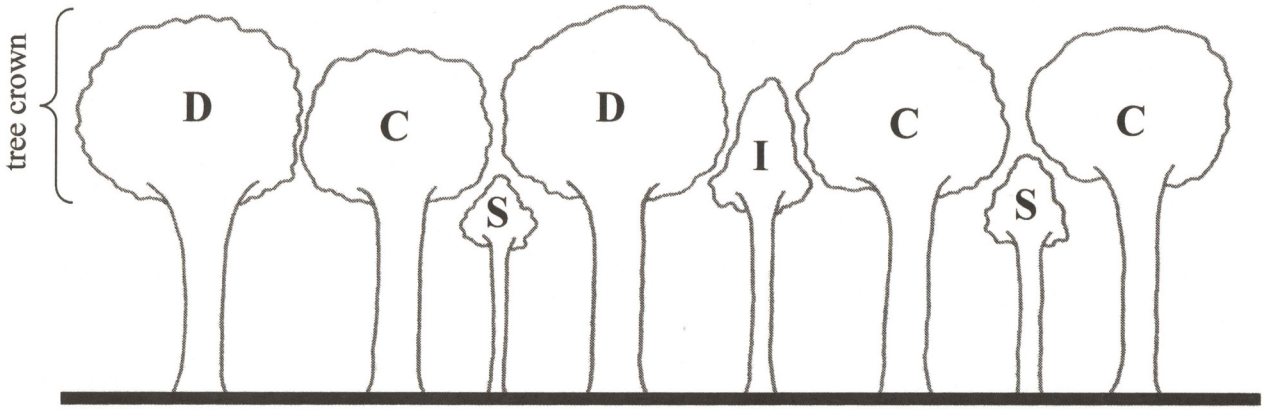
2.4 MANAGING FOR HIGH-VALUE TREES

BACKGROUND

Quality timber trees are important to the region's wood products industry.
Quality is determined by tree size and the amount of clear, knot-free lumber the tree produces. Both are heavily influenced by the density of the stand. Stand density also affects tree growth. When the density is too high, tree growth will slow. When density is too low, individual trees may grow quickly, but growth per acre diminishes because there are too few trees. There may be problems with excessive branching because low stand density interferes with natural pruning. Excessive branching results in reduced lumber quality. Pruning excess branches is expensive but can increase timber quality.



Tree crown position as it relates to dominance in a forest stand. D=Dominant, C=Codominant, I=Intermediate, S=Suppressed
(by M. Tarr adapted from Smith 1986)

Stand Development: Tree diameter isn't always correlated with age.
Many forest stands are even-aged because they developed following major disturbances such as agricultural abandonment or clearcutting. Although many stands contain trees of different diameters, most overstory trees are in fact the same age. Diameter isn't always correlated with age.

Trees are grouped into four crown classes: dominant, codominant, intermediate and suppressed. Dominant and codominant trees are the largest trees and form the main canopy of a stand. Dominant and codominant trees have larger crowns and grew faster than their neighbors. Intermediate and suppressed trees are the smallest trees and generally are overtopped by dominant and codominant trees. They have much smaller crowns than dominant and codominant trees.

Trees with the largest crowns are the fastest-growing and healthiest trees. In many stands, a 16-inch diameter tree and a 10-inch diameter tree of the same species are the same age. To improve the timber quality and growth of an even-aged stand, focus on removing the weak competitors (intermediate and suppressed trees) and leaving the well-formed strong competitors (codominant and dominant). In an even-aged stand don't remove the large trees to favor the small trees.

