



WISCONSIN WOODLANDS:

Estimating Stocking Conditions In Your Timber Stand



Jeff Martin

Foresters use the term stocking to indicate the number of trees or basal area per acre in a timber stand—an aggregation of trees that is uniform enough in species mix, age and size, to be distinguishable from adjoining areas. Stocking is a relative term; it compares the existing number of trees or basal area in a stand with the density that produces optimum growth.

You can have a fully stocked, an understocked or an overstocked stand. An overstocked stand contains more trees—or more basal area—than desired. An understocked stand has fewer trees than you want.

Stocking is an important measure foresters need to manage stands. Ideally, forest managers want a level of stocking that produces maximum yields of the products they want to grow. When managing for timber, landowners probably want a level of stocking that maximizes volume growth. However, if they manage primarily for wildlife, such as deer and turkey, the desired stocking may be that which maximizes acorn production.

HOW TO DETERMINE STOCKING

The first step in estimating stocking is to decide what constitutes a fully stocked condition for the species mixture in your stand. Fortunately, for most of our major lake-states tree species, this information is available in charts reprinted in this publication. To determine stocking, you need to estimate three items: 1) the cover type, or species mixture, in your stand; 2) the basal area per acre; and 3) the number of trees per acre.

For some older stocking guides, you may need to determine only basal area per acre or number of trees per acre, not both. However, such single-factor stocking guides aren't as useful as those that consider both tree size and number. Regardless of how you estimate stocking, it usually requires only a few hours in the woods.

Cover Type

Cover type is a descriptive classification of forestland based on the tree species present. Thus, you have the oak-hickory type, the maple-birch-beech (or northern hardwood) type, the red pine type, and others.

Determining cover type is usually easy for pure stands or uniform species mixtures. However, in some cases, mainly in hardwood stands, it may be more difficult. Establishing the cover type is difficult if you have to judge the type subjectively.

If cover type isn't obvious, then record basal area by species or species groups when you estimate basal area. Basal area is usually used to define cover type. By determining which species, or group, has the most basal area, you can determine cover type.

Basal Area Per Acre

A tree's basal area is the cross-sectional area of the stem at 4½ feet above ground—breast height (Figure 1). Foresters report basal area as either square feet per tree or square feet per acre.

For those interested in the mathematics, you can estimate a tree's basal area with the following equation:

$$\text{Basal Area} = \frac{3.1416 \text{ DBH}^2}{4 (144)}$$

This equation simplifies to:

Basal Area = 0.005454 DBH², where DBH equals the diameter of a tree's stem, in inches, at 4½ feet above the ground.

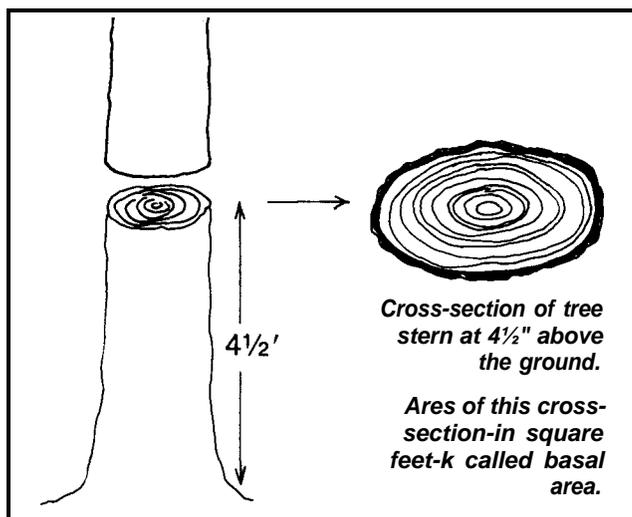


Figure 1. Basal area of an individual tree.

You could determine the basal area for your entire woodlot or for one acre of your woodlot by summing the basal areas of each tree in the woodlot or on the acre. Fortunately there are several ways of estimating basal area without measuring each tree.

To determine basal area per acre, foresters use a special kind of prism or an angle gauge to obtain precise estimates. However, if you are interested only in a rough estimate to help you decide if you need to thin your stand or call in a professional forester, you can use other tools. For a gauge, glue a 1-inch wide target on a yardstick at the 33-inch mark, or use a penny held 25 inches from the eye—about arm's length. If you use the yardstick gauge, place the zero end under your eye and look toward the 1-inch target 33 inches away.

