

### WISCONSIN WOODLANDS

# **Intermediate Cuttings** in Forest Management



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Why should you manage your forest? Didn't the colonists discover some of the most magnificent forests ever on this continent? And if these forests developed so well with so little human intervention, why can't you just let your trees grow the same way?

Most forest landowners have a number of reasons for owning their property. Their objectives might include producing timber, creating wildlife habitat, protecting watersheds, and enhancing aesthetics or recreation. Achieving these goals usually requires landowners to manipulate the forest vegetation. Although they could wait for nature to do the job, the changes would most likely be slow in coming and not what they wanted anyway.

To hasten and direct changes in forests with a minimum expenditure of time, energy, and money, landowners and foresters practice what is called **forest management**. Management practices that manipulate vegetation are pretty much limited to planting trees or cutting them down. When you cut trees, the activity is called **intermediate cutting** if the trees are immature, and **harvest cutting** if the trees are mature. This publication focuses on intermediate cutting.

Intermediate cuttings are made in a stand between the time of its formation and its major harvest. (A stand is a tree community that is different from the ones around it and large enough to be managed as a single unit.) Intermediate cuttings include thinning, crop-tree release cuts, improvement cuts, salvage cuts, and sanitation cuts. In some practices, the term "cutting" has actually been broadened to include chemical treatment and girdling of trees. The most important intermediate cut for many stands is a thinning; therefore, we treat it at some length in this publication.

## What are Thinnings and Why are They Needed?

Young forest stands usually contain far more trees than can survive to maturity. As the trees grow and mature, and their crowns and roots begin to interfere with one another, the competition between them for sunlight, water and nutrients increases.

If you don't manage the stand, several things may ultimately happen, depending upon the tree species and quality of the site. The trees' lower branches may die; the trees' diameter and height growth may be reduced. Some trees may grow taller than their counterparts, and eventually overtop and shade the smaller trees, which then die. Change, including death, is a natural part of a forest.

Landowners or foresters need not sit idly by as this "natural selection" occurs. Rather, they have a powerful tool, thinning, to partially control a stand's development. Thinnings are intermediate cuttings designed to reduce the competition of crop trees by removing surplus trees. Foresters thin stands to improve the growing conditions for the crop trees, not just to remove "bad" trees. Therefore, you should identify the crop trees as soon as possible, based on your management goals.

Because sunlight, water and nutrients are fixed inputs, a stand of given age, species mix, and site quality cannot produce more than a certain amount of wood. By thinning, you redistribute the stand's growth, putting the same total growth on fewer trees. Thinnings stimulate—or at least maintain—growth on the remaining trees, increasing the yield of useful products. They also let a landowner remove and use trees that would otherwise die and rot before the stand is ready for harvest cutting.

Thinning produces other benefits besides those strictly related to wood production. First, thinnings often make it possible to see further into a stand or forest, increasing its aesthetic appeal. Also, harvest residue provides food and shelter for wildlife. For example, if you thin white cedars during winter, the lopped branches are an excellent food for yarded deer; birds, rabbits and other small animals find refuge in piles of tree limbs

## Frequency, Timing and Intensity of Thinnings

To develop an effective thinning program, you should determine the thinning method to use at each stage as the stand matures. Analyze the timing, frequency and intensity of the operations. Of paramount importance, however, is the economics of each thinning. If the trees you cut when thinning are impossible to sell, it may not pay to thin your stand.

Theoretically, a thinning may be performed whenever the crowns or root systems of adjacent trees meet and begin to interfere with one another. In practice, however, foresters employ the live-crown ratio and/or stocking charts to determine when a stand needs thinning.

The proportion of a tree's total height enveloped by live branches—the live-crown ratio—is one of the best indicators of competition in a stand. As long as potential crop trees maintain a live-crown ratio of about 40 percent, a thinning is unnecessary. But, if the live-crown ratio falls below 30 percent, a thinning may be required to maintain a stand's health.

At the other extreme, if some dominant trees grow much faster than their neighbors and develop large, limby crowns, they need to be removed before they reduce the value of the entire stand. If the average live-crown ratio of the stand drops below 40 percent, monitor diameter growth each year; contemplate a thinning when the diameter growth slows noticeably for two successive years.

The second criterion for judging if thinning is appropriate is to compare the current stocking level in a stand with accepted guidelines for the species in question. Foresters express stocking levels in terms of the combined cross-sectional area of all trees (basal area) and the number of trees per acre. Comparing your stand to an optimal stand is an involved procedure because it requires an inventory, or cruise, of the stand. If the stand is judged to be "overstocked," a thinning is usually recommended. Stocking charts (Figure 1), which indicate the optimal basal area and number of trees per acre for a given average tree diameter, are helpful in determining the proper residual stand density. Refer also to UW-Extension Bulletin G3362, Wisconsin Woodlands: Estimating Stocking Conditions in Your Timber Stand.

