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MINOR TOPOGRAPHIC CHANGES AFFECT GROWTH and YIELD of PLANTED SOUTHERN PINES

BULLETIN 439
NOVEMBER 1972

AGRICULTURAL EXPERIMENT STATION
AUBURN UNIVERSITY
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First Printing 3M, November 1972

Minor Topographic Changes Affect Growth and Yield of Planted Southern Pines

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INTRODUCTION AND METHODS

RECOGNIZING THAT WOOD, like any field crop, is a product of the soil, research workers of the Auburn University Agricultural Experiment Station in 1932 selected a 9-acre strip of gently rolling terrain on which to investigate the relationship between topographic position and yield of planted southern pines. The experimental area, which is in a zone of transition between the Hilly Coastal Plain and the Piedmont Plateau, had recently been in cultivation. Maximum difference in elevation was about 30 feet.

Topography was classified as follows:

1. Hill – dry ridge tops and upper or middle slopes that were mostly eroded, some with broken terraces.

2. Slope – middle and lower slopes, mainly with gentle gradients and not severely eroded.

3. Flat – nearly flat, lower slopes and well drained branch bottom.

4. Swamp – branch bottom permanently wet except during drought.[2]

The soil was Norfolk, with local alluvium and colluvium in low areas. Texture of the topsoil varied from fine sand and loamy sand on the hills to sandy loam and loam on the flats and swamps.

Ground cover in addition to topographic position was utilized in dividing the experimental area into the four site classes. In this way, the classification was made to reflect moisture regime more accurately than was possible on the basis of topography alone.

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[1] Assistant Professor, Department of Forestry.

[2] Not included in the final analysis. A utility right-of-way was cut across the experimental area removing much of the Swamp Type from the experiment.

Scarcity of soil moisture on the Hill Type was indicated by the absence of all but a sparse, grassy ground cover, mainly *Andropogon virginicus* L. There was more abundant, grassy vegetation with a scattering of young hardwoods on the Slope Type. The Flat Type had a dense cover of sweetgum (*Liquidambar styraciflua* L.) and Japanese honeysuckle (*Lonicera japonica* Thunb.). The abundant moisture of the Swamp Type was reflected in a tangle of vines and canes (mainly Jap. honeysuckle and species of *Vitis* L., *Smilax* L., *Rubus* L., and *Arundinaria* Michx.) along with a rank growth of young sweetgum, black gum (*Nyssa sylvatica* Marsh.), willow (*Salix nigra* Marsh.), yellow-poplar (*Liriodendron tulipifera* L.), and miscellaneous other hardwoods. Woody vegetation was cut from all areas when the pines were planted.

Stand Establishment

Planting was begun in 1932 and completed in 1934. Locations of the individual species plantings in relation to the topographic situations are shown in Figure 1. All plantings were made manually with 1-year-old stock at a 6 × 6 foot spacing. Slash pine (*Pinus elliottii* Engelm. var. *elliottii*) and shortleaf pine (*P. echinata* Mill.) were planted the first year, longleaf pine (*P. palustris* Mill.) the second year, and loblolly pine (*P. taeda* L.) the third. This staggered planting was not planned but was necessitated by a shortage of seedlings.

Measurements

Six inventories of the planted areas were conducted, beginning 7 years and ending 31 years after planting was begun. Diameters of all surviving pines were measured at each inventory and recorded to the nearest 0.1 inch. Heights of all dominant and codominant planted trees were measured by Abney level or Haga hypsometer and recorded to the nearest foot in the last two inventories, while heights of other trees were estimated and recorded to the nearest 5 feet. Heights of all trees were not determined in earlier inventories, but enough were on record that the remainder could be estimated by a curvilinear regression on diameter and age for each species. Hardwoods were included only in the last two inventories.

