



Forest Stewardship

Thinning Pine Plantations

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*15-year-old stand thinned
to basal area of 60 square
feet per acre*



Thinning is a forest management practice that is generally performed at some point(s) in time during the course of the growth and development of both natural and planted pine stands. Thinning (as a forest management practice) can be defined as the calculated removal of certain trees from an existing stand and is usually conducted with a specific objective in mind.

There are various reasons why thinning should be employed as a management practice in pine stands. Thinning promotes the growth of individual trees within a stand by removing surrounding trees, which compete for water, sunlight, and soil nutrients. Most natural and planted stands require thinning at certain stages of their development in order to sustain good tree growth throughout the life of the stand. Thinning is beneficial to the overall health of a stand of trees. Certain methods of thinning allow for the removal of a greater portion of diseased trees and trees that are of poor quality and form. Many of these poorly formed, cankered trees will die before the final harvest. Therefore the landowner is capturing an early economic return with the thinning (removal) of these poor quality trees. Thinning can be effective in enhancing habitat for certain wildlife species.

THINNING INDICATORS

A common question from landowners is: "When should I thin my stand of trees?" The answer to this largely depends on their objective(s) for the stand. Most landowner objectives involve three major factors: rotation age, products to be grown (pulpwood, sawtimber, poles, pine straw), and stand

health/vigor assuming timber production is a high priority. There are several indicators (of stand conditions) that can aid in determining when a stand should be thinned:

- **Live Crown Ratio** (of trees in a stand) is defined as the height of the live crown (the part of the tree with live branches) divided by the total height of the tree. When the average live crown ratio falls below 35 percent, the stand should be thinned. For example, if the average tree height is 45 feet and the average length of the live crown is 16 feet, then that stand needs to be thinned soon ($[(16/46) \times 100 = 35.5\%]$).
- **Basal Area** (of a stand) is the area in square feet taken up by an individual tree trunk at DBH (diameter at breast height or 4.5 feet above the ground). Basal area per acre is the sum of the square feet represented by all of the trees growing in one acre. Basal area per acre is a measure of stand density. When the basal area for loblolly, slash, and longleaf pine is greater than 100 to 120 square feet per acre then the stand biologically is in need of a thinning. Thinning back to a basal area of 60 to 90 square feet per acre is a common rule of thumb.

Slash pine, biologically, needs to be thinned when live crown ratios are greater than 33 percent if the goal is to maintain a vigorously growing stand. Pine straw revenues may not make thinning a pine stand financially attractive. Typically, once a stand is thinned in Georgia it is no longer raked for straw. Conversely, loblolly pine can be thinned at a later time to promote stand pruning and assist with making more attractive "final crop" trees for sawtimber.

Table 1. Southern pine beetle hazard rating as a function of loblolly pine basal area (tree size and numbers) and/or age (years) on an average site (SI = 63 ft @ age 25 yrs).

Basal area (square feet per acre)	Age (years)	SPB Hazard Rating
< 70	<10	Very low
70 to 90	10 to 13	Low
90 to 125	13 to 17	Medium
125 to 145	17 to 21	High
> 145	> 21	Very high

Susceptibility to pine beetle attacks increases as a function of basal area and age (Table 1). As a stand grows over time the demand for water, sunlight, and nutrients increases. At some point, pine stands come under increased stress for their continued growth needs. As stand stress increases, beetle hazard increases. Thinning pine stands reduces stand stress as fewer trees per acre are competing for water, sunlight, and nutrients.

THINNING METHODS

There are several thinning methods that an individual can employ once it is determined that a stand should be thinned. Selection of method is usually based on stand density, stand uniformity, and owner objective. Remember, the greatest benefit biologically and economically is to leave the best trees (good form, no stem cankers, no forks). The following are four common thinning methods:

- **Row Thinning** (planted pines) - Alternate rows are removed from the stand. A row thinning might remove every third, fifth, or seventh row.
- **Selective Thinning** (natural or planted pines) - Individual trees are selectively removed from the stand. Tree selection is generally based on position, form, and general health.
- **Combination Thinning** - A combination of both row thinning and selective thinning.
- **Strip Thinning** (natural pines) - A strip of trees (rather than rows) are removed from the stand following the land contours.