The intensity and frequency of thinnings should be governed by the overall management objective, and by the fact that as the number of trees removed in a thinning increases, so also does the length of time before another is needed. Removing trees from a stand creates openings in the canopy—the aggregate of all tree crowns. If the openings are too large, undesirable vegetation—such as "weed" trees, shrubs and grasses—may grow into the gaps before the crop trees' crowns can expand. Thinning also decreases the rate at which trees naturally prune themselves. If you remove too many trees, new branches, called epicormic branches, may develop on the remaining trees' boles.

If timber production is your main management objective, and you want trees with long, clear, unbranched boles, either delay thinning until most of the branches have died to at least 17 feet—natural pruning progresses upward from the tree's base—or gradually open the stand with a series of light thinnings. The gaps you create by thinning should be small enough so that crop trees can close them before understory plants capitalize on the increased sunlight and start rapid and sustained height growth.

If wildlife habitat is your primary objective, create small openings in the forest for feeding areas, and leave overmature trees as dens.

#### Thinning Methods

Foresters have developed many ways to thin a stand, but the most common are thinning from below, crown thinning and mechanical thinning. These methods were formulated for even-aged stands—those stands where trees are the same age, within 10 to 20 years. However, you can also

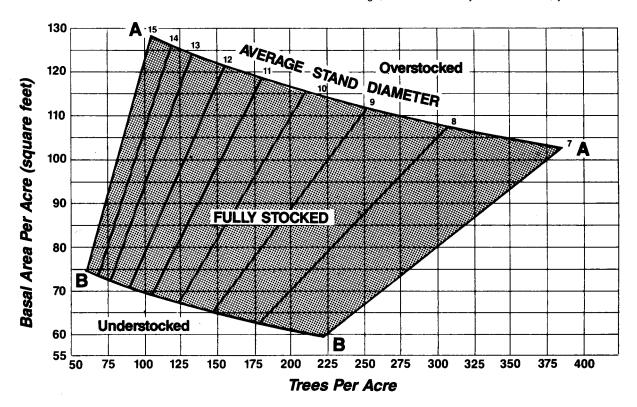


Figure 1. Upland hardwoods (oak-hickory) stocking chart.

apply these methods to uneven-aged stands, because uneven-aged stands are generally composed of many relatively small, even-aged components, We'll deal with each method in some detail.

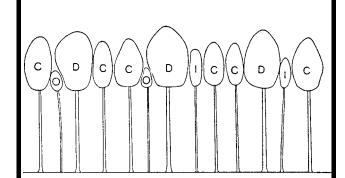
#### Thinning From Below

With this method, also called low thinning, foresters cut trees in the two lower (intermediate and overtopped) crown classes (Figure 2). This method imitates and accelerates the natural mortality that occurs in stands. Because thinning from below doesn't create openings in the main canopy, it stimulates very little growth in the remaining trees. Crown class is not the only criterion used to select the trees to be cut. Foresters also use dbh, the diameter at breast height—4½ feet above ground level. The trees removed are typically thinner than average, so a low thinning effectively increases the average dbh in the stand.

The method's greatest merits are that it is simple, it closely mirrors the stand's natural development, and it is likely to cause minimal damage to the residual stand.

Because low thinnings create openings in the lower canopy, the method may be somewhat less desirable than a crown thinning if a troublesome understory is likely to develop. This is a result of the difference between high and low shade. Low shade—shade cast by vegetation relatively close to the ground—inhibits growth more effectively than shade cast by tall trees. Consequently, you may want to use a different thinning method if an undesirable, shade-tolerant understory is likely to grow under a low-thinned stand

An even more important problem with low thinning is that the small trees you harvest may be difficult to sell. As a result, the method's usefulness is limited primarily to stands in which the smaller trees are of merchantable size, but



The illustration above shows the relative positions of trees in the different crown classes in an even-aged stand that has not been thinned. The letters D, C, I and O stand for dominant, codominant, intermediate and overtopped crown classes

**Dominant.** These are trees with crowns extending above the general level of the crown cover and receiving full light from above and partly from the side. Dominant trees are larger than the average trees in the stand, and have well-developed crowns that may be somewhat crowded from the sides.

**Codominant.** These are trees with crowns forming the general level of the crown cover and receiving full light from above but comparatively little from the sides. These trees usually have medium-sized crowns more or less crowded on the sides.