Ages in years from planting of the different species at successive inventories follow:

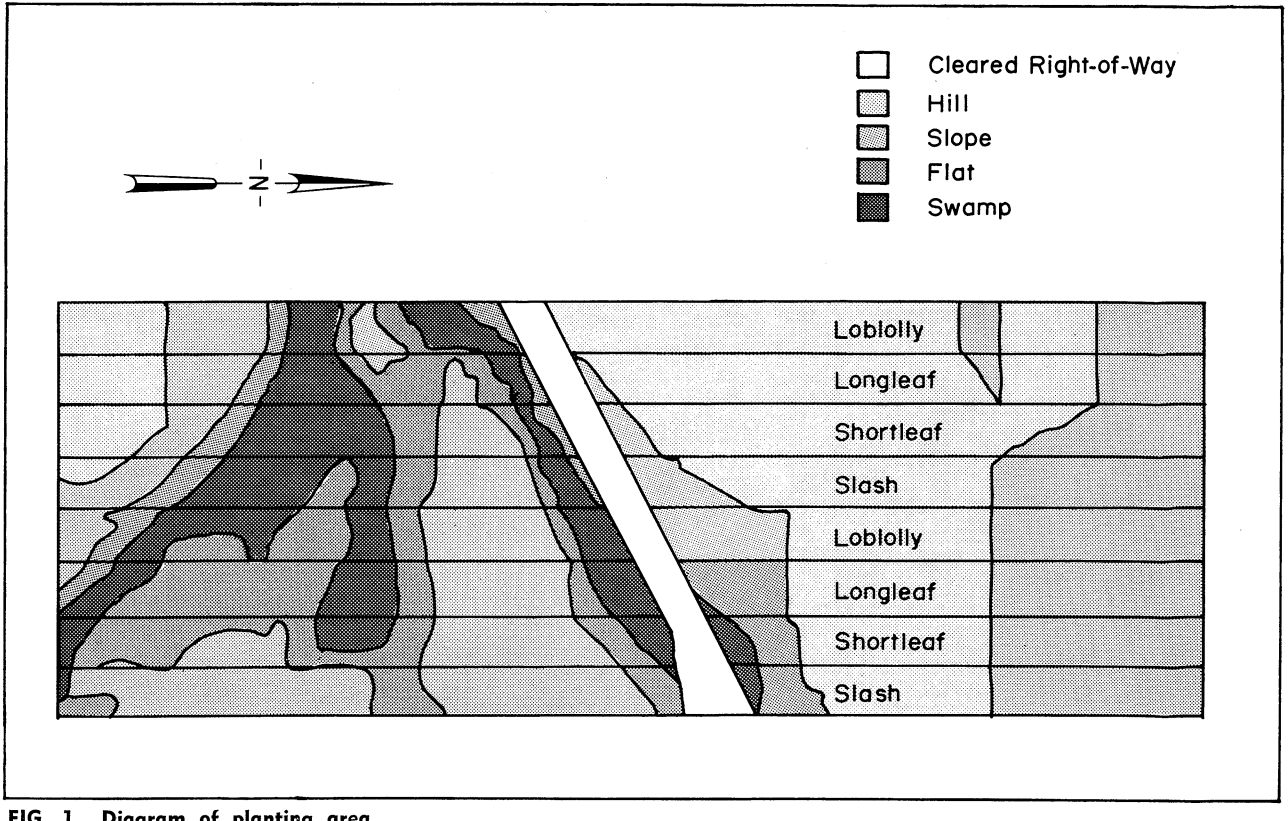


FIG. 1. Diagram of planting area.

Slash and shortleaf pines.....7, 10, 12, 19, 24, 31;
Loblolly pine.....5, 8, 13, 17, 22, 29;
Longleaf pine.....6, 9, 14, 18, 23, 30.

Individual tree volumes were derived from appropriate cubic foot formulas adapted from Bamping and Oliphant *(1)*, then accumulated for per-acre values and placed on a mean annual basis. Comparisons of periodic annual growth and yield were omitted because of the age differences.

