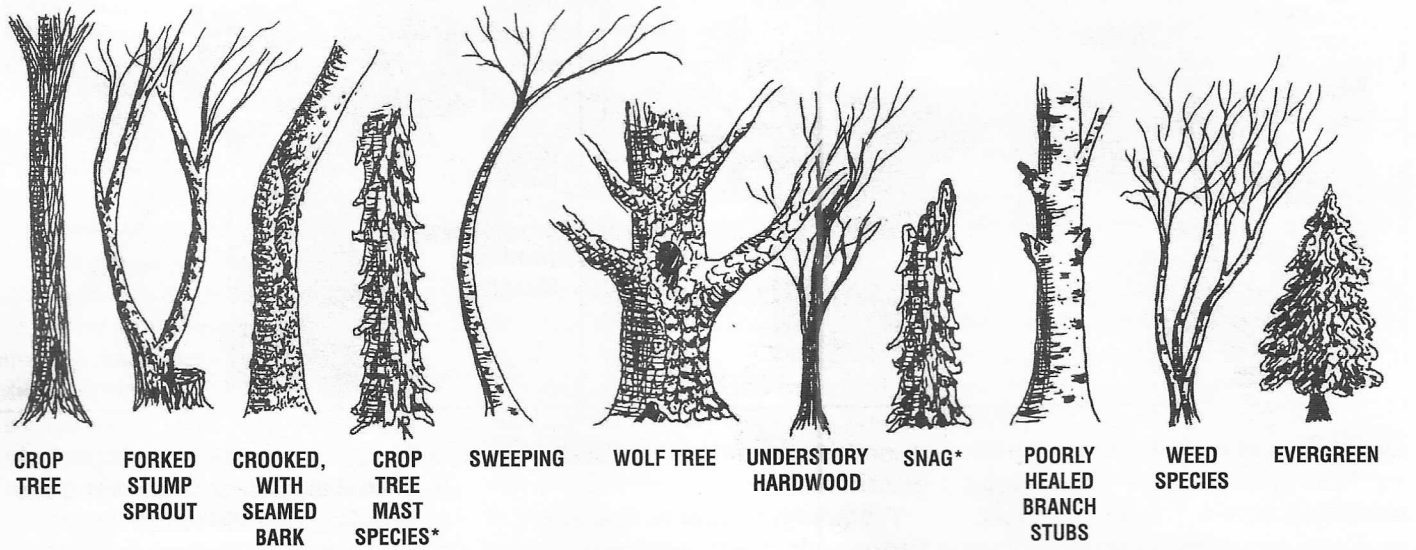
To understand the purpose of TSI, it is necessary to understand how a forest stand develops. Most existing stands originated following a major disturbance, such as land clearing for homesteads or farms, fire or past harvests.

Following such disturbances, thousands or tens of thousands of seeds may germinate and grow into small trees. As they grow larger and crowd each other, competition increases for light, moisture and nutrients. The most vigorous trees grow taller and expand their crowns. They become the dominant trees in the stand.

As less vigorous trees are crowded by these dominants, their crowns become misshapen and restricted. If they can compete successfully enough to maintain a place in the canopy, they are called co-dominants. These co-dominant trees receive light from above, but crown growth is restricted on the sides. Trees of intermediate crown classes are shorter than dominant or co-dominant trees and receive little light. Suppressed or over-topped trees are totally below the main canopy. They receive no direct sunlight and eventually die.

A forest is a very dynamic environment. Changes are constantly occurring; a tree that dominates a forest stand one year may die due to disease, insects or a natural disaster the next year. Of the tens of thousands of seedlings beginning life in a forest, less than 100 per acre may survive and thrive to become mature trees suitable for harvest.

The crown ratio, or percentage of the tree with live branches or leaves, indicates the relative vigor of a tree. With a crown ratio of 1/3 to 2/5, a dominant or co-dominant tree is able to take advantage of openings in the canopy to expand its crown and to increase its growth rate. Trees with lower crown ratios, or trees of lower classes, do not have the resources to thrive. Those with higher crown ratios are too branchy to



*MAY HAVE HIGH WILDLIFE VALUE

Illustrations: Pennsylvania State University, Forest Resources Extension

Trees to consider when conducting a Timber Stand Improvement (TSI) in your woodlands

produce quality timber.