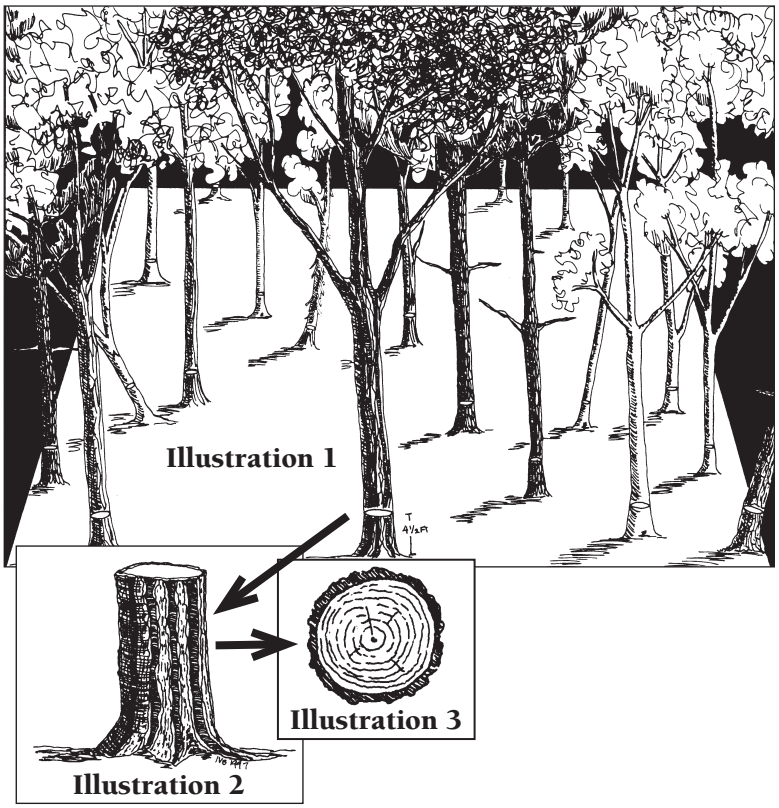
Stand Density

Stand density, or crowding, is based on tree size (diameter), the number of trees per acre, and how close together they are growing. Stand density is calculated in terms of basal area. Basal area is a measure of the area of the cross-section of tree diameter at breast height (DBH).

Basal area is usually expressed in square feet. To picture basal area, imagine that all the trees in a stand were cut off at 4.5 feet above the ground (illustration 1). The area of the top surface of the stump

(illustration 2) is measured to determine the basal area of that tree (illustration 3). If the basal areas of all trees on an acre are added together, the result is square feet of basal area per acre. It takes several small trees to equal the basal area of a large tree. For example, the basal area of four 6-inch DBH trees equals the basal area of one 12-inch DBH tree.

Adjust a stand's density by cutting some trees and removing them for firewood (or some other use) or by girdling (cutting into the cambium in a complete ring around the tree) and letting them die in place. Different standards apply to even-aged and uneven-aged management. Thinning is the silvicultural tool most often applied to improve timber quality and growth. When done before the trees are ready to harvest, it is called precommercial.



Precommercial Treatments

Precommercial treatments, also known as timber stand improvement, refers to a variety of noncommercial practices that improve growth, value and regeneration of desired species. Focus timber stand improvement activities on the better growing sites—soils with a site index of 60 or higher for the desired species (see 2.3 Regeneration Methods for a discussion of site index). Stands with shallow-to-bedrock soils or excessively wet soils are less of a priority. The poorer growing conditions increase the probability of the trees being in poor form or declining health. Stands dominated by one species, such as oak or white pine, benefit more from precommercial thinning than mixed-species stands. For stands dominated by a single species, start releasing the crop trees when they reach 5 to 8 inches DBH. Releasing involves removing the less desirable trees whose crowns overtop or otherwise touch the crowns of the crop trees. The goal is to give more sun to the crop trees' crowns. The sooner released, the faster they will grow in diameter.

Weeding controls the species composition by cutting or girdling unwanted species and favoring desired ones. Weeding is usually most needed in mixed stands of conifers and hardwoods when conifers are the crop trees. Release conifers by weeding out overtopping hardwood in sapling stands (1 to 4 inches DBH and 10 to 20 feet tall). Bring the upper crowns of valuable stems into full sunlight. Stands remaining after treatment should be dense enough to assure self-pruning of lower limbs, straightness of stem, and protection against snow and ice damage.

Financial benefits of timber stand improvement are questionable especially if the costs per acre are too high. Often the increased growth provided by releasing a crop tree at a young age is offset by the cost that is carried (and compounded) for decades. Generally, releasing fewer crop trees per acre and having a commercial harvest as soon as possible helps maximize the return.

Crop Tree Management

Crop tree management is a thinning technique where high-quality trees with vigorous crowns are identified as crop trees and competing trees are cut to release their crown. It encourages the fastest growing, highest quality trees to have as large a crown as possible by allowing increased amount of sun on

the crown. The larger the crown, the faster the tree will grow in diameter. Focus crop tree release on those trees that are most likely to increase in volume and value.

A crown thinning releases one to four sides of the crop tree from trees that touch its crown. A crown thinning should provide 5 to 10 feet of free growing space for the crown of the crop tree by removing competing trees. When two crop trees grow in close proximity, treat them as one tree and remove all trees whose crowns touch those of the two crop trees.

