

# THINNING • THEME & VARIATION • TH

The natural forest is crowded, naturally; but we have the technology to address that.

By Robbo Holleran

**S**ince forests grow, there are almost always too many trees. Some survive—and not always the strongest and seldom the best—and some will perish. Thinning is a way to select the survivors according to your goals, and also gives you a chance to capture some products from the trees that will die. For example, if a young forest is only 1/3 oak trees, after a couple of treatments and 30 years, it could be 3/4 oak trees. A sapling forest with 10,000 trees per acre may have only 1% final survivors.

When you look at the “pattern” in growth rings of a tree, you do not see a record of weather, unless you live in a very dry region. Drought or wet, cool and warm years have almost no influence on the growth rings of most forest trees. The rings show a record of crowding and release. When the green crown of the tree is crowded, growth will be slow. The leaves are collecting solar energy to make sugar. The sugar is burned for energy, and used as building blocks for new roots, leaves, and twigs. The extra sugar is used to build wood on the stem. When we think of a crowded forest of tall spindly trees, we think the trees are “reaching upward toward the light.” This is half true. The height growth is generally determined by the quality of the soil, but they are thin because the diameter growth is slow. We can fix that. When a tree is given room to grow, the diameter growth rate can increase as much as 10-fold. Crowding means eventual death for many trees; some trees—such as birch or cherry—do not tolerate shade. Some trees like maple or hemlock tolerate shade, but are not growing at a healthy pace. When trees have room to grow, they are

more vigorous. This should dispel the myth that the natural forest is always healthy.

## Immature Stands with Quality Potential

Thinning is appropriate in crowded stands with immature trees. If the trees are healthy, have quality potential, and are able to grow for another 20 years or more, thinning is recommended. There are a number of ways to think about this which we will discuss below. In each case, “crop trees” are selected for timber value potential, wildlife or aesthetic values. Other trees are harvested to give them space, sun, and water, and to provide products with some usefulness and value such as firewood, pulp, or low-grade logs.

The trees to grow should be species that are good for that soil, healthy, straight, and without major defects or risk factors like crotches, disease, or storm damage. And they should have a well-formed crown in the main



Thinning is the best treatment for overstocked, immature stands with quality potential"

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canopy of the forest. Trees to harvest might be the larger low-quality trees that take up too much of the canopy, a species not suited to the site or goals for the stand, or whatever trees that are directly competing with our “crop trees.” We can make allowance for the logging process, laying out access trails, and felling corridors for the larger trees, and sometimes a crop tree has to be sacrificed to make a workable project.

If the overall stand is close to mature, or more than 1/2 of the trees are mature, over-mature, defective, or low quality, then it might be time to think about ways to regenerate a new forest. And that is an entirely different discussion.

## Tree Spacing and Stocking Guides

Thinning usually removes about 1/3 of the stand. Every forest type has guidelines published by the U.S. Forest Service with details and recommendations, including specific “stocking guides” for thinning. These guides show the basal area or number of trees along with the diameter in relation to the stocking level. The A-level is the total natural stocking in undisturbed stands. Above the A-level is severe crowding with high mortality. The B-level is the minimum number of trees to “fully occupy” the site. The C-level is the level at which 10 years of growth should bring you to the B-level. The C-level, or below, is understocked, and will result in some regeneration. At the B-level, total growth and individual tree growth should be maximized and there should be no mortality due to crowding.

In northern hardwoods, the B-level has about 300 trees per acre (12-foot spacing) at 6-inch diameter, 100 trees per acre (21-foot spacing) at 11 inches, and 45 trees per acre (31-foot spacing) at 16 inches. Obviously you can’t move around your best trees to fit. Some of them won’t make it to the final stand.