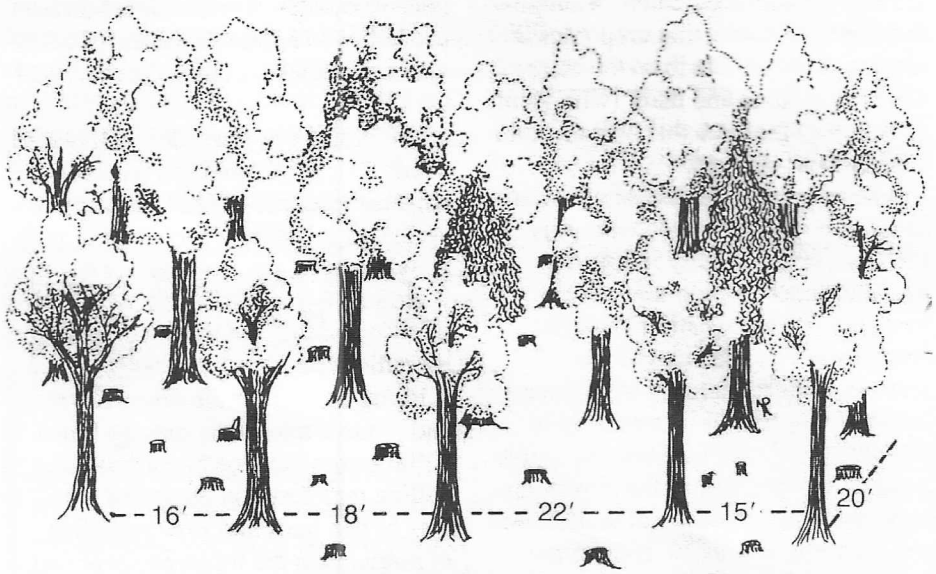
TSI gives you the opportunity to select and encourage the dominant and co-dominant trees that will become your final crop trees.

TSI consists of a series of operations, some of which may be combined to reduce labor and material costs. The following terms describe these operations:

- Crop tree selection: Choosing which trees to encourage
- Liberation cut: Removing over-topping trees to reduce competition to sapling-sized crop trees in understory
- Weeding: Removing undesirable species or individuals competing with crop trees in sapling-sized stands (1-4 inches diameter at breast height [dbh] at 4.5 feet above ground level).
- Improvement cut: Weeding done in pole-sized (4 to 10 inches dbh) and larger stands
- Thinning: Removing nearby trees to further encourage crop trees
- Pruning: Removing lower branches to improve quality

The objective of TSI is to provide optimum growth of selected trees. This is done to encourage early financial returns and to promote healthy and vigorous forest stands.

TSI work may require input of time and money with no immediate return. However, the increased return from high-quality timber products and a healthy forest environment should more than repay earlier investments. Increased use of wood for home heating has expanded markets for the material generated by TSI; federal or industrial cost-share or assistance programs may be available in your area to further reduce your immediate costs.