While standing over a single point, hold the gauge and look at each nearby tree as you rotate in a full circle. Don't miss any trees as you turn. Focus on each tree at breast height—4½ feet above ground. If the stem of any tree is wider than your target—sticks out past the sides of the penny, for example—count the tree (Figure 2). You don't have to measure anything, just count trees. When you've completed a 360-degree circle about the point, multiply the count by 10. The result is one estimate of basal area per acre.

Because most stands aren't uniform, you need to make several estimates at points distributed fairly uniformly throughout the stand and average them to get an acceptable estimate of basal area for a stand.

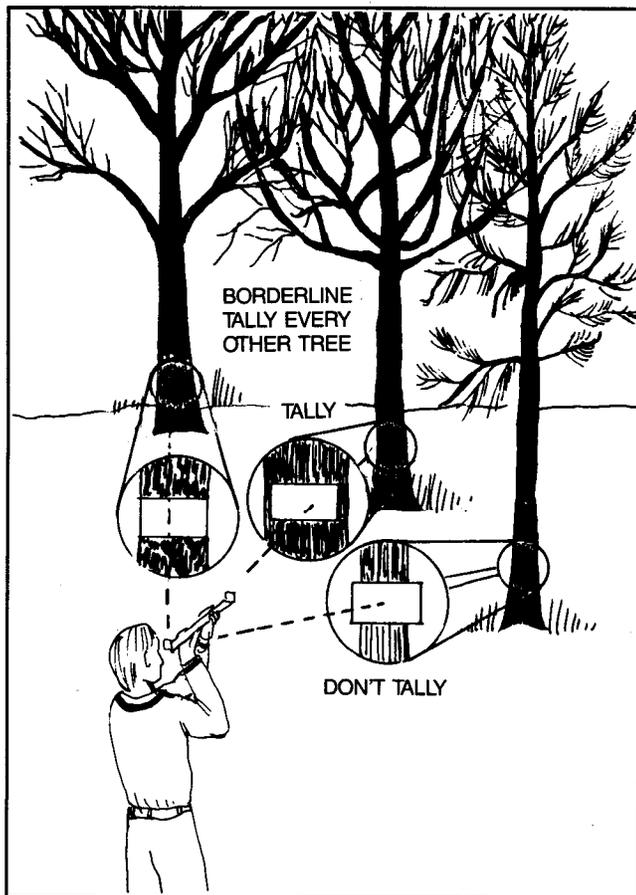


Figure 2. Point-sampling with an angle-gauge.

A large stand usually requires more sampling than a small one, but the key is variability of size, species, and stocking. The more variable the conditions, the greater the number of individual estimates needed. Here are some general guidelines. For stands smaller than 15 acres, five to 10 samples are adequate. For larger stands, take one sample for every two acres; however, 20 to 25 samples should provide an adequate estimate for most stands.

Trees Per Acre

The number of trees per acre is also an important figure to help you gauge stocking. To estimate trees per acre, use the same points you used for estimating basal area. At each point, lay out a circular plot, using the point as the center, with a radius of 26.3 feet. This circle is a 1/20th-acre plot. Count the trees in the plot that are larger than 1 inch in diameter and multiply that number by 20 to estimate trees per acre. As with basal area, make several estimates in the stand and average them to get a reliable overall figure for trees per acre.

Sometimes it is useful to count the trees by species or species groups and by diameter classes: saplings, 1 to 4 inches; poletimber, 5 to 9 inches; and sawtimber, 10 inches and up. Although this information isn't necessary to judge present stocking, it may help as you plan the management of your stand. If you decide to do this, record the trees by size while you estimate basal area and the number of trees per acre. You don't need to measure trees for diameter each time—soon you'll be able to decide which size class they belong to just by looking at them.

To make the job easier, prepare a tally sheet before you go into the woods. Simply use a dot tally, or similar system, to record basal area and trees per acre (Figure 9). To avoid any confusion when you total things up later, use a separate sheet for each point/plot combination. There is a blank tally sheet on page 8, which you can copy.

HOW TO USE STOCKING CHARTS

Two stands with the same basal area per acre may have very different numbers of trees per acre—a reflection of different size trees. To deal with these differences for the purposes of stocking, experts developed combination stocking charts for even-aged stands (Figures 4-8).

To use the charts, determine the cover type of your stand and then consult the appropriate stocking chart. Locate the basal area estimate on the side of the chart, and the number of trees per acre along the bottom of the chart. Then, project these points across the chart until they intersect.

If the lines intersect above the “A” line the stand is overstocked; if they intersect below the “B” line the stand is understocked; and if the stand falls between the “A” and “B” lines it is fully stocked.

