




ARE MY

**Pine Trees**



READY TO THIN?





One of the most frequently asked questions by private forest landowners is, “Are my pine trees ready to thin?” There is no definite answer to this question, because every pine plantation may be different. Some plantations may be ready to thin as early as age 12, and some may not be ready for thinning until age 18 or older.

Many factors determine when a pine plantation is ready to be thinned, such as site productivity, planting density, genetics, and weed competition. However, the timing of the first thinning is very important. This first thinning may affect the productivity and economics of the pine plantation for the next 20–30 years; therefore, it is imperative that thinning be conducted at the proper time.

An understanding of the biology of pine trees can help clarify why and when pine trees should be thinned. Pine trees are shade intolerant, meaning they need direct sunlight to survive and grow productively. As pine trees grow, they

compete with each other for water, nutrients, and sunlight. The green needles in the tree crowns manufacture food for tree growth. The fastest growing trees are the ones with the biggest crowns. These trees assume a “dominant” position in the stand, where they receive direct sunlight from above and from the side.

Since pines do not tolerate shade, their branches die from the ground up as the trees get taller and the lower branches become more shaded. Known as “natural pruning,” this process results in fewer and smaller branches on the lower stem and a higher quality tree. As a tree farmer, you want to grow a tall tree with a clean stem and well-developed crown. An expanded, well-developed crown can manufacture more food and will allow the tree to grow more quickly.

Trees are similar to other crops in that they grow poorly if there are too many per acre. The number of trees per acre affects diameter growth of individual trees, and thus the yield and growth of the entire

stand. As the trees grow larger, the site can support fewer trees per acre. To maintain the vigor and growth rates of the best trees, known as “crop trees,” pine plantations are thinned to a density the site can most effectively support. When pines are thinned at the proper time and in the proper manner, landowners benefit in several ways:

- **High quality trees are permitted to grow.** Lower quality trees are removed to allow “crop” trees more growing space. Growth is increased on fewer, higher quality trees. It takes less time for trees to reach the more valuable saw-timber size class.
- **Landowners receive intermediate income.** Trees that become crowded and overtopped will die before final harvest. Thinning allows landowners to sell and use these trees that would otherwise be lost during the “natural thinning” process.

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- **Health and vigor of the stand are maintained.** By reducing competition and removing weak trees, the remaining trees are more vigorous and less susceptible to Southern Pine Beetles and other insects and diseases.

- **Wildlife habitat is enhanced.** Thinning allows sunlight to reach the forest floor, resulting in greater production of browse for deer and other wildlife.

As you can see, it is to your advantage to thin your pine plantation. When is the proper time to conduct your first thinning? Consider the following five criteria before you thin your pine plantation:

1. Tree diameters
2. Stand density
3. Tree heights
4. Natural pruning
5. Growth rates

Although all five criteria are important, tree diameters and stand density are the two most important factors.

## TREE DIAMETER

Diameter at breast height (DBH) is the diameter of the tree stem 4 1/2 feet above the ground. This measurement can be taken with a tree scale stick (see figure 1) or with a diameter measuring tape.

DBH is important because trees must be at least 5 inches DBH to be sold for pulpwood. Trees smaller than 5 inches DBH are not “merchantable” and typically will not be cut. Consequently, thinning your stand before the majority of the trees are 5 inches DBH or larger, may result in “high grading,” where

the only trees harvested are the larger, faster growing “dominant” trees. These are the trees you want to leave as your “crop trees,” not the ones to harvest. When your trees are all 5 inches DBH or larger, you can harvest the slower growing, smaller, less vigorous trees and provide your “crop trees” more room to grow.

## STAND DENSITY

Stand density is determined by both the size (DBH) of the trees and the total number of trees per acre (TPA). As the average size of the tree

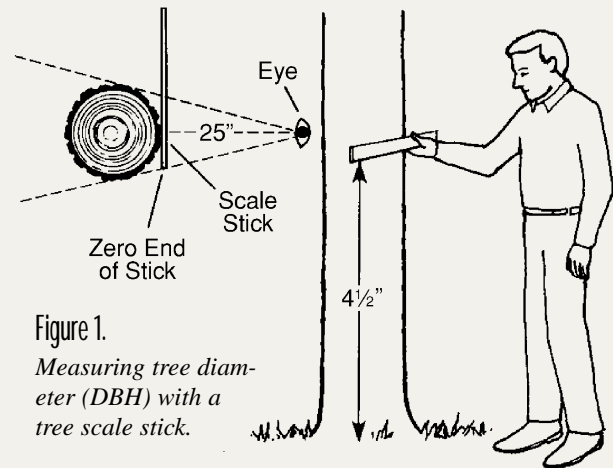


Figure 1.  
Measuring tree diameter (DBH) with a tree scale stick.