Thinnings

Concurrently with the third, fourth, and sixth inventories, low thinnings were conducted. Shortleaf and longleaf pine plantings, however, were left intact the first time because their density was insufficient to require thinning. The thinnings were applied uniformly as normal silvicultural measures, not as additional experimental treatments.

Statistical Design and Analysis

Although this experiment was not designed for a standard statistical analysis, it was adaptable to an approximate analysis. Examination of Figure 1 reveals that the planting may logically be divided into 2 blocks, each with all 4 species planted on equal-sized strips that cross the minor topography in a north-south direction. The swamp area, however, was omitted from the analysis because of the low survival rate of trees planted there, the loss of much of the original swamp area to a utility right-of-way, and the extreme variability of the small area remaining.

The analysis adopted was a split plot in time and space *(3)* with species planted the main treatment, site class defined as topographic position the split in space, and age class defined as inventory number the split in time. Age could not be treated as a covariate because several species-site combinations exhibited growth curves with different shapes. Replicated in two blocks, there were four species, three sites, and six inventory ages for total values, which include both cut and uncut trees. There were three thinning ages for only the trees cut.

In addition to the split plot in time and space, ordinary split plot (in space) analyses of the final age class alone were computed to provide error terms appropriate for comparing species and sites in this restricted but important category. Since error

terms from the main analyses were inappropriate for these comparisons, the consequent reduction in degrees of freedom for the final split had to be accepted.

Significance levels of individual comparisons were estimated by Duncan's New Multiple Range Test *(2)*, which provides special protection against finding false significant differences at the probability chosen but may fail to detect every truly significant difference. A 95 per cent or greater probability of real difference between means was considered significant.

The reader is reminded that the original plan of analysis for the experiment is unknown and a design that fit as nearly as feasible was adopted. One basic assumption of the adopted analysis is that main treatments (species) be assigned at random to plots within blocks. Since species appeared in the same sequence within each block and randomization is not mentioned in the records, it seems highly unlikely that the assumption is valid. The consequences, if any, of this violation are unknown. Independence of treatments is also assumed, but this is erroneous because of differential competition between species along the approximately 1,000 foot borders of plots that were only 48 feet wide. A strong bias in favor of rapid early growth, as well as a smaller bias due to priority of planting, can be surmised but not quantitatively determined. Although age is not assumed to be random in the analysis, a bias of undetermined extent is involved because the individual species were inventoried at slightly different ages.

RESULTS AND DISCUSSION

The early investigators' premise that tree growth would differ with small changes in topographic position was demonstrated to be correct by periodic inventories of the plantations. Generally considered to be the best indicator of site quality, height growth of average dominant and codominant trees of the same species on different positions differed by as much as 19 feet 31 years after the first plantings. Loblolly pine showed the greatest height growth response to changes in topography. Features of the dominant and codominant planted stand at the last inventory are presented in Table 1. Stand tables from all inventories appear in the Appendix.

Early survival of all species was greatly affected by site class, probably a result of differences in competition. Despite several

TABLE 1. SUMMARY BY SPECIES AND TOPOGRAPHIC SITE CLASS OF THE DOMINANT AND CODOMINANT TREES, PLANTED STAND AT THE LAST INVENTORY (AGE 29 TO 31 YEARS)

Topographic site class	Trees per acre	Average DBH[1]	Average total height	Site index[2]
	No.	*In.*	*Ft.*	*Ft.*
Slash pine (age 31 years)				
Hill	187	10.5	66	85
Slope	203	11.4	74	95
Flat	171	12.2	78	100
Swamp	28	13.2	76	95
Loblolly pine (age 29 years)				
Hill	173	9.7	64	90
Slope	200	11.2	75	100
Flat	157	13.6	83	110
Swamp	16	14.6	76	100
Shortleaf pine (age 31 years)				
Hill	76	7.9	52	75
Slope	71	8.5	56	80
Flat	31	8.7	58	80
Longleaf pine (age 30 years)				
Hill	134	9.9	68	90
Slope	50	10.5	70	90
Flat	28	11.3	74	95

[1] Diameters here and throughout the article were averaged by the basal area method. Bark was included.