For example, suppose you have a maple stand with 100 sq. ft. of basal area per acre and 240 trees per acre. The northern hardwoods chart (Figure 5) shows that the stand is overstocked.

Because northern hardwoods often occur in uneven-aged stands, researchers have developed a different stocking recommendation for this cover type. These guidelines are usually presented in a table (Table 1) rather than a chart. The table shows the desired number of trees and basal area per acre for trees of different diameters.

Table 1. Stocking guidelines for uneven-aged stands of northern hardwoods, showing the desired number of trees and basal area per acre for trees of different diameters as measured in inches at breast height.

| DBH Class (inches) | Desirable Stand After Cutting | |
|-----------------------|-------------------------------|----------------------------------|
| | Trees/Acre (number) | Basal Area/Acre (square feet) |
| 2-4 | 202 | 8 |
| 5-9 | 65 | 16 |
| 10-14 | 28 | 22 |
| 15-19 | 17 | 26 |
| 20-24 | 8 | 20 |
| TOTAL | 320 | 92 |

HOW TO INTERPRET STOCKING

Once you collect and summarize the information about stocking, you are ready to prescribe a treatment for the stand.

If the stand is overstocked thinning is probably appropriate—at least from a biological standpoint. Economics and market availability may indicate that waiting awhile is best.

Take for example the overstocked maple stand mentioned above. If, after weighing other factors such as markets, prices, and operable volume, you plan to thin, use the chart

to guide the marking. Generally foresters want to thin the stand so as to bring it near the “B” line; although, if this is the first thinning in a stand, such a cut might be too severe.

If the stand is slightly understocked you should probably do nothing for now. If the stand is badly understocked you may want to consider underplanting additional trees, or perhaps clearcutting the stand and starting over with a new crop.

Depending on your goals, fully stocked stands probably need little attention now. Monitor growth periodically and be ready to react when a reduction in stocking is needed. Total volume growth, in cubic feet per acre, is about the same for all stands located between the “A” line and the “B” line. However, stands near the “B” line put maximum growth on fewer trees; this means more board feet in larger trees, which usually bring greater dollar returns.

Before undertaking management activities, woodland owners should seek technical help from a professional forester. Thus, one real benefit of up-to-date stocking information is that it helps you determine when you need technical assistance.

SUMMARY OF THE STEPS

1. Pick a sampling point in the woods.
2. Rotate the gauge 360 degrees around the point, counting the trees wider than the target.
3. Multiply the count by 10 to get basal area per acre.
4. Lay out a 1/20-acre plot about the point, a circle with a radius of 26.3 feet.
5. Count all trees in the plot and multiply by 20 to determine trees per acre.
6. Repeat steps one through five several times; take at least five or 10 samples.
7. Average the results from the samples.
8. Determine the cover type.
9. Consult an appropriate stocking guideline or stocking chart.