**Intermediate.** These trees are shorter than those in the two preceding classes but with crowns extending into the crown cover formed by codominant and dominant trees. Intermediate trees receive a little direct light from above but none from the sides. They usually have small crowns that are considerably crowded on the sides.

**Overtopped** (also called suppressed). These are trees with crowns entirely below the general level of the crown cover. Overtopped trees receive no direct light either from above or from the sides.

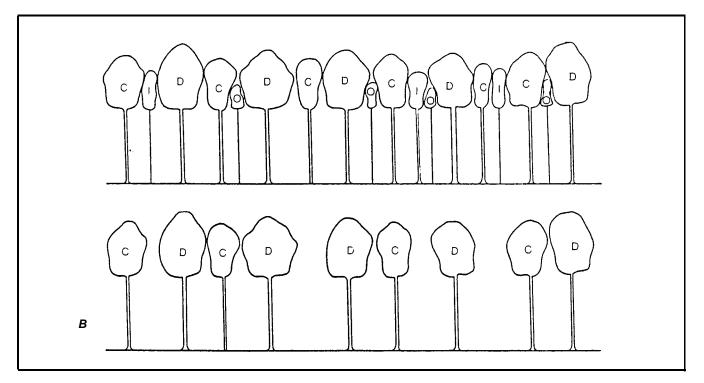


Figure 2. How a stand might look before (A) and after (B) a low thinning. The letters on the tree crowns denote/crown

wouldn't grow rapidly if you cut nearby trees to reduce competition. It is also useful in areas with a good firewood market.

#### **Crown Thinning**

In crown thinning, or thinning from above, foresters remove some trees of the upper (dominant and codominant) crown classes in order to benefit other promising trees in the same classes. Crown thinning favors the same trees as a low thinning, but in a different way. Instead of eliminating most or all of the overtopped individuals, this method removes only a few strong competitors from around the crop trees (Figure 3). Proper crown thinning usually maintains the average dbh, but may cause it to decrease slightly.

Crown thinning differs from low thinning in that the principle cutting affects the upper crown classes while the intermediate and suppressed trees remain relatively intact. The shorter trees shade the forest floor and help retard the growth of undesirable vegetation. The shorter trees also "train" the crop trees by preventing the latter from develop ing epicormic branches on the lower stem, and by expanding into gaps created by dying crop-tree branches.

The primary advantage of crown thinning is that it allows the crop trees' crowns to expand and stimulates the crop trees to grow more quickly than they would after a low thinning. However, the residual stand may be damaged by falling crowns, or from the harvesting machines scraping against the trees.

#### **Mechanical Thinning**

In mechanical thinning, foresters cut the trees on the basis of a predetermined spacing or pattern, regardless of their physical qualities. Cutting trees in such an arbitrary manner is most useful in highly uniform stands where the trees have not differentiated into crown classes. This method is often used when thinning plantations (Figure 4).

The residual stand usually receives little logging damage; when cutting, you can fell each tree in the direction of the row. Also, a logger can easily move the necessary machinery up and down the row without needing to worry about hitting residual trees. Later, when the stand is ready for a selective thinning, a logger can cut and remove the trees by moving machinery in the "corridors" cut through the stand during mechanical thinning.

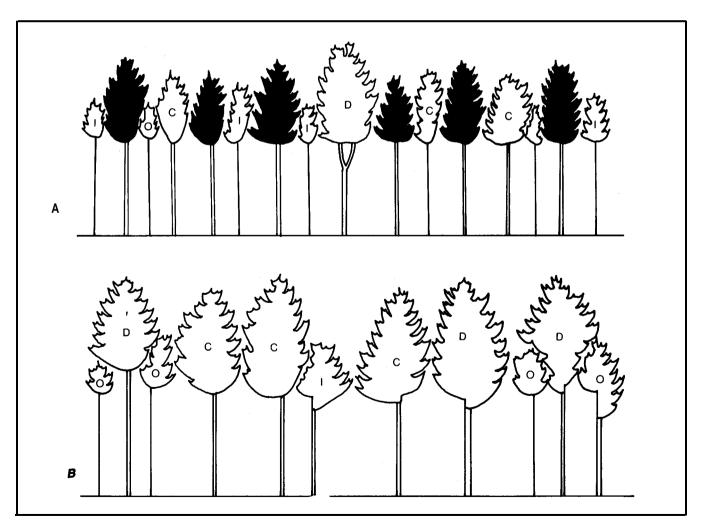


Figure 3. A coniferous stand immediately before a crown thinning(A). The shaded crowns indicate the crop trees.

The lower sketch (B) shows the same stand about 20 years after the thinning, when the crowns have reclosed the canopy.