[2] Base age is 50 years. Site index was estimated to the nearest 5 feet from USDA curves *(4)*.

cleanings to free the planted seedlings of competition from sprouting woody vegetation, longleaf and shortleaf pine plantings in the swamp were failures and the other species were near failures. Hardwoods eventually accounted for 60 per cent of total net basal area growth in the slash pine swamp planting and 74 per cent in the loblolly. Best early survival of all species of pine was on the hills and slopes, where competition from weeds and hardwoods was lightest.

Upper crown class trees of all species grew tallest on the flats, and their average diameter increased from dryer to wetter sites. Loblolly pine showed the greatest absolute and relative difference, with a 50 per cent increase in diameter from hill to swamp.

Site quality estimates based on total height of the dominant stands suggest that the flat should be the most productive site for all of the planted species. It can be seen in Tables 2 and 3, however, that actual volume production was greater on at least one other site class for every species, though the difference among species averages was not significant. Failure of the flat to produce

TABLE 2. MEAN ANNUAL TOTAL STEM VOLUME INCREMENT PER ACRE THROUGH THE FINAL INVENTORY, PLANTED PINES LARGER THAN 4.5 INCHES DBH

Species	Site class			
	Hill	Slope	Flat	Average[2]
	Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
Slash[1]	176 a	249 b	231 ab	219 b
Loblolly[1]	148 a	247 b	225 b	207 b
Shortleaf[1]	63 a	75 a	25 a	54 a
Longleaf[1]	93 a	42 a	28 a	54 a
Average[2]	120 a	153 a	127 a	133

[1] Site values within the same species not followed by the same letter are significantly different.
[2] Site or species averages not followed by the same letter are significantly different.

TABLE 3. MEAN ANNUAL MERCHANTABLE (4-INCH TOP) VOLUME INCREMENT PER ACRE THROUGH THE FINAL INVENTORY, PLANTED PINES LARGER THAN 4.5 INCHES DBH

Species	Site class			
	Hill	Slope	Flat	Average[2]
	Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
Slash[1]	165 a	236 b	223 ab	208 b
Loblolly[1]	134 a	232 b	219 b	195 b
Shortleaf[1]	54 a	66 a	22 a	52 a
Longleaf[1]	88 a	40 a	27 a	47 a
Average[2]	111 a	143 a	123 a	126

[1] Site values within the same species not followed by the same letter are significantly different.
[2] Site or species averages not followed by the same letter are significantly different.

its potential was the result of the reduced early survival. The overall pattern differed among species, but significant differences between sites were confined to slash and loblolly pines. Production of slash and loblolly pines was far higher than that of shortleaf and longleaf. Much of this species difference was expected, but the extremely low production of shortleaf and longleaf pines must be attributed in part to competition from their faster growing neighbors. Shortleaf and longleaf pines were also less able to compete effectively with weeds and hardwoods than were slash and loblolly.

Yields from thinning appear in Table 4. They follow volume increment fairly closely, but there are a few additional significant differences. Most prominent is the higher yield from slash pine than loblolly. This probably was caused by heavier infection of the larger slash pines with southern fusiform rust (*Cronartium fusiforme* Hedg.), which encouraged heavier cutting.

TABLE 4. MEAN ANNUAL MERCHANTABLE YIELD PER ACRE, FROM THINNINGS ONLY

Species	Site class			
	Hill	Slope	Flat	Average[2]
	Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
Slash[1]	83 a	116 b	107 ab	102 b
Loblolly[1]	57 a	106 b	91 b	85 b
Shortleaf[1]	26 a	34 a	11 a	24 a
Longleaf[1]	35 a	15 ab	9 b	19 a
Average[2]	50 a	68 b	54 a	57

[1] Site values within the same species not followed by the same letter are significantly different.
[2] Site or species averages not followed by the same letter are significantly different.