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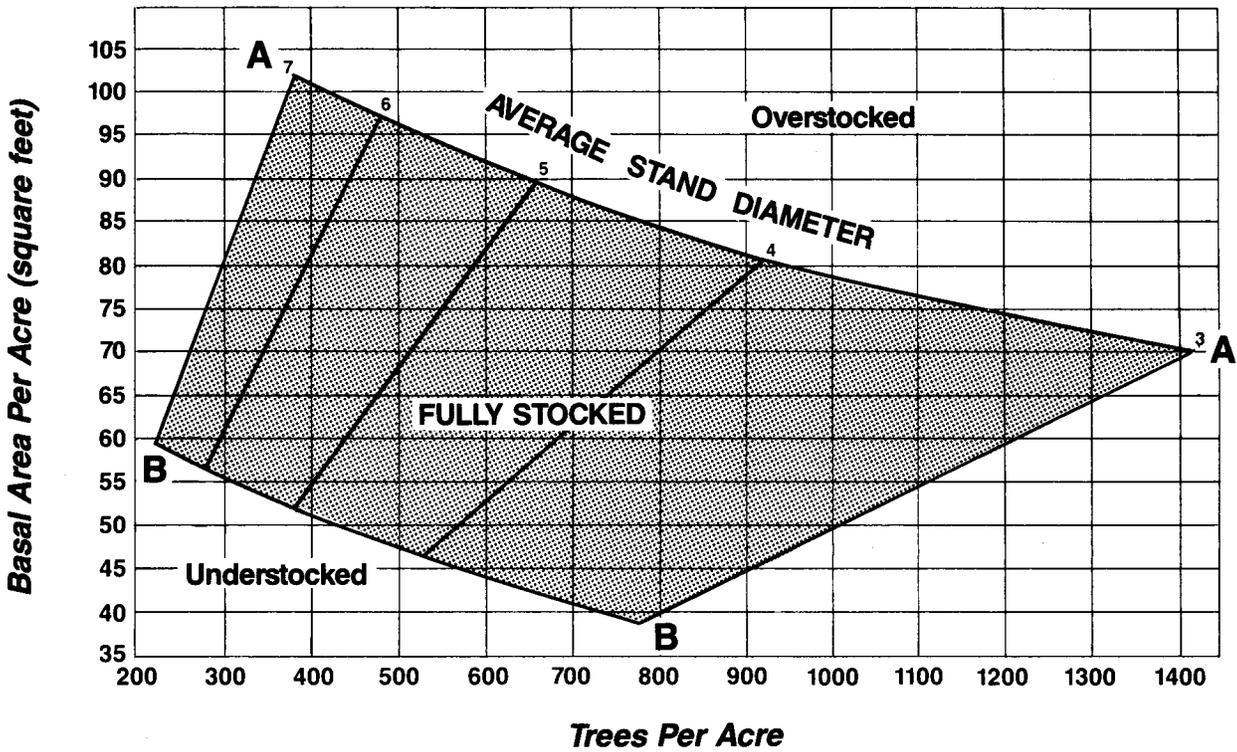
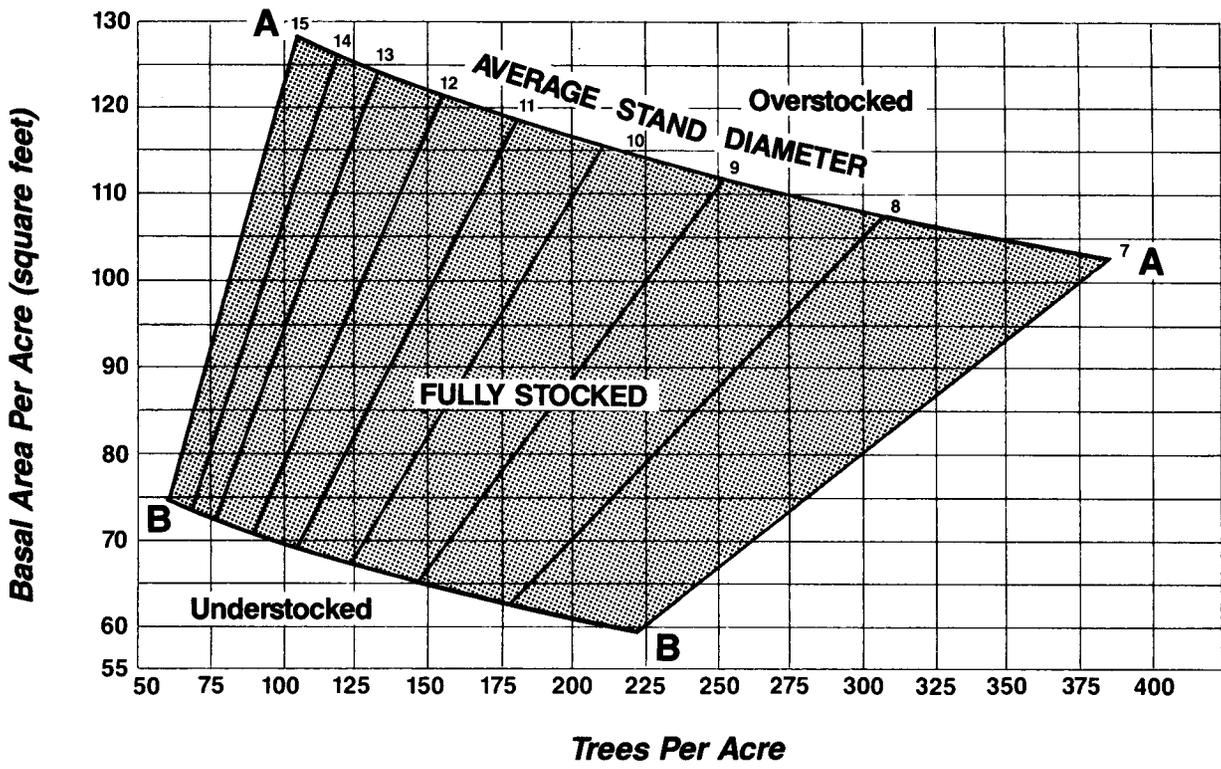


Figure 3. Upland hardwoods (oak-hickory) stocking chart. Use the upper chart for stands with larger diameter trees and the lower chart for stands with small diameter trees.

