HOW TO DETERMINE WHEN YOUR CONSERVATION RESERVE PROGRAM (CRP) PINE PLANTATION IS READY TO THIN

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Abstract—The CRP program was initiated in 1986 by the United States Department of Agriculture, Farm Services Agency, to protect topsoil from erosion. There have been 308,000 acres of CRP pine plantations established in Mississippi, and 1.2 million acres of CRP plantations have been established nationwide. Many of the CRP pine plantations in Mississippi will soon be ready for the first thinning. Timing and frequency of these first thinnings should be determined by site quality and landowner objectives. However, first thinnings are all too often considered to be a source of income for private landowners, and not a stand improvement tool. While income is a positive result, most landowners in Mississippi want to produce higher value sawlogs rather than low value pulpwood. Timing the first thinning too soon or too late can decrease site productivity and subsequent longer term financial returns for the landowner. The method presented here was developed to assist landowners and foresters in deciding when a first thinning should take place in CRP pine plantations in Mississippi. It is based upon five factors: 1) stand density, 2) natural pruning height, 3), average tree diameter, 4) heights of dominants and codominants, 5) and basal area growth rate. The decision of whether to thin or not is based on these characteristics, rather than on current pulpwood prices. This method provides a sound, unbiased means for foresters and landowners to decide the optimum time for the first thinning of young loblolly pine plantations.

INTRODUCTION

The Conservation Reserve Program (CRP) is the federal government's single largest environmental improvement program (USDA 1997). CRP was established in 1985 to provide participants an annual per acre rent, plus half the cost of establishing a permanent land cover (Dorell et al 1993). To date, approximately 308,000 acres of CRP pine plantations have been established in Mississippi with an average annual rental payment of $45 per acre for 10 years (Londo 2000).

Faculty in the Department of Forestry at Mississippi State University have developed a workshop to teach landowners the proper time to make the first thinning of their CRP pine plantation. This workshop shows them how to measure the following basic forest characteristics: average tree diameter, average tree height, stand density, height to natural pruning, and basal area growth rate. The workshop, as well as the recommended criteria for each measurement will be described.

WORKSHOP MECHANICS

The pine thinning workshops are held in individual counties in conjunction with each County Forestry Association (CFA) and Extension Agent. The first hour of the workshop is held indoors and serves as a lecture period. The lecture is usually given by one of the MSU Area Extension Foresters. The Area Extension Foresters are faculty members in the Department of Forestry and are responsible for conducting Extension forestry programs in their district of the state.

Information concerning pine growth and development, reasons for thinning, and method for thinning pine plantations are discussed. Following this lecture period, the landowners then go to a pine plantation to collect stand data.

With the assistance of forestry faculty and professional foresters, the landowners are broken into groups and disperse through the plantation for measurement collection. All measurements are collected within 100th acre plots. We encourage our participants to collect data on at least ten plots, scattered throughout the plantation. This is the minimum number of plots to get a good representative sample.

A double sampling technique is used to collect data. Plots are distributed systematically in a plantation using compass and pacing. The first sample is a 1/100th acre plot measuring DBH and trees per acre. Within each 1/100th acre plot, a single sample tree in the dominant or codominant crown class nearest plot center is measured for total

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Table 1—Basal area growth rate by DBH and 3-year radial growth. Bold numbers designate the threshold 10 percent annual rate of growth. Growth rates at or below the threshold indicate it is time to thin

DBH (inches)	3-year wood radial growth (inches)					
	0.3	0.4	0.5	0.6	0.7	0.8
		Basal Area growth rate (% per year)*				
5	**9**	12	15	18	21	25
6	7	**10**	12	15	17	20
7	6	8	**10**	12	15	17
8	5	7	9	11	13	15
9	5	6	8	**10**	11	13

* BA growth (%/year) = [(future BA – current BA) / (3 years * current BA)] * 100%
current BA = [current DBH]^2 * .005454
future BA = [current DBH + (2* radial growth)]^2 * .005454

height, pruning height, and basal area growth. The sample tree selected is also preferably free from any serious defect.

DBH is measured with a diameter tape and total height with a clinometer.