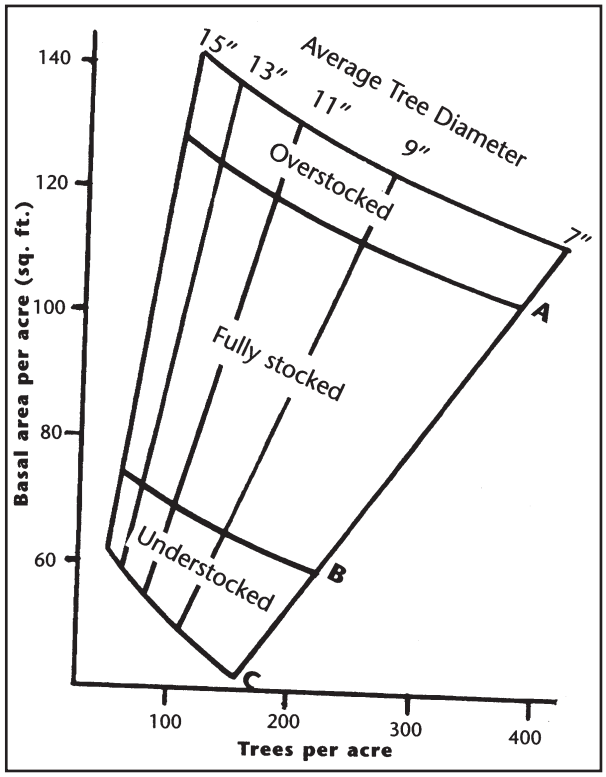
Timber crop trees have the following characteristics:

- Dominant and codominant trees at least 25 feet tall.
- Healthy, vigorous crown.
- High-quality butt-log potential.
- No epicormic branches (sprouts).
- No high-risk trees such as splitting forks or leaners.
- High-value commercial species (red oak, sugar maple, yellow birch, black birch, black cherry, white pine, red maple, white ash and red spruce).
- Expected longevity of at least 20 years.
- Species well-adapted to the site (see table in 2.3 Regeneration Methods for site requirements by tree species).

Fully releasing the crown of a crop tree increases the possibility for epicormic branching, which lowers its timber quality. Practicing crop tree management only on the best growing sites limits epicormic branching. Black cherry and red oak have strong epicormic branching tendencies; red maple has moderate tendencies; white ash and yellow birch low; and sugar maple has low tendencies on good sites.

Even-aged Management

When a forest stand is managed for one distinct age class, it is termed even-aged management. These stands are regenerated by clearcut, shelterwood, or seed tree cutting methods. Two-aged stands result when larger trees are left temporarily to aid regeneration or for goals other than regeneration (e.g., for wildlife). Two-aged methods regenerate and maintain stands with two age classes for a longer time period, even after regeneration is established. Two-aged management is included as an even-aged technique in this and other references.



The best density for even-aged stands is reflected in stocking guides (also called stocking charts). These guides help the timber manager determine if the forest is stocked too heavily with trees (overstocked), too lightly (understocked), or adequately (fully stocked).

Stocking guides provide at least two reference lines, an A-line and a B-line. In general, the A-line shows the upper density limit of a naturally developing uncut forest stand, although some stands do become more dense. The B-line estimates the best density for sawtimber growth in the stand. If the stand's density is

higher than the B-line, the stand is too crowded and diameter growth will be slow. If density is lower than the B-line the stand is understocked, resulting in lower timber growth per acre and potentially excessive branchiness, resulting in knots in the timber.

When density has increased to halfway between the A-line and the B-line, foresters generally reduce the stand's density to the B-line level. This typically permits a commercial harvest and increases diameter growth. The trees removed are often the poorest quality, so the growth is concentrated on the best quality trees (crop trees). Crop trees may be chosen on the basis of commercial value, aesthetic quality, or their contribution to desired wildlife habitat. Since crop trees are the most capable of achieving the desired goals, use extra consideration when deciding the spacing around these trees and how much light they receive.

Uneven-aged Management

In uneven-aged management, forest stands are managed for three or more age classes. This technique simultaneously provides for regeneration, thinning competing trees, and harvesting mature timber.

All diameter classes are in the stand. Since the relative proportions of the diameter classes to each other are the same, there is generally one best density range after the harvest. Foresters mark the trees to be cut in the stand to achieve a desired distribution of diameter classes. Diameter classes are used because age is difficult to determine in standing trees. Harvests can be considered when the basal area is at least 30 square feet above the desired distribution (See Recommended Practices for specifics).