Deciding on the “ideal” stocking level is a philosophical discussion. For appearance, the A-level looks pretty to most. These have the dark forest floor with little understory. The B-level is more open with light filtering in and some growth on the floor. Each has wildlife and aesthetic implications, but generally you want to be somewhere between the two. From an economic standpoint, heavier harvesting will be more profitable and B-level stocking allows the heaviest



Free thinning in natural hardwood stands will improve growth, quality and species composition.

cuts that still maximize the growth rate. So you might grow to the A-line and harvest to the B-line each time. But growth will be slowing as you approach the A-line, so industrial management might do the harvest somewhere below the A-line, and cut to the B line or even below. Small-woodlot management might harvest less, more frequently, keeping stocking either closer to the A-line or the B-line. Maintaining a higher stocking level has economic benefits even if growth is slowed. This allows more future market opportunity and is a benefit if the expectation is for higher markets in the future. It also maintains higher real-estate value. Since marking and preparing a sale and moving equipment onto and off of a job all have costs, this will be factored into the “cutting cycle” (frequency of harvesting). Tree health, events such as storm damage, and markets all play a role. Generally, younger stands, good sites, and easy access areas would be thinned more frequently. The growth rate in most of the northeastern forests is almost 1 cord per acre per year. So removing 5–8 cords every 10 years is sustainable. A 15-year cycle is typical.

## Variations on the Theme

Changing species composition is a main benefit of thinning in mixed stands. Some species will be preferred based on site, market characteristics, defects, insects, or disease. We can select these and give them what they need to grow. For a simple example, where

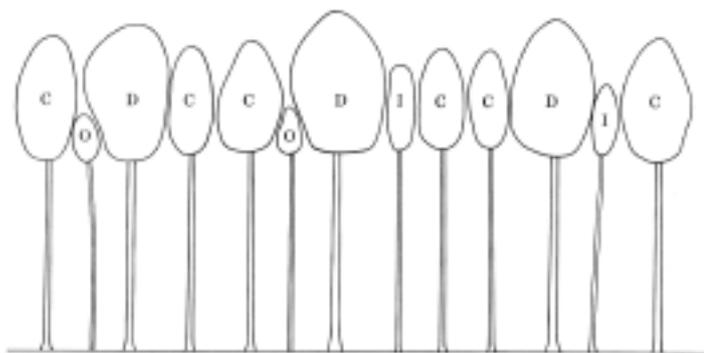
softwoods and hardwoods are mixed, we might choose one or the other for that stand. In stands that are middle-aged, thinning can produce valuable saw timber and still retain some of the best trees to grow. This maximizes the yield over the long term. Some species will reach maturity sooner, which makes thinning choices more obvious. For example, poplar, birch, and red maple might be mature and harvestable, but enough maple and oak can be retained as crop trees for more growth. Spruce and fir often grow together, and removal of fir to grow spruce is a clear choice. If we can select the species best suited to the site and the goals, then we can ensure their success.

Thinning is often described as being “from above,” “from below,” or “free.” This refers to the crown position of the trees that are removed. For example, thinning from above is common and applied to young or middle-aged stands. Larger trees in the top of the canopy might be fast-growing intolerant species like poplar or birch, or they might be older residuals from the previous stand. If the trees with the best potential are mid-canopy trees (longer-lived trees with quality stems), then harvesting the taller trees “from above” is recommended. These are usually larger diameter and make for a somewhat economical harvest in young stands. Of course, careful felling and skidding are required to keep the damage to remaining trees to a minimum.

Thinning from below involves selecting the shorter trees from under the main canopy. This is sometimes done in older stands to salvage expected mortality, but is less common. These shorter trees are usually smaller diameter and low value, but in older stands the volume and value may be considerable. Taking trees from the lower part of the canopy does little to influence the growth rate of the

dominant trees unless it is a very dry site with water stress. This treatment is usually done near the end of the rotation when you are really preparing for a shelterwood regeneration cut (shelterwood preparation). So the goal is to salvage expected mortality, change the species composition, and put some daylight on the ground to start the regeneration process.

Most thinning treatments are best described as free thinning, where some trees are selected for harvest from all crown positions: upper, middle, or lower. Since natural forests tend to be diverse, this is often appropriate. Poor-quality trees and crop trees are found in all strata and the details vary from one acre to another. [Crown diag. here.](#)



Four different crown classes in an even-aged, pure stand. Showing dominant, codominant, overtopped and intermediate trees.