Natural pruning height (height to the first live limb) is measured using an 11 ft pole that is marked into 1-foot increments. Holding this pole, with your arm fully extended, will reach about 18 ft for most people. Lower pruning heights are easily determined by lowering the pole and counting the number of increments lowered. Stem radial growth (used to estimate basal area growth) is measured from an increment core collected at breast height.

Thin/wait Decision Based on Stand Density (DBH and TPA)

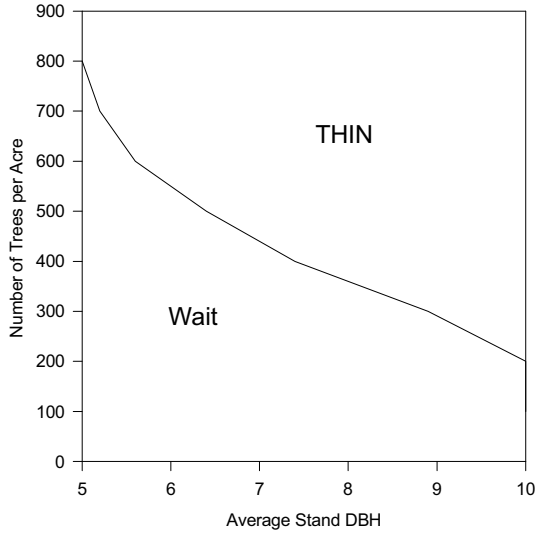

Figure 1—Thin/Wait decision based on 55% Stand Density Index (bold line) for young loblolly pine plantations.

Table 2—Pulpwood tons per tree for pines harvested during the first thinning. From: Jim McCreight. 1998. Unpublished data for Louisiana and Mississippi pine plantations

DBH (inches)	Total Height (feet)*		
	35	40	45
	Tons per tree		
5	0.029	0.030	0.032
6	0.061	0.064	0.068
7	0.095	0.100	0.107
8	0.133	0.140	0.150

* For young pines, merchantable height to a 3" top equals total height minus 10 feet.

A quick field estimate of future basal area growth is provided in table 1 using DBH and radial growth. Radial growth is measured from an increment core of wood taken horizontally through the central pith of the stem of the sample tree at breast height. Width of the growth rings for the last full three years is measured. Predicting future wood growth using past growth is “a reasonable postulate for a 3-5 year span” (Avery and Burkhardt 1994). Bark growth for the three-year period is assumed to be negligible. A simple interest rate was used because a straight-line best describes tree growth in young unthinned stands (Grosenbaugh, 1958). The calculations used to generate table 1 are:

Basal area (BA) is expressed in square feet per tree while DBH and radial growth are in inches.

current BA = [current DBH]^2 * .005454
future BA = [(future BA-Current BA)/(current BA)/(3 years)]*100percent
BA growth rate expressed as percent per year :
BA growth percent = [(future BA – current BA) /(3 years * current BA)] * 100 percent

DBH Measurements

Diameter at Breast Height (DBH) is important, because trees must be at least 5" DBH to be sold for pulpwood (Traugott 2000). Trees smaller than five inches DBH are not merchantable and typically won’t be cut. Consequently, thinning plantations when only the larger trees are above this minimum size may result in high grading of the stand (Traugott 2000). We recommend at least an average tree diameter of six inches. Larger diameter trees also produce more volume, increasing the money earned by the land-owner at the time of thinning.

Other data may also be collected, such as the number of forked, diseased, or ice-damaged trees. Ice storms in 1994 and 1998 have damaged many pine plantations in North Mississippi. This information can be important for determining stand health and allowing for an informed decision on which trees to cut.

Table 3—Summary table for evaluating pine plantation characteristics measured in the field in order to determine whether plantation is ready to be thinned

Characteristic	Guideline	Ready for Thinning?		
Average DBH	≥ 6 inches	YES	Borderline	NO
Trees Per Acre				
Stand Density Index from figure1	≥ 55%	YES	Borderline	NO
Total Tree Height	≥ 40 feet	YES	Borderline	NO
Natural Pruning Ht	≥ 18 feet	YES	Borderline	NO
Basal Area Growth Rate	≤ 10%?	YES	Borderline	NO
What Do We Recommend?		THIN	WAIT __ yrs	

Stand Density

The average tree DBH and number of stems per acre can be used to determine if the stand is dense enough to warrant thinning. Figure 1 shows a "thin – wait" decision line for loblolly pine. This line represents combinations of mean tree diameter and density that equate to 55 percent of the maximum Reineke's Stand Density Index value (SDI) for loblolly pine (Reineke 1933). Fifty-five percent of maximum SDI is where density-related mortality (self-thinning) can be expected to begin (Dean and Baldwin 1996).