Measuring tree diameter (DBH) with a diameter-measuring tape.

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increases, the number of trees the site is capable of supporting decreases. For example, at the time of tree planting, a site may easily support 600 or more tree seedlings per acre. However, as tree diameters and crowns increase in size, the amount of nutrients, soil moisture, and sunlight required for optimum growth also increases. Eventually, the stand density (TPA & DBH) becomes too high to maintain good growth rates. The goal of thinning

is to reduce stand density by removing the slow growing, lower quality trees, thus maintaining rapid growth on the straight, healthy, vigorous, and evenly spaced crop trees.

There is a simple method to determine when the stand density (TPA & DBH) dictates a thinning. Cut a piece of string, a stick, or piece of bamboo to a length of 11 feet  $9 \frac{5}{16}$  inches. This is the radius of a  $\frac{1}{100}$ -acre circle. Using either a

tree scale stick or a tree diameter measurement tape, go through the following steps:

**Step 1**

Walk through your plantation and take 10 random  $\frac{1}{100}$  acre plots evenly distributed over the plantation. Record the number of trees and the DBH of each tree on each plot (see chart below).

**Step 2**

Take the sum of the diameters of all trees on each plot, and then take the sum of the total number of trees on each plot.

**Step 3**

Add the number of trees counted on all the plots.

**Step 4**

Calculate the trees per acre (TPA) as the total trees counted on all plots divided by the number of plots (10) times 100.

**Step 5**

Calculate the average DBH (the sum of all DBH's divided by the number of trees.)

Plot No.	Tree DBH							Total DBH	No. of Trees
1	6	7	5	7				25	4
2	7	8	6	6	7	7		41	6
3	7	6	6	5	5	7		36	6
4	6	6	6	7	6	6	7	44	7
5	7	7	7	6	6	6	5	44	7
6	5	5	5	6	5	6		32	6
7	7	7	7	7				28	4
8	7	7	6	6	5			31	5
9	7	6	6	5	5			29	5
10	7	7	7					21	3
TOTALS								331	53

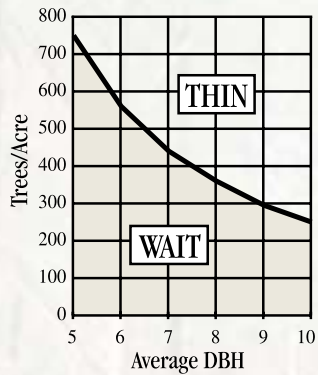
Average Trees per acre =  $53 \text{ (total \# trees)} \times 100/10 = 530$   
 Average DBH =  $331 \text{ (total sum of DBH's)} / 53 \text{ (total \# trees)} = 6.2''$

### Step 6

Locate the average TPA and the average DBH of your plantation on the Thinning Graph.

#### THINNING GRAPH

Thin/wait decision based on stand density (TPA & DBH)



Using the example of 530 TPA and 6.2-inch DBH, the graph indicates that we should WAIT to thin.

Although TPA and DBH are the two primary factors that determine the need to thin, several other factors should be considered. When your stand density indicates your trees are in **need** of thinning, then you need to evaluate tree heights, natural pruning, and growth rate factors to determine exactly **when** to thin.

## TREE HEIGHTS

Trees should be at least 40 feet tall for a plantation to be economically thinned.

Logging operations today use tree-length log trucks to haul trees from the woods to the mill. If pine trees are not tall enough, the timber harvesters have several problems. Short trees must be loaded in a manner known as “double-stacking,” where the tops of logs are loaded on the butts of other logs (photograph below). Loaded in this manner, a truck can haul the maximum 25 tons of pulpwood allowed by state law. However, if the trees are less than 40 feet tall, a fully loaded truck can haul only about 15-20 tons. Consequently, the hauling cost is higher, and your stumpage price may be much lower. If you wait until your trees are at least 40 feet tall, this problem can be eliminated.