OBJECTIVE

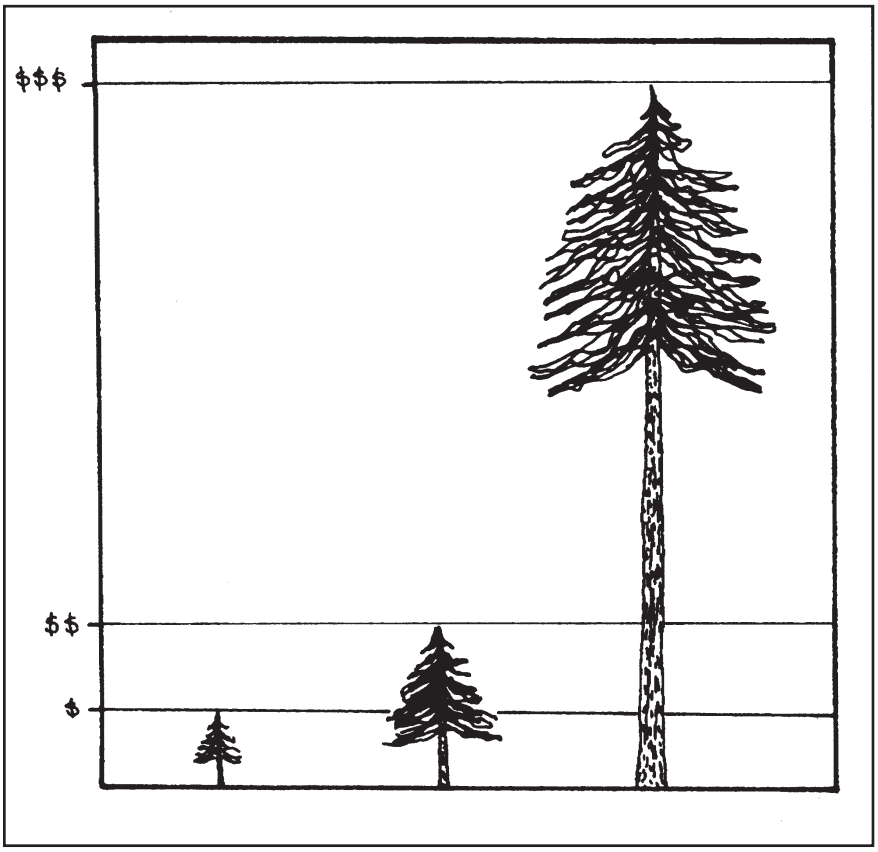
Control the growth and quality of forest stands through maintenance of optimum stand densities.

CONSIDERATIONS

- Providing a sustainable flow of timber depends on maintaining density and stand structure, and providing for regeneration.
- Thinning is the silvicultural tool most often applied to improve timber quality and growth of a stand.
- Young stands, where most of the trees to be removed won't produce commercial products, may require noncommercial treatments. These stands may qualify for federal financial assistance. Pruning also may qualify.
- Markets for timber are variable, especially over the span of a couple of decades. What is a low-value species today could become a high-value species in 20 years. Maintaining a diversity of tree species with good form and vigorous crowns will help lessen the impacts of our limitations in predicting future timber markets.
- The following conditions affect the optimum residual basal areas in uneven-aged stands:
  - The time between harvests (the cutting cycle, which ranges from 10 to 25 years). When the cutting cycle is short, the density of the remaining forest stand should be on the high end of the suggested density range because of the shorter growing period until the next harvest. When the cutting cycle is long, the density of the remaining forest stand after cutting should be on the low end of the suggested range. This accommodates the longer period of growth available and prevents overcrowding within the stand toward the end of the cutting cycle.

- Occasionally the stand density must be decreased to the lower ranges of the suggested density to accommodate harvesting trees that would otherwise die or deteriorate. There are many causes for this such as insect attack, diseases, ice damage, drought stress, or an uneven distribution of age classes.

- A dramatic jump in value usually occurs as a tree grows into the sawlog class (greater than 8 to10 inches DBH for softwood and greater than 10 to 12 inches DBH for hardwoods). An even greater jump in value may occur as a tree grows past the 10 to 18 inch DBH classes. The difference in value between a 12-inch DBH sawlog-grade tree and an 18-inch veneer-grade tree can be 400 percent to 500 percent.



- The overall quality of a stand being considered for uneven-aged management may be so low (less than 40 square feet per acre of high-quality trees in hardwoods and 60 square feet per acre of high-quality trees in softwoods and mixed-woods), that even-aged management may be a better option.
- Growing high-quality trees can't be accomplished through high grading (removal of the best trees) or liquidation (removal of all merchantable trees). Diameter-limit cuts also aren't preferred. If used, they should be based on an inventory and use different diameter limits by species to qualify as a quality-sustaining practice.