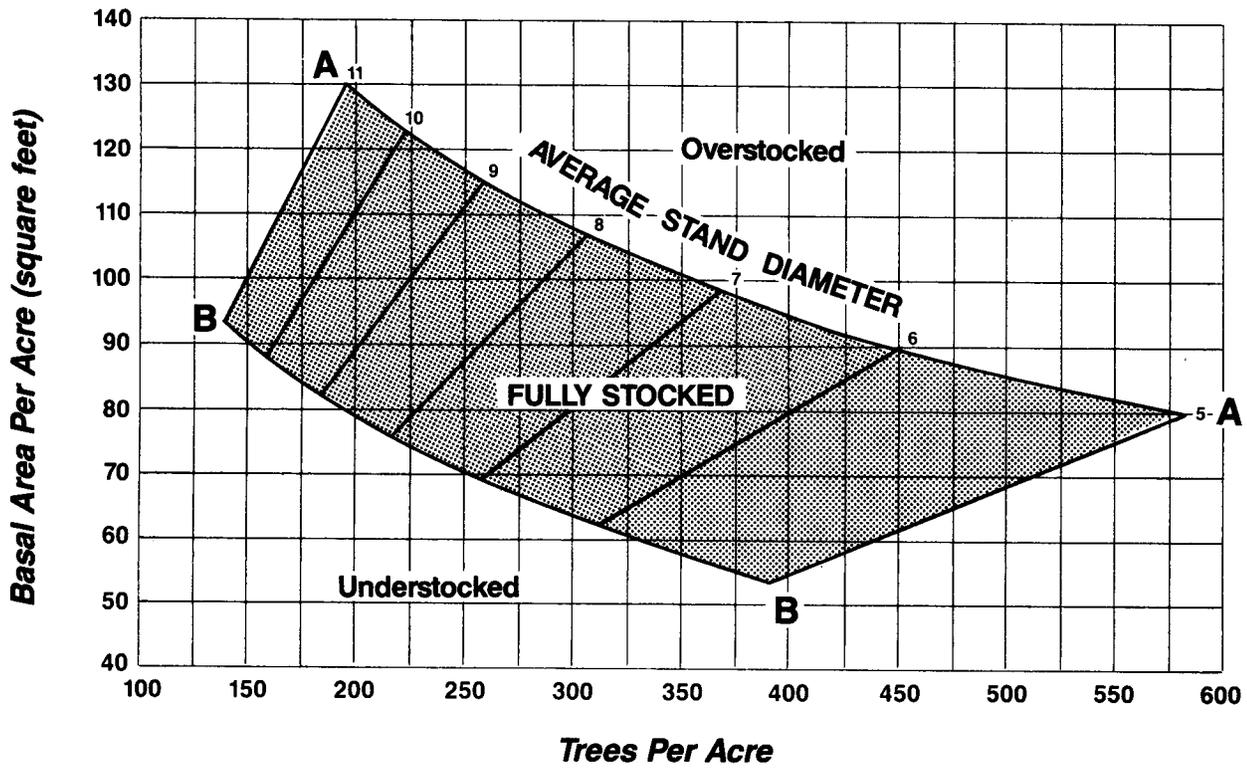


Figure 4. White birch stocking chart.