*A young pine plantation that has not been naturally pruned to desired 18-foot height.*

## NATURAL PRUNING

Since pines do not tolerate shade, their branches die from the ground up as trees become crowded and overtopped. These dead limbs, over time, will shed or fall off the trees. This is known as “natural pruning” and results in a tree of higher value with a clean stem and a well-developed crown.



*A double-stacked log truck*

Natural dying of the lower branches to a minimum height of 18 feet should be accomplished before a pine plantation is thinned. If there are live, green limbs less than 18 feet from the ground, (see photograph on page 4) thinning the stand could lower tree quality. These green limbs will be exposed to sunlight after thinning and will continue to grow. Tree growth needs to be concentrated on the main pole of the tree, supported by a well-developed crown. Thinning too early can result in growing larger lower limbs, which eventually lower the quality of the logs, inhibit diameter growth, and reduce the value of the tree.

## GROWTH RATES

The main objective of thinning a pine stand is to maintain vigor and growth rates on the best trees, known as “crop trees.” Therefore, when growth rates decline, it is time to thin. The ideal situation is for the “crop trees” to continue growing at

a steady and vigorous rate. Take a growth increment core from trees to determine growth rates of your dominant and co-dominant trees (see photograph below). Calculate the percent annual growth by using increment boring and several other tree measurements. This annual growth rate is the final criteria you should use to determine if your plantation is ready to thin.

For example, your plantation may have the DBH, heights, natural pruning, and density levels to justify a thinning. However, if trees are still growing at an annual rate of 12 percent, it may be wise to postpone thinning. Why would you want to harvest half your trees when they are still growing at 12 percent?

Growth rates will vary from site to



*A tree increment core*

site, depending on the soil site index.

In a situation as described, there may be other reasons to postpone thinning. The value and volumes of individual trees increase with diameter growth. For example, it takes about 46 trees 5 inches in DBH to make a cord of pulpwood. It only takes about 21 trees 6 inches in DBH and 15 trees 7 inches in DBH to make a cord of pulpwood (see below). If your pine plantation is growing at an annual growth rate of 12 percent, many of the smaller 5- to 6-inch DBH trees may grow into

### Number of Trees Per Cord

Diameter Breast High (Inches)	Trees Per Cord of 128 Cubic Ft. (Number)
5	46
6	21
7	15
8	10
9	8
10	6
11	5
12	4

*Note: This is an approximate table for rough determination.*

*Measuring tree growth with a tree increment core.*



6- and 7-inch DBH trees in only a few years. The result will be higher harvest volumes per acre, higher stumpage prices, and ultimately a higher per acre income from your first thinning. In some situations, it may be advisable to postpone thinning a pine plantation, and in other situations it may not. Growth rates are the final determining factor, and this factor is really determined by individual landowner objectives.

Landowners should decide what growth rate is acceptable to them. Some landowners may decide that as long as the trees are growing at the prime interest rate, let them grow. Other landowners may have predetermined rates of return they expect the trees to produce. An acceptable factor could range

between 5 percent and 15 percent, depending on individual landowner objectives.

## ARE MY PINE TREES READY TO THIN?

**A**s a landowner, you can evaluate your pine plantation by using the five criteria described above and by using the Thinning Graph on page 4.

Some of these criteria such as DBH, TPA, tree heights, and natural pruning may be determined by landowners, but growth rates normally require the assistance of a professional forester.

Remember, the first thinning of your pine plantation may be the

most important activity conducted and will impact the future growth and economics of your pine plantation for many years. Using the services of a professional forester in evaluating your pine plantation is highly recommended.

Criteria	Limit/Minimum
Tree Diameters (DBH) & Stand Density	See Thinning Graph
Tree Heights	40 Feet +
Natural Pruning	18 Feet +
Growth Rates	less than 5%



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## FIELD WORKSHEET

Plot No.	Tree DBH							Total DBH	No. of Trees
<b>Totals</b>									

*Average Trees per acre = \_\_\_\_\_ (total # trees) x 100/10 = \_\_\_\_\_*  
*Average DBH = \_\_\_\_\_ (total sum of DBH's) / \_\_\_\_\_ (total # trees) = \_\_\_\_\_*



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