Volume increment of sawtimber material in cubic feet is shown in Table 5. Shortleaf pine had a negligible volume in this size; longleaf pine, a significantly larger production. Slash and loblolly pines were almost equal and each was vastly greater in volume than longleaf. Unlike total merchantable volume, sawtimber volume apparently reflected the superiority of the flat site quality. Though the flat was not significantly higher in volume than the slope, both definitely surpassed the hill, which showed the lowest site quality. Neither shortleaf nor longleaf pine exhibited significant site class differences. Table 6 shows that sawtimber yield from thinning loblolly pine was significantly higher on flats than on slopes. Otherwise, sawtimber yield from thinning follows practically the same pattern as sawtimber production.

The thesis that the flat was potentially the most productive site is supported by the superior basal area increment of volunteers there, Table 7. Although average basal area growth of the

TABLE 5. MEAN ANNUAL SAWTIMBER (8-INCH TOP) VOLUME INCREMENT PER ACRE THROUGH THE FINAL INVENTORY, PLANTED PINES LARGER THAN 9.5 INCHES DBH

Species	Site class			
	Hill	Slope	Flat	Average[2]
	Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
Slash[1]	71 a	145 b	158 b	125 b
Loblolly[1]	50 a	140 b	173 b	121 b
Shortleaf[1]	3 a	9 a	2 a	4 a
Longleaf[1]	43 a	22 a	18 a	28 a
Average[2]	42 a	79 b	88 b	70

[1] Site values within the same species not followed by the same letter are significantly different.
[2] Site or species averages not followed by the same letter are significantly different.

TABLE 6. MEAN ANNUAL SAWTIMBER YIELD PER ACRE, FROM THINNINGS ONLY

Species	Site class			
	Hill	Slope	Flat	Average[2]
	Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
Slash[1]	18 a	42 b	54 b	38 b
Loblolly[1]	5 a	35 b	56 c	32 b
Shortleaf[1]	0 a	1 a	0 a	0 a
Longleaf[1]	11 a	4 a	1 a	6 a
Average[2]	8 a	20 b	28 b	19

[1] Site values within the same species not followed by the same letter are significantly different.

[2] Site or species averages not followed by the same letter are significantly different.