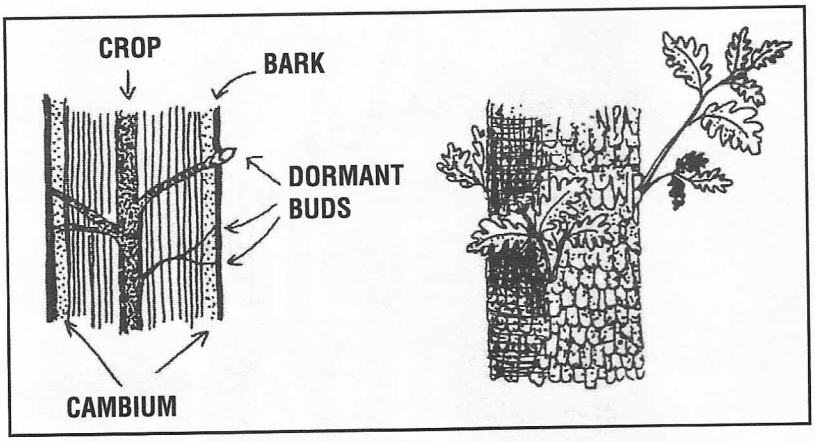
Well-spaced crop trees

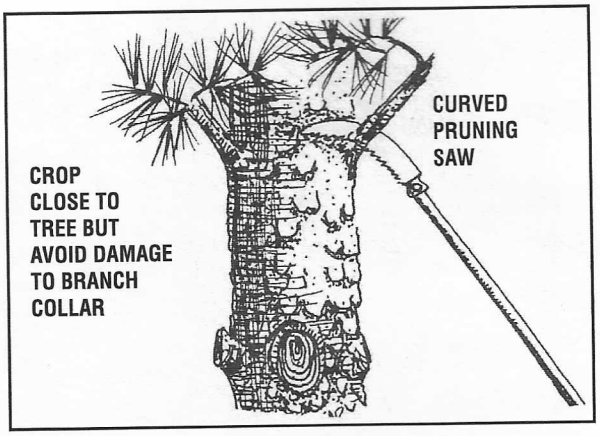
Your management objectives, as well as physical and financial resources, determine how much TSI work you can undertake. A thorough job of improvement in part of your woodland probably will net more gain than a half-done job throughout your entire property.

Trees need room to grow. If they are too close to one another, they must compete for water, nutrients and sunlight. By removing competing trees, you are releasing the trees you choose to favor (crop trees) from competition and encouraging their growth. If you remove only a few of the competing trees, the remaining undesirable trees will use nutrients, water and sunlight that could be increasing the growth of selected crop trees.

Selecting crop trees

Your objectives will dictate the tree species you wish to favor. Ideally, each timber crop tree should be straight, tall, vigorous and free from obvious defects. Pole-sized timber (4 to 12 inches dbh, 4.5 feet above ground level) will





respond best to release. To increase its vigor and growth, the crown of a crop tree should have a space of 3 to 4 feet on at least two sides.

Selecting crop trees will take time, but ultimately will result in an improved forest environment and increased economic potential. A simplified method of selecting crop trees is to pace about 20 feet from the edge of your forest stand and mark (with paint or flagging) the trees that best meet the criteria for crop trees.

Permanent marking is not necessary, as over time, certain crop trees may fall from favor. Twenty feet farther on, select another crop tree. As nature does not follow strict patterns, you may have to search an area 5-7 feet around the ideal spot to locate a suitable crop tree. If no tree is up to standard, select the best tree. Save it to avoid large openings in the crown that may encourage invasion of undesirable shrubs, forbs or grasses. If there are no trees at all, move 20 feet down the line. By a series of such selections you should end up with 100 to 150 crop trees per acre, spaced 15 to 25 feet apart.

If your stand has not been treated previously, many of the non-crop trees probably will be of low quality. Do not mark every reasonably good tree as a crop tree as this defeats the purpose of your work. If you don't remove them now, nature will select many trees in a crowded stand for destruction before they reach maturity. This is your opportunity to help nature and yourself by removing those of lesser values.

If you discover a good crop tree that does not fit into the 15-25 foot spacing pattern, mark it. So long as you allow it enough space to grow, it should be a good investment.

The trees you select as final crop trees, and the trees you choose to remove, will depend on your management objectives. Species selection greatly influences the ultimate value of your woodland. A professional forester can help you assess the potential of various species present in your woodland.

The crop trees you retain will benefit from reduced competition whether the adjacent trees are cut and removed or are killed in place. If fuelwood or pulpwood markets are available, or if you will use the wood yourself, you may profit by cutting the wood yourself or by selling the cutting rights.

If you don't have the resources to cut and remove trees, they may be killed. Killing trees in place by girdling or frilling may result in increased numbers of den trees and slow recycling of nutrients in the forest environment. Gradual deterioration of trees will reduce damage that could occur to crop trees if culled trees are felled and removed. However, careful logging and removal will speed the release of crop trees and permit use of the wood. The economics of cutting vs. killing must be decided according to individual objectives and the financial and physical resources available.

The most common methods of killing trees are girdling (cutting the bark around the entire trunk) or frilling and applying approved chemical herbicides. Girdling may be done with an axe or chainsaw. The cut must be complete and deep enough to sever all living tissue connecting the roots to the crown. Frilling is accomplished by spaced or connected axe cuts made around the tree, followed by application of chemicals. Frilling generally results in a more rapid and certain death. But slow killing by girdling or frilling will protect understory trees from immediate and severe exposure to sunscald and frost, and may reduce the incidence of epicormic branching on crop trees.