THINNING TIMING

The timing of a thinning can be somewhat critical as well. If there is moderate bark beetle incidence in the county of the pine stand, the thinning should be performed in the winter months. If there is a high bark beetle incidence in the county, then it should not be thinned. Harvesting damage to residual trees after thinning often attracts bark beetles and can lead to stand destruction. Conversely, if the stand is in an area of high annosus root rot hazard (well-drained soils with at least 65% sand in the first 12 inches and a low seasonal water table), then the stand is best thinned during summer months. Studies indicate that thinning between

October and January has the greatest potential for causing annosus root rot infection. Borax treatment to freshly cut stumps (immediately after tree felling) can reduce future infection.

FINANCIAL RETURNS WITH FOREST MANAGEMENT THAT INCLUDES THINNING

Returns from thinning with today's pine pulpwood prices are near record lows. Many forest landowners having heard pine pulpwood prices that neighbors got in the mid-1990's are shocked to hear what pine pulpwood prices are today. Good forest management though, including thinning as a management tool, can dramatically change the products a landowner grows. Just as an acre of land can only grow so much corn, cotton, or winter grain under a specific level of management (weed control and fertilization) and soil type, so the same is true with trees. Six hundred trees per acre are going to have a much smaller average diameter than 300 well spaced trees at age 20 to 25 years. Tree diameter, stem form, and branch habit are important criteria that determine product class distributions or the proportion of the stand in pulpwood, chip-n-saw, or sawtimber sized trees. Pine pulpwood trees are generally trees with poor form, cankers, forks less than 17 feet high and a DBH of 5 to 9 inches. Pine chip-n-saw (dimension lumber and chips) trees generally have a DBH between 9 to 13 inches and have good form. Pine sawtimber trees have a DBH greater than 13 inches and also have good form. Currently, sawtimber value on the stump is worth 4 to 6 times as much as pulpwood. Chip-n-saw stumpage is worth 3 to 5 times as much as pine pulpwood. A properly performed thinning by a reputable crew done at the right time can dramatically change the amount of wood that will grow to become higher valued chip-n-saw, sawtimber and ply logs. Figure 1 illustrates that 34 cords of low value pulpwood, 20 cords of chip-n-saw and 2 cords of sawtimber are grown under a no-thin management regime in a loblolly pine stand through age 24 years. If the stand is thinned at age 15 years and grown to age 24 years, there are now 21 cords pulpwood, 27 cords chip-n-saw, and 8 cords of sawtimber sized trees. With thinning the landowner has decreased pine pulpwood sized trees by 13 cords and increased higher valued chip-n-saw and sawtimber trees by 7 and 6 cords,

Table 2. Loblolly pine wood flows and financial returns on an average site¹, medium prices² and medium site preparation³ on a 24-year rotation.

Fertilize (NP)	Thin @ 15 yrs	Pine Straw	% Pulpwood	Mean Annual Increment (cd/ac/yr)	Net \$ Per Acre	Internal rate of Return (%)
No	No	No	61	2.35	2277	8.91
No	Yes	No	38	2.32	3005	11.07
Yes	No	Yes @ \$50/ac/yr	49	2.69	2826	11.36
Yes	Yes	Yes @ \$50/ac/yr for yrs 10-14	38	2.68	3315	11.94

¹ Site index = 63 ft @ age 25 yrs

² Stumpage prices/cd: pulpwood = \$16 (thin) and \$22 (final cut), chip-n-saw =\$83, sawtimber =\$96 (2000 Timber Mart South 3rd quarter prices)

³ Site preparation and planting cost/ac = \$250, fertilization cost = \$100/acre (age 8 and 15 yrs)

Table 3. The effect of lowering first thin pulpwood prices on financial results in 24-year rotation age loblolly pine stand (no fertilization).