A stand density index value of 55 percent was set as a general target rather than an absolute thinning criteria. Thinning a stand prior to this density may be desirable if a landowner is interested in maintaining high stand vigor and rapid individual tree growth. Delaying thinning beyond this density may be desirable if a landowner is willing to risk some mortality in order to capture a greater total stand volume yield. In addition to stand density index values, the decision of whether to thin or not must also take into consideration the other plantation characteristics discussed in this paper.

Tree Heights

Trees should be at least 40 feet tall for a plantation to be economically thinned (Traugott 2000). We are assuming that the top ten feet needs to be cut off to reach a 3-inch top. Logging operations in Mississippi typically use tree-length log trucks to haul trees from the woods to the mill. Merchantable stem lengths shorter than 30 feet create several problems for the logger. Double stacking short stems results in the truck being full of wood, but typically weighing less than the maximum haul weight of 25 tons (table 2). Higher hauling costs for short trees subsequently lowers stumpage prices for the landowner.

Natural Pruning

Since pines are shade intolerant, their branches die from the ground up as trees become crowded and over topped (Traugott 2000). Natural pruning needs to be at a minimum height of 18 feet. This 18 feet of natural pruning will result in a clear 16-foot butt log for future harvests. This is a much lower standard than the 24 ft reported by Nebeker et al (1986) which would achieve almost 1.5 clear logs.

Natural pruning is most important in the butt log since it is the largest and most valuable log in the tree. Live limbs produce knots in the wood, decreasing strength and subsequent value as lumber. Pruning can be used to achieve the same results, but most landowners do not have the time or money to invest in this kind of operation.

Thinning before natural pruning occurs will allow limbs to live longer and get larger in diameter. What could have been future quality sawtimber is pulpwood or at best low-grade sawtimber. Current prices in Mississippi show this to be a $20 to $30/ton loss in value, or $200-$300 per acre.

Basal Area Growth

One important factor that affects the best time to thin is basal area growth of individual trees. Basal area is the stem cross-sectional area at breast height. Slow growth in basal area is an indicator of poor tree health and increased risk of loss to southern pine beetles. Basal area growth is also an important financial measurement because it is closely related to volume growth (Wenger 1984).

A general target of 10 percent basal area growth is useful for field evaluations. The choice of an acceptable growth rate is a personal one. Landowners reinvesting thinning income at a rate of return above 10 percent will thin earlier. If low rates of return 5 percent or less are expected from reinvestments, landowners will thin later. In general, trees growing over 10 percent each year are producing enough wood to justify waiting to thin. Once basal area growth drops to 10 percent or less there is financial incentive to thin.

Evaluation of Data

At the end of the workshop, we summarize all the data collected and determine if the pine plantation is ready to thin. The format to summarize and evaluate the data collected during the workshop can be found in table 3. We base the decision of whether to thin the plantation on the five factors listed.

SUMMARY AND CONCLUSIONS

There are thousands of acres of CRP pine plantations in Mississippi that are approaching the time for the first thinning. Proper timing is the most important management decision landowners can make for their pine plantation. The first thinning sets the stage for the future productivity and value of the plantation.

The method presented in this paper for determining the timing of the first thinning in CRP plantations is based on stand diameter, density, total height, natural pruning height, and basal area growth. Threshold levels for each of these factors are provided to indicate the need for thinning. The decision of whether to thin or not is made with specific knowledge of these five stand characteristics, rather than on stand age, appearance, or pulpwood prices. This method is easy to use, straightforward, and can be used by landowners and foresters alike. Modifications for different regions in the south could be easily made based on growth rates and markets in those areas.

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