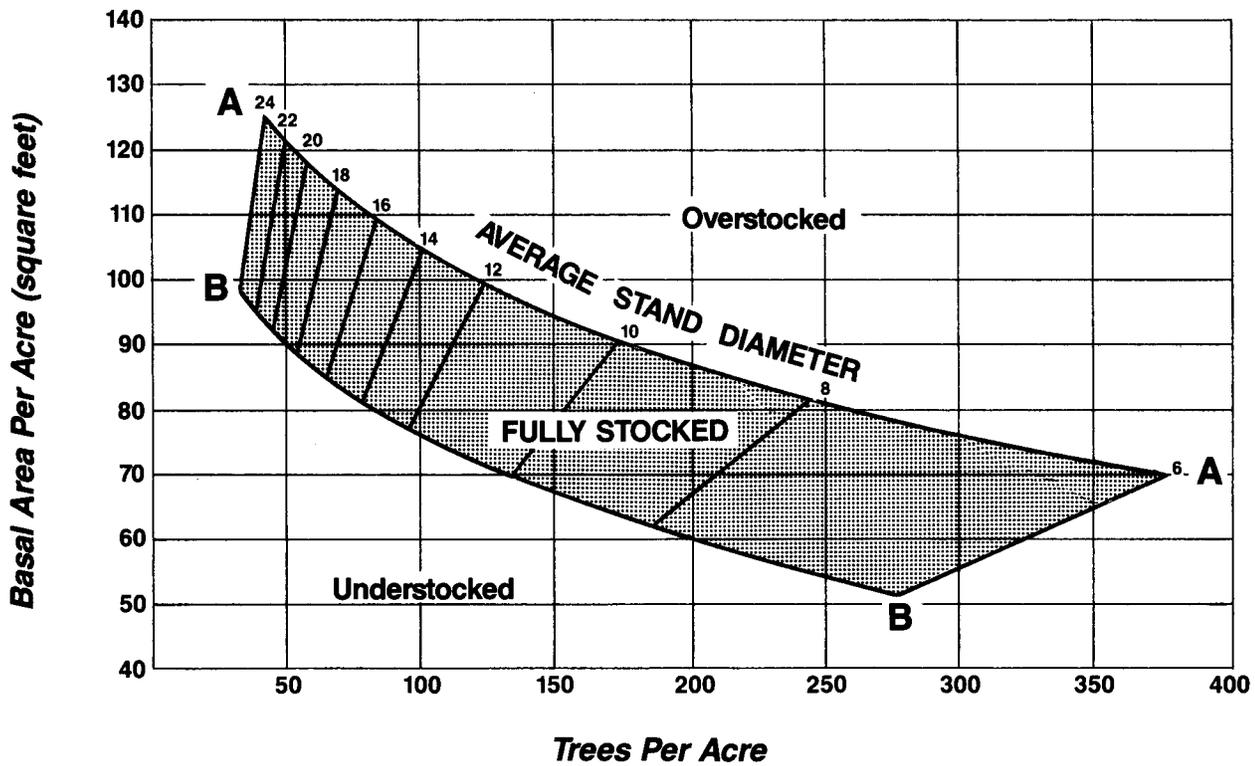


Figure 5. Northern hardwoods stocking chart (for even-aged stands).