Epicormic branches develop from dormant buds beneath bark on tree trunks. If the tree trunk is exposed to sufficient light after surrounding trees are removed, buds will grow into branches. Knots resulting from formation of epicormic branching will reduce the quality of wood.

Weeding, thinning, liberation and improvement cuts

These practices are designed to reduce competition to crop trees. Weeding and liberation cuts are performed in relatively young stands where trees are 1-4 inches in diameter. Weeding removes undesirable or less valuable species and poorly formed individual trees. Liberation cuts remove trees that are over-topping crop trees, reducing available sunlight and competing in the root zone for water and nutrients.

Thinning and improvement cuts are performed in older stands, where trees exceed 5 inches in diameter. If prior TSI has not been performed, many trees will be suitable for removal.

Trees to remove include:

- Those competing with selected crop trees
- Diseased trees
- Overmature trees
- Crooked or sweeping trees

- Forked trees
- Wolf trees
- Trees with broken or seamed bark
- Trees with large or poorly healed branch stubs
- Weed species
- Species favored by spongy moths (previously called gypsy moths), if there are only a few such trees

A seriously neglected stand may have few individual trees of good quality. And removing all defective and overtopping trees may expose the remaining individual trees to risk of sunscald, epicormic branching or windthrow (being blown down in stormy winds). If few quality trees exist, two or more light cuttings separated by 5-10 year intervals may be preferable to one heavy cut.

If timber production is your prime objective, you may wish to consider a regeneration cut to improve crop tree density. Low density means you have room to waste, rather than room to grow. If trees cannot fully occupy the site by closing openings in the canopy, you are wasting resources. You are also opening your forest stand to invasion by plants that may be detrimental to existing trees or that may prevent future reproduction.

When timber production is not your only management objective, you may wish to leave a few individual trees with particular wildlife or aesthetic values. One or two den trees and snags per acre, and some evergreens and mast (nut producing) trees will provide shelter and food for wildlife. To you, the aesthetic value of a flowering dogwood or a wolf tree may outweigh its negative effect on surrounding trees.

How much to remove

Your objective should not be a sustained yield (continuing supply) of defective trees. For this reason, artificial limits should not be set on the volume of wood removed in an improvement cut. You should remove as much of the defective material as you can physically and financially afford. Concentrate on removing those trees immediately adjacent to selected crop trees without creating unduly large openings in the canopy. Once your initial cut has been made, crop trees and other trees that remain should increase their growth rates and vigor.

When the trees have grown to occupy the site fully (10-15 years on good sites), you should consider a second improvement cut or a thinning. Closure of the openings you made in the canopy indicates that another improvement cut or thinning may be appropriate. The second cut will remove additional cull trees and trees that are now crowding final crop trees.

If your cutting plan has been well designed and closely followed, your timber stand should be well on its way to providing what you want from it. You may wish to prune selected crop trees for reasons of timber value improvement and aesthetics. Careful pruning, begun early in a tree's life, may increase its value substantially. Veneer-quality logs and clear-lumber logs generally command premium returns; a carefully pruned stand provides an attractive view. Pruning of hardwoods is not a common practice, but can be done for aesthetic reasons.

Pruning should begin when a tree is pole size, or 4-10 inches dbh. White pine is most often pruned. But red and white oaks, yellow birch, black cherry, spruces and other species also may increase in value after pruning. Saw off all branches less than 2 inches in diameter to a height of 17 feet. If there are no crop trees capable of producing clear 16-foot logs, prune trees to 9, 11, 13 or 15 feet. Do not remove more than one-third of the live branches on a tree. A cut on the underside of larger branches, before sawing from the top, helps prevent tearing of live tree tissues. A straight saw for undercuts and a curved pruning saw will make the job easier.

Successful timber stand improvement involves planning and work. The ultimate results are more valuable timber and fuelwood, plus a vigorous, productive forest stand. An added benefit is the satisfaction of knowing you have fulfilled your role as a manager and steward of woodland resources.

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