Row thinning is a normal option in forest plantations. The first thinning in a planted forest usually needs to take out complete rows just for practical access and future trails. And this turns out to be a good idea. Plantations tend to be uniform, so some criterion for selection needs to be used to get started. Taking a whole row makes a swath for practical felling, and straight trails reduce damage to residual trees. The row will have some dominant trees with value, and some “runts.” Row thinning might harvest one out of two, three, or even five rows, depending on the condition of the stand. And if the harvested strips are further apart, such as five rows, then you might be harvesting trees from

adjacent rows. Cut-to-length systems work great for this.

You can also consider the row-thinning concept in natural stands. This first occurred to me in a crowded, young pine stand of natural pasture regrowth. I just couldn’t decide where to start! There were obvious dominant trees with crotches, weevil damage, and large limbs to remove, along with small-crowned runts, plus straight trees with decent crowns. Trying to snake through and pick out the poor-quality trees would be a nightmare for the logger. So I picked a compass bearing parallel to a boundary and marked trails every 80 feet or so, almost regardless of the tree condition. I moved them 10 feet or so to pick up the

dominant culls. Then I marked the areas between strips to remove trees of poor quality in a free thinning. This gave the operator a clear space to work and put all the trees within a tree-height of a straight trail. I have applied this to many natural stands since that day.

Crop-tree release is a simple forestry technique that can be applied to a broad range of situations in immature stands. In general, you will be selecting crop trees and releasing them from competing trees to ensure their survival and increase their growth. Crop trees are the trees that best meet your goals for the site. They can be trees that will provide food for wildlife like oaks or apples. They can be lumber or veneer potential trees

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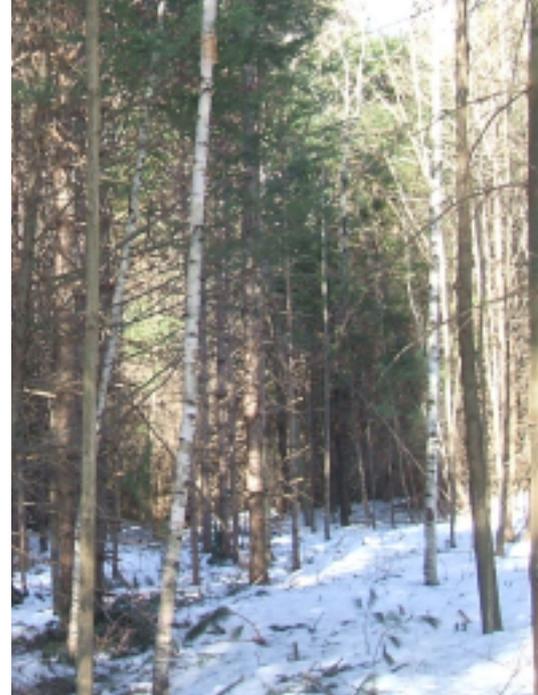
## THINNING • Thinning by definition is light-intensity removal of lower-quality products.

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like straight cherry, maple, or pine. This technique can influence species composition and be applied to commercial or pre-commercial thinning. It can be used in 20-year-old saplings that are 4 inches in diameter, or it can be used in 80-year-old hardwoods with 18-inch saw logs that are still healthy enough to grow. Crop tree release is an investment that will be best returned on good soils, in younger stands of healthy, high-quality trees.