Thin @ age 15 years	\$/cord for pulpwood @ thinning	Net \$ per acre	Internal rate of return (%)
No	No thin	2277	8.91
Yes	16	2863	10.23
Yes	12	2806	10.02
Yes	6	2730	9.73
Yes	0	2654	9.44

Site index = 63 ft @ age 25 yrs

Stumpage prices/cd: pulpwood = \$0, \$6, \$12 and \$16 (thin) and \$22 (final cut), chip-n-saw =\$83, sawtimber =\$96 (2000 Timber Mart South 3rd quarter prices)

Site preparation and planting cost/ac = \$250

respectively (Figure 1). Fertilization and thinning improves the amount of chip-n-saw and sawtimber wood grown through age 24 years by 9 and 10 cords per acre, respectively (Figure 1).

If the best (crop) trees are given sufficient room to grow with a thinning, then the overall financial picture improves (Table 2). Even if first thinning pulpwood prices fell to \$6 and \$12 per cord, the overall financial rate of return (10.02% and 9.73% in this scenario) would be greater than under a no-thinning management regime (8.91%, Table 3). If the landowner got no income from the first thinning, the rate of return would be greater (9.44%) than if the landowner did not thin the pine stand (8.91% in this scenario, Table 3). This is due to more trees and more wood volume growing into the larger, higher valued product classes (chip-n-saw and sawtimber, Figure 1).

There are at least two reasons that forest landowners may delay or forego a thinning: (1) anticipated near-term dramatic increase in pine pulpwood prices and demand, and (2) annual revenues from pine straw make it financially unattractive to thin. Much of the attractiveness, financially, for thinning stands is the large price disparity between pine pulpwood and chip-n-saw and sawtimber. If chip-n-saw and sawtimber prices

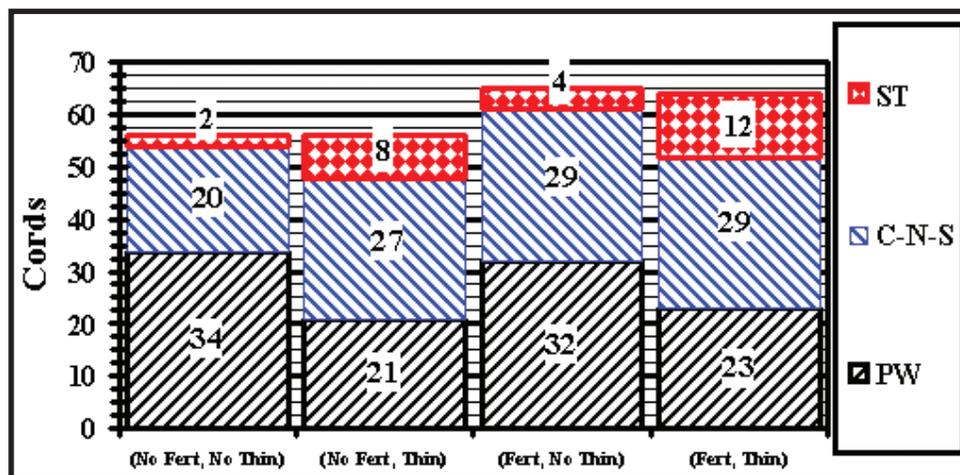


Figure 1. Effect of forest management of products grown in a loblolly pine stand, moderate productivity (Site index = 63 ft @ age 25 yrs, and 2.35 cds/ac/yr base production) through age 24 years.

decline dramatically and the price differential between pulpwood, chip-n-saw and sawtimber narrows, then the above forest management picture changes.

SUMMARY

Thinning pine stands can have biological and long-term economic benefits. Removal of the poor quality and diseased trees (many that may die if not thinned) and leaving the best trees in good condition with a thinning

can benefit many forest landowners in Georgia. Remember, you have been tending to your pine stands since they were seedlings, placing great care in the stand. Do not rush into a thinning. Do your homework. Get professional help. Get the best possible logging crew in your area to do the work. The large financial gain is not in the thinning income, but in leaving the best trees to grow into higher valued products. 🌲

Photos courtesy of UGA



15-year-old unthinned stand with a basal area of 150