#### Other Intermediate Cuts

The intermediate cuts described below also remove trees from a stand that is not ready for a harvest cut. However, these cuts differ from true thinnings with respect to, for example, their objectives and the age of the stand when applied. Trees slated for removal may be cut, or else girdled or killed with chemicals, and left standing.

These other types of intermediate cuts often don't generate merchantable forest products. Whenever this occurs, the cuts are strictly an investment in the stand's future. Therefore, before conducting such an operation, consider the possible benefits and costs. Use standard investment analysis procedures to properly weigh these considerations.

#### **Improvement Cuts**

Although most thinning methods could be called improvement cuts, the term usually refers to operations conducted in young stands. Specific methods grouped under this heading include weedings, cleanings, liberation cuttings and release cuttings. Their individual characteristics and applications are more detailed than we can provide in this publication.

However, these operations generally remove 1) inferior species, 2) crooked, leaning, extremely limby or badly formed trees, 3) overmature individuals and 4) trees seriously injured by insects, disease, or bad weather. Their use includes removing aspen or boxelder saplings from pine plantations. Another example is releasing young maple, ash

and basswood from under short-holed, low-quality red and white oak in a stand that was pastured until the last 10 to 15 years.

#### **Salvage Cuts**

Foresters prescribe salvage cuts primarily to remove mature trees that have been—or are in imminent danger of being—killed or damaged by something other than competition between trees. Perhaps the best example of this is the recovery of merchantable wood that has been blown down in a windstorm.

#### Sanitation Cuts

Sanitation cuts remove trees that may serve as hosts for diseases or insects that may infector infest other trees in the stand. Sanitation cuts are neither effective nor worth conducting unless removing susceptible trees interrupts a pest's life cycle and reduces its spread to other trees. Sanitation cuts are often made to control oak wilt, Dutch elm disease, pine bark beetle infestations, and eutypella cankers in maple stands. Sanitation cuts are sometimes made in conjunction with salvage cuts.

#### **Crop-Tree Release Cuts**

If you are going to thin a stand but not generate immediate income from the harvest, strive for the greatest possible increase in diameter growth for the least amount of work. One relatively inexpensive method of accomplishing this goal is called "crop-tree release" in which you remove only the most direct competitors from around each crop tree.

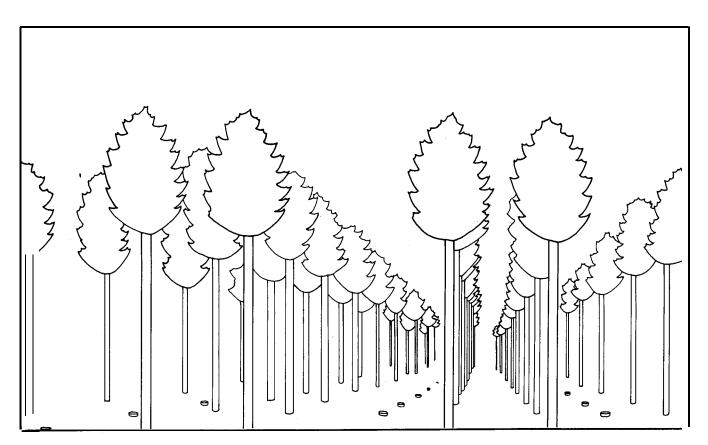


Figure 4. A pine plantation in which every third row of trees has bean removed. The opening in the canopy should close in a few years.

With crop-tree release, it is imperative that you identify crop trees that will respond to increased sunlight. Choose those with the best form and greatest potential value to your management objective. Then identify and remove those trees that may outgrow, shade or break the leaders of crop trees. Unless the crowns are intertwined, don't worry about adjacent trees that are shorter and slower growing than a crop tree. If the crowns are intertwined, carefully cut down the undesirable tree.

#### **Conclusions**

Ideally, a thinning should produce enough merchantable timber to generate an immediate profit. However, this isn't always possible. Often thinning is just part of the cost of managing a stand, and generates no income. If economic return is your primary objective, time thinnings based on forecasts of their economic consequences. An investment analysis can predict whether a thinning is financially feasible.

The analysis estimates future yields and net dollar returns for the stand with and without thinning. By comparing rates of return (or present net values) for each outcome, landowners can make a more informed decision about whether to thin now, later, or not at all. Even though the analysis may indicate that a thinning is not economical, you may decide to proceed with the operation, knowing the cost of that decision.

It is extremely difficult to generalize about when or if you should make an intermediate cut. Each stand and ownership is unique. You must consider both biological and economic factors. Because these decisions may be complicated, you should contact a consulting or county forester to obtain professional advice concerning your particular property.

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