Generally, giving a crop tree 5–15 feet of room to grow on two or three sides is ideal. Releasing one side does not give a very good growth response, and releasing four sides will result in a forest that is too sparse. I would start by tying surveyors flagging around the best

crop trees in an acre or so. How many is “enough?” This is a judgment call, but they should be 20–30 feet apart; 50–100 trees per acre are plenty. Then I would cut or mark the worse trees that are directly adjacent to the crown of the flagged trees until they have light on two or three sides. This is usually “thinning from above.” The shorter trees are incidental, as they do not crowd the crowns. Cutting one large cull tree may release several crop trees. Or you might cut 10 trees to release one. You should refrain from cutting a real nice tree unless it clearly competes with a much better tree or unless it will add significantly to the salvage value in a commercial thinning. For example, three adja-



Modified row thinning can remove forked trees and volunteer hardwoods to improve the growth in plantations.

cent crop trees can all be released on the other sides. All the “junk” trees do not have to be cut, as many will be between or below the selected crop trees. In crop-tree release, we ignore these “in-

between” areas.

In commercial thinning, flagging on the crop trees will clearly indicate to the loggers which trees are to be protected. This can be a huge benefit to the final result if your very best trees are free from felling or skidding damage. Access trails and felling corridors need to be considered, and removal of incidental trees can be ignored if they are inconvenient, or they can be taken if they are handy to the trail and add something to the operation.

### Pre-commercial Thinning

In a sapling stand where thinning is justified (3–6 inches or so), it is important to knock down the competing trees and make the mess. The goal is to grow the crop trees, and the Crop tree release method is best. You can complete an acre or two in a day if you are not fussy about cleaning things up. It will take 10 times as long to clean up the mess. In these sapling stands, it

is important to wait until the trees have grown in height enough to develop a clear butt log, as this will be the main product. Very early release will help with species composition and diameter growth, but the crop trees will develop wide crowns and the stem will be poor quality. In many cases, it may be best to wait until the first opportunity for commercial treatment. In my opinion, the early expense of treatment is only justified when waiting will give some unacceptable result. This is usually when the tallest, fastest-growing trees are not acceptable to the goals of the stand, like poplar overtopping oak or maple.

If the trees you are cutting are 6–9 inches, you will have quite a bit of firewood to pick up if you want to. But the goal is to grow the crop trees, and the cleanup will really slow you down. There will be plenty of firewood to salvage in any woodlot and the crop trees will



Crop tree release gives space around selected trees, and ignores the areas in between.

grow even more, so don't be fussy about waste. If the harvested trees are 10 inches or larger, then they will have enough volume to be worth salvaging for firewood, pulp, and saw logs. It may be worthwhile for a commercial logging operation, and you can even be paid some

stumpage money for a crew to release your crop trees.

There are market factors involved with these decisions. Thinning by definition is light-intensity removal of lower-quality products, so the economics can be marginal. Markets for firewood, boltwood logs, specialty products, and biomass can be important decision-makers for these operations. For example, if you are thinning your own land for personal firewood, you do not need a commercial volume per acre, and you have a strong advantage for cull tree removal, thinning from below, harvest of small-diameter trees, and crop tree release. A boltwood or pallet-log market may boost a project from break-even to being profitable. Biomass harvesting is a major game changer for thinning. Since biomass can consume almost any species and stem form and is relatively efficient with small-diameter trees, it expands the opportuni-

ty for thinning. While a low volume-per-acre is a detriment to the system, there are ways to make good use of the technique. The natural “row thinning” concept is a good place to start, with careful layout of felling and skidding corridors. Mechanized felling can reach between crop trees and remove competitors.

There are conundrums with everything, especially forestry. One of the problems in thinning is the dappled daylight that reaches the forest floor. This is often just enough light to encourage undesirable growth. Beech, striped maple, and invasive shrubs can accumulate in a well-thinned forest. While they do not interfere with the crop trees, they make it difficult to regenerate the forest when that time comes. Sloppy thinning can damage roots, stems, or crowns of crop trees, and heavy thinning can increase the risk of wind damage or stem sprouts that degrade the logs.

Thinning requires careful logging, minimizing damage to the crop trees, and produces low volumes per acre. This raises the harvesting costs. Also, lower value products produce less income, so thinning is not a moneymaker at the time. This is a decision to grow trees for the future—an investment with the hope that the forest will increase in value. And there are other benefits that we cannot put a value on like the pride of ownership and stewardship and the joy of walking through a well-managed woodlot. ■

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