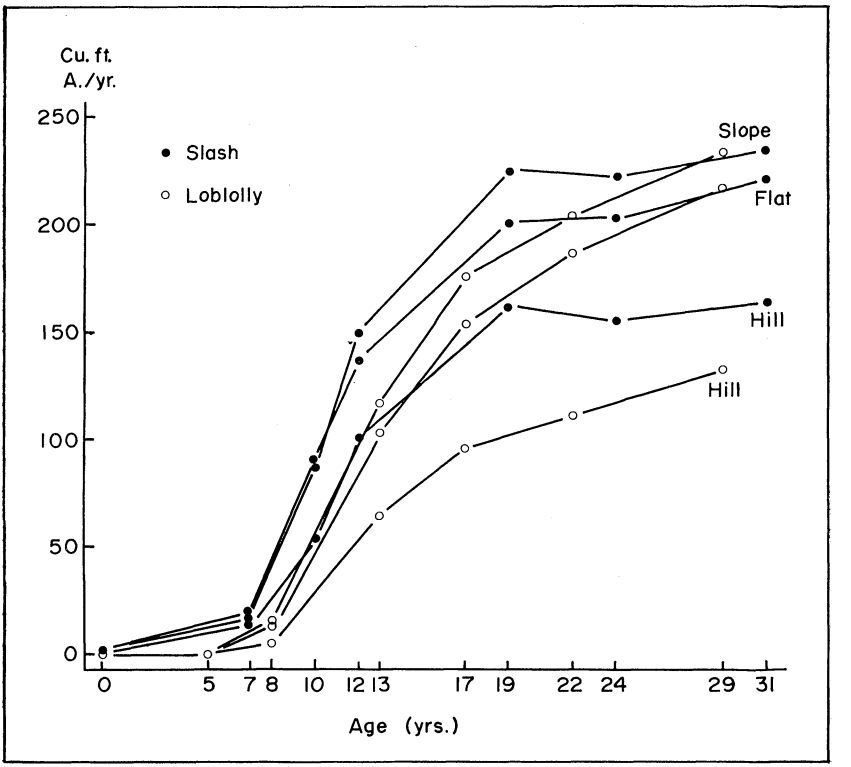


FIG. 2. Net merchantable mean annual increment to different ages of slash and loblolly pines planted on hill, slope, and flat.

TABLE 7. MEAN ANNUAL BASAL AREA INCREMENT PER ACRE FOR ALL TREES AND ALL TREATMENTS THROUGH THE FINAL INVENTORY

Trees and treatment	Site class			
	Hill	Slope	Flat	Average[2]
	Sq. ft.	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*
Planted pines				
Slash[1]	6.89 a	8.41 a	7.10 a	7.47 a
Loblolly[1]	6.55 a	8.56 b	6.18 a	7.10 a
Shortleaf[1]	3.44 a	3.79 a	1.09 b	2.77 b
Longleaf[1]	3.21 a	1.38 ab	.92 b	1.83 b
Average[2]	5.02 a	5.53 a	3.82 b	4.79
Other pines				
Slash[1]	0.17 a	0.33 a	0.71 a	0.42 a
Loblolly[1]	.02 a	.00 a	.00 a	.01 a
Shortleaf[1]	.02 a	.08 a	.33 a	.14 a
Longleaf[1]	.00 a	.10 a	1.87 b	.66 a
Average[2]	.05 a	.13 a	.74 b	.31
All pines				
Slash[1]	7.06 a	8.74 a	7.85 a	7.88 a
Loblolly[1]	6.57 a	8.56 b	6.18 a	7.10 a
Shortleaf[1]	3.46 a	3.87 a	1.42 b	2.91 b
Longleaf[1]	3.21 a	1.49 a	2.79 a	2.49 b
Average[2]	5.07 ab	5.66 a	4.56 b	5.10
Hardwoods				
Slash[1]	0.12 a	0.27 a	1.00 a	0.46 a
Loblolly[1]	.10 a	.17 a	1.69 b	.62 a
Shortleaf[1]	.10 a	.06 a	1.94 b	.70 a
Longleaf[1]	.02 a	.28 a	2.20 b	.84 a
Average[2]	.09 a	.19 a	1.69 b	.66
All trees				
Slash[1]	7.18 a	9.01 a	8.85 a	8.35 a
Loblolly[1]	6.67 a	8.73 a	7.78 a	7.72 a
Shortleaf[1]	3.56 a	3.92 a	3.36 a	3.61 b
Longleaf[1]	3.23 ab	1.77 a	4.99 c	3.33 b
Average[2]	5.16 a	5.86 a	6.24 a	5.75

[1] Site values within the same species not followed by the same letter are significantly different.

[2] Site or species averages, in the same group, not followed by the same letter are significantly different.

planted pines was definitely lowest on the flat, pine and hardwood volunteers made the combined basal area of all trees highest on the flat. However, the between site differences in increment of all trees were not significant. The basal area superiority of all trees in both the slash and loblolly pine plantings over either the shortleaf or longleaf plantings was highly significant despite the inclusion of volunteers. The differences between species within both of the two pairs could be accidents of sampling.

Reference to Figure 2 will show that slash pine grew more rapidly than loblolly on every site during the early years. However, slash pine increment leveled off after 19 years, while mean annual production of loblolly pine continued to increase significantly. On both the flat and the slope, loblolly pine equalled slash at about 30 years and appeared to be still increasing its rate of production. Even on the hill, the difference between the two species was not found significant at the final age.