- Stand density varies by the species mix:

Stocking Table for Hardwood, Mixed-Wood and Softwood

Mean DBH (inches)	Hardwood A-line (sq. ft./acre)	Hardwood B-line (sq. ft./acre)	Mixed-Wood A-line (sq. ft./acre)	Mixed-Wood B-line (sq. ft./acre)	Softwood A-line (sq. ft./acre)	Softwood B-line (sq. ft./acre)
4	90	54	100	81	114	100
8	117	61	155	101	199	125
12	122	63	173	106	230	137
16	125	64	180	108	240	141

Hardwood = less than 25% softwood.
Mixed-wood = 25% to 65% softwood.
Softwood = greater than 65% softwood.

Stocking Tables for White Pine and Spruce/Fir/Hemlock

Mean DBH (inches)	White Pine A-line (square feet / acre)	White Pine B-line (square feet / acre)	Spruce / Fir / Hemlock A-line (square feet / acre)	Spruce / Fir / Hemlock B-line (square feet / acre)
8	240	90	205	110
12	255	100	270	150
16	285	150		

- Another approach to managing for high-value, fast-growing pine is called low-density white pine management. Low-density management grows fewer crop trees per acre than traditional stocking guides suggest. The goal of this technique is to grow a high-quality butt log free of knots in the shortest time possible. To achieve this goal white pine crop trees (100 or fewer per acre) are heavily released and pruned to a height of 1½ logs (a log is 16 feet long). Recommended residual stocking densities are well below the C-line on traditional white pine stocking guides.

RECOMMENDED PRACTICES

Even-aged Management

✓ Measure the basal area and average stand diameter of the overstory trees only. Leave out the trees that are in the understory and are completely overtopped by other tree crowns.

✓ Follow the density guidelines in the stocking table. Thin when the density is halfway between A and B, or higher.

Example: A mixed-wood stand is determined to have an average stand diameter of 8 inches and a basal area of 135 square feet per acre. Locate the average diameter in the first column and follow that row across to the mixed-wood category. Half the distance between the A-line and the B-line would be:

(155 + 101) ÷ 2 = 128 square feet per acre.

The basal area of the stand presently (135 square feet per acre) is greater than half the distance between the A-line and the B-line.

Uneven-aged Management

- ✓ Measure the basal area of all trees down to 4.5 to 5.0 inches in DBH. (Since uneven-aged stands have a range of tree size, average stand diameter isn't used as a guide.)
- ✓ Use the following optimum ranges. Schedule a harvest when the basal area exceeds the desired residual basal area by about 30 square feet.

Stand Type	Residual Basal Area (sq.ft./acre)
Hardwood	70-80
Mixed-wood	70*-100
Softwood	70*-120

** The lower end of the range is based on spruce-fir and applies to longer cutting cycles. The suggested minimum residual basal area is higher for white pine. The higher end of the range will maximize growth.*

Precommercial Treatments

- ✓ Protect crop trees susceptible to epicormic sprouting (most hardwoods) from receiving too much light on their trunks. For those trees not prone to epicormic sprouting and growing on good sites, release on at least three sides of its crown to increase diameter growth. Check with your UNH Cooperative Extension county forester to see if financial assistance is available.
- ✓ Follow the following guidelines when pruning:
  - Prune pole-sized crop trees (4 to 6 inches in DBH and never larger than 10 inches).
  - Limit the number of crop trees pruned per acre to those that can be carried to full maturity and add enough growth of clear, knot-free wood to justify the pruning investment. Prune no more than 100 softwood and no more than 50 to 75 hardwood crop trees per acre.
  - Pruning should follow, rather than precede, thinning. Keep damage to crop trees at an absolute minimum during harvests.
  - Document when and where pruning occurred.

CROSS REFERENCES

2.2 Forest Structure; 2.3 Regeneration Methods; 5.4 Logging Damage.

ADDITIONAL INFORMATION

Beattie, M., C. Thompson, and L. Levine. 1993. *Working with Your Woodland: A Landowner's Guide (2nd ed.)*. University Press of New England, Hanover, N.H. 279 p.

Perkey, A.W., and B.L. Wilkins. 1993. *Crop Tree Management in Eastern Hardwoods*. USDA For. Serv. NA—State and Private Forestry. NA-TP-19-93. 6 p.

Perkey, A.W., and B.L. Wilkins. 2001. *Crop Tree Field Guide: Selecting and Managing Crop Trees in the Central Appalachians*. USDA For. Serv. NA—State and Private Forestry. NA-TP-10-01. 140 p.