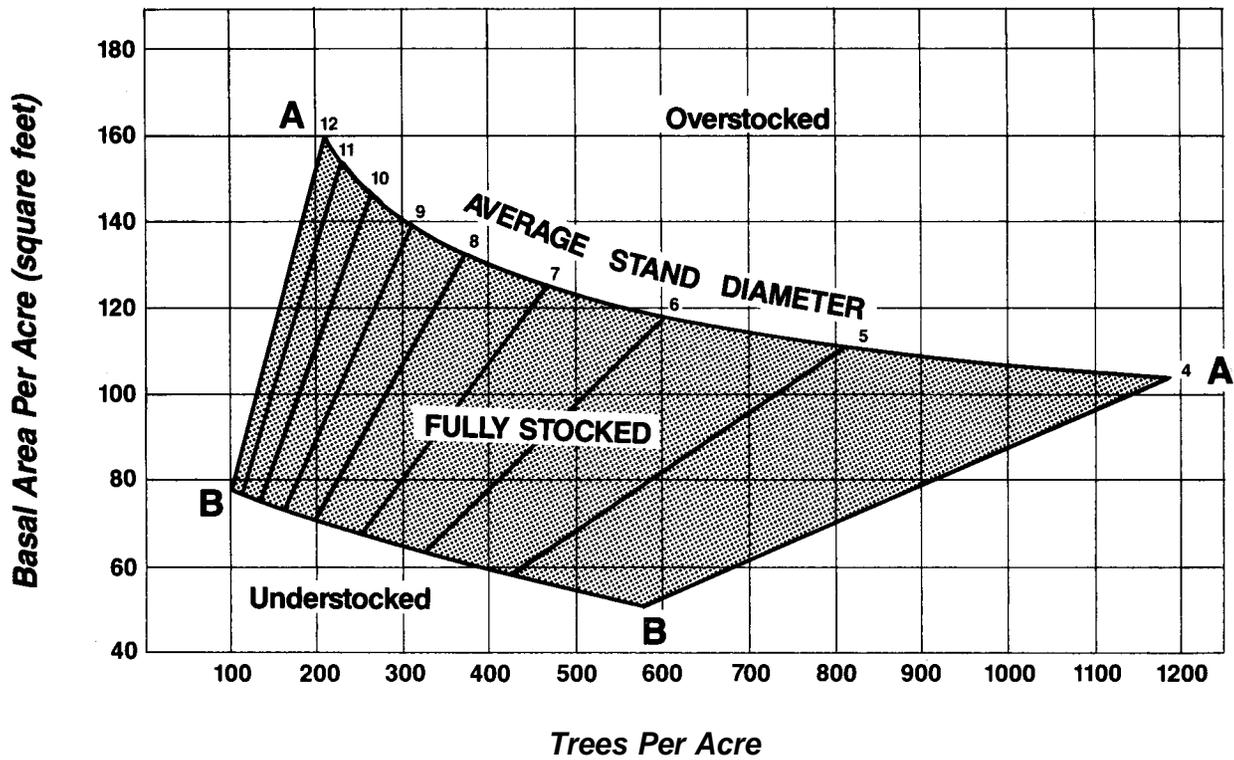


Figure 6. Jack pine stocking chart.

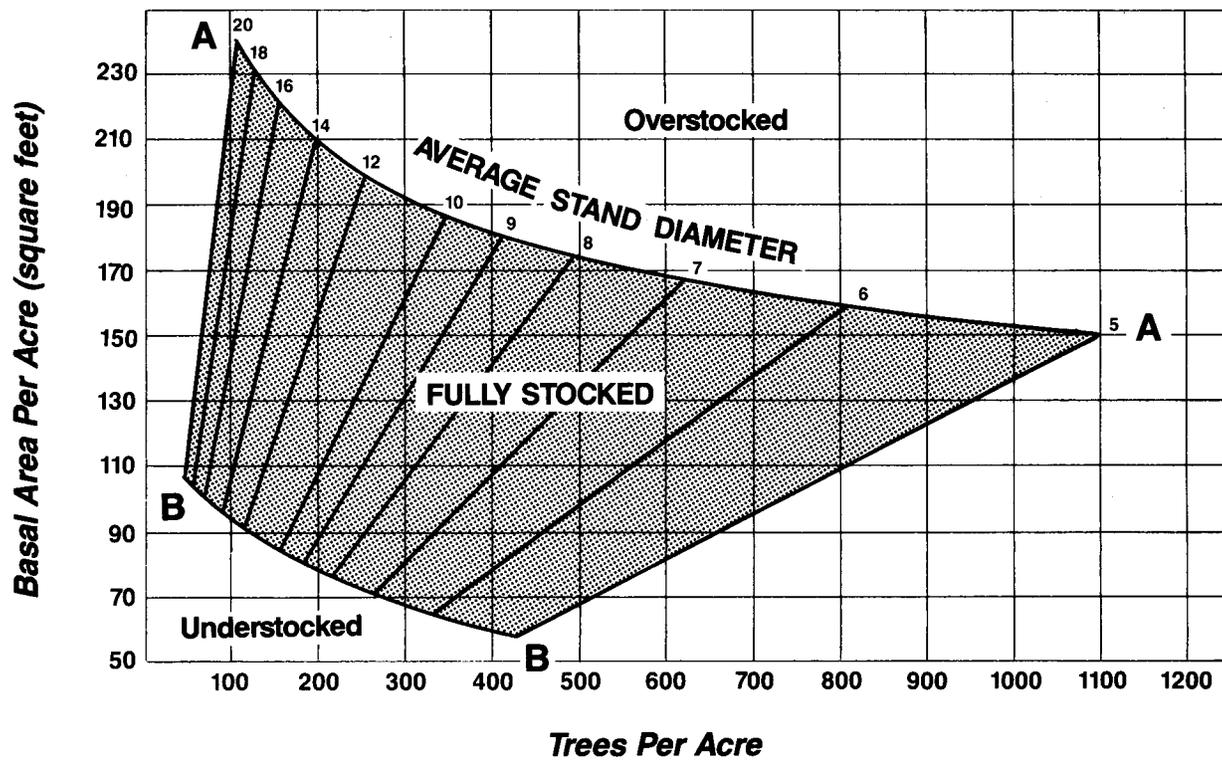


Figure 7. Red pine stocking chart.

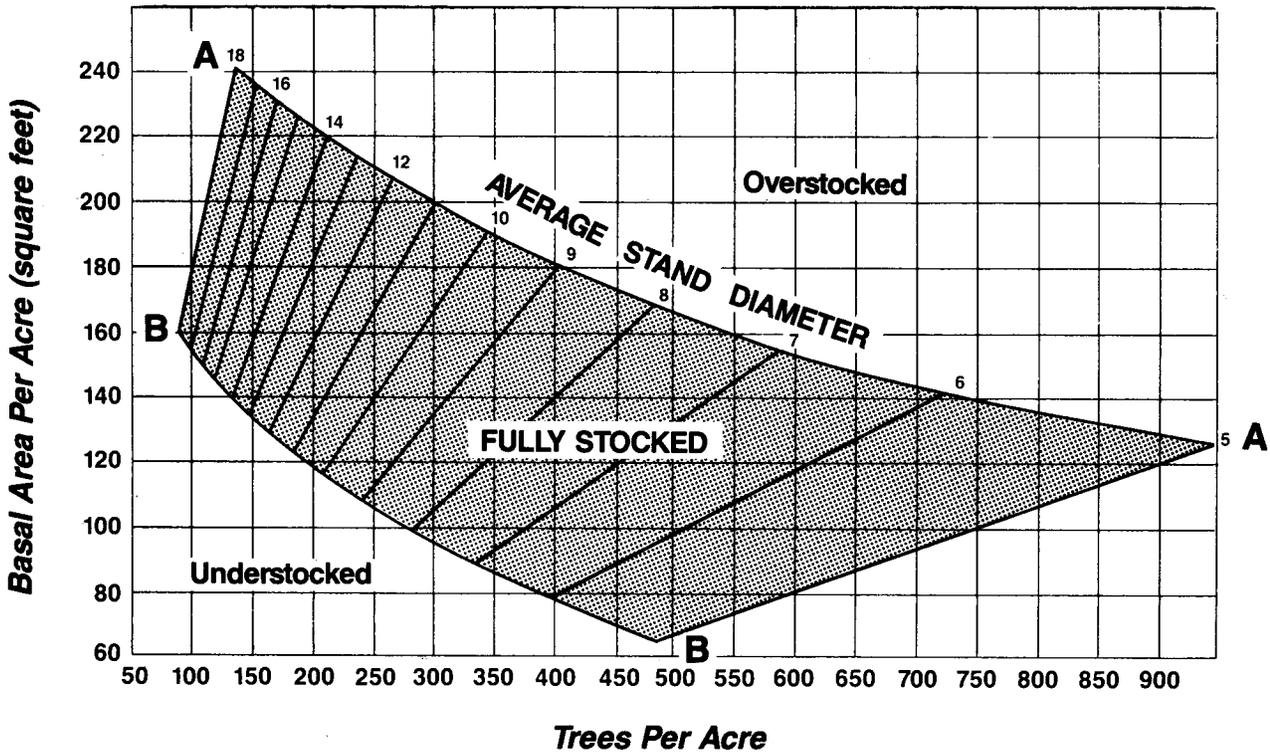


Figure 8. White pine stocking chart.

Location/Stand My woods
 Plot/Point 1 Date 7-6-86

| Species or Species Group | Basal Area Tally | | | | Tree Count | |
|--------------------------|---------------------|-----------------------|----------------------|-----------------------------|-----------------------------|-----------------------------|
| | Saplings (DBH 1-4") | Poletimber (DBH 5-9") | Sawtimber (DBH 10"+) | Total per Acre ¹ | No. Trees in 1/20-Acre Plot | Trees per Acre ² |
| Maple/Birch | XX | X | XX XX | 70 | 6 | 120 |
| Oak | | | XX | 20 | 4 | 80 |
| White Pine | | X | | 10 | 2 | 40 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| Total | 20 | 20 | 60 | 100 | 12 | 240 |

¹Total tally times for a "10-factor" angle gauge.

²No. of trees in 1/20-acre plot times 20.

Figure 9. Sample tally sheet, with an example of recoding basal area and number of trees by species and size class.

TALLY SHEET

Location/Stand _____

Plot/Point _____ Date _____

| Species or Species Group | Basal Area Tally | | | | Tree Count | |
|-----------------------------|------------------------|--------------------------|-------------------------|-----------------------------|--------------------------------|--------------------------------|
| | Saplings (DBH 1-4") | Poletimber (DBH 5-9") | Sawtimber (DBH 10"+) | Total per Acre ¹ | No. Trees in 1/20-Acre Plot | Trees per Acre ² |
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| Total | | | | | | |

¹Total tally times for a "10-factor" angle gauge.

²No. of trees in 1/20-acre plot times 20.

Authors: Jeff Martin is a professor of forestry with the College of Agricultural and Life Sciences, University of Wisconsin-Madison, and a forestry specialist with the University of Wisconsin-Extension, Cooperative Extension.

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