LITERATURE CITED

(1) BAMPING, J. H. AND L. M. OLIPHANT. 1961. Southern Pine Cubic Foot and Board Foot Formulae for the Southeastern United States. School of Forestry, University of Georgia, Athens, Ga., and the Division of State and Private Forestry, U.S. Forest Service, Atlanta, Ga.

(2) DUNCAN, D. B. 1955. Multiple Range and Multiple F Tests. Biometrics, Vol. 11.

(3) STEEL, R. G. D. AND JAMES H. TORRIE. 1960. Principles and Procedures of Statistics. McGraw-Hill, New York.

(4) U.S. DEPARTMENT OF AGRICULTURE. 1929. Volume, Yield, and Stand Tables for Second-Growth Southern Pines. Office of Forest Exp. Sta., Forest Service, USDA. Washington. Misc. Pub. 50.

APPENDIX

APPENDIX TABLE 1. SLASH PINE PLANTED ON HILLS, 0.482 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
7	Total	1,072	47	2.8	15	58	8	5.0	24	0	0	----	----
10	Total	1,066	86	3.8	24	233	38	5.4	30	0	0	----	----
12	Cut & lv.	977	109	4.5	30	402	72	5.7	36	2	1	9.6[3]	46[3]
12	Cut only	384	29	3.7	26	75	14	5.8	36	2	1	9.6[3]	46[3]
19	Cut & lv.	573	135	6.6	46	500	128	6.9	47	13	8	10.5	55
19	Cut only	289	51	5.7	44	219	45	6.1	45	0	0	----	----
24	Total	254	98	8.4	56	253	97	8.4	56	52	32	10.6	61
31	Cut & lv.	250	133	9.9	63	246	133	9.9	64	117	80	11.2	66
31	Cut only	102	47	9.2	62	102	47	9.2	62	31	20	11.1	67
Other pines													
7	Total	27	2	3.7	22	10	1	4.8	29	0	0	----	----
10	Total	27	4	5.0	27	16	3	6.0	31	0	0	----	----
12	Cut & lv.	27	5	6.0	33	22	5	6.8	39	0	0	----	----
12	Cut only	27	5	6.0	33	22	5	6.8	39	0	0	----	----
19	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
19	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
24	Total	0	0	----	----	0	0	----	----	0	0	----	----
31	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
31	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
Hardwoods													
24	Total	4	1	7.4	49	4	1	7.4	49	0	0	----	----
31	Total	18	4	7.1	52	14	3	7.2	53	2	1	9.8[3]	54[3]

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other has no trees in this size class.

APPENDIX TABLE 2. SLASH PINE PLANTED ON SLOPES, 1.189 ACRES. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
7	Total	1,069	53	3.0	16	69	9	4.9	24	0	0	----	----
10	Total	1,048	101	4.2	26	26	59	5.4	32	0	0	----	----
12	Cut & lv.	967	129	4.9	32	540	103	5.9	37	1	0	9.9[3]	49[3]
12	Cut only	391	38	4.2	29	129	24	5.8	37	0	0	----	----
19	Cut & lv.	546	158	7.3	51	499	155	7.5	53	45	27	10.4	60
19	Cut only	259	58	6.4	50	224	55	6.7	50	8	5	10.9	62
24	Total	259	121	9.3	63	251	120	9.4	64	97	63	10.8	67
31	Cut & lv.	257	166	10.9	72	253	165	11.0	73	188	140	11.7	74
31	Cut only	102	56	10.1	72	102	56	10.1	72	58	38	11.0	74
Other pines													
7	Total	38	3	3.9	21	12	2	5.3	28	0	0	----	----
10	Total	37	6	5.6	33	26	6	6.2	37	0	0	----	----
12	Cut & lv.	41	9	6.5	40	30	9	7.1	43	1	0	10.0[3]	51[3]
12	Cut only	40	9	6.5	40	28	8	7.1	43	1	0	10.0[3]	51[3]
19	Cut & lv.	2	1	9.9	59	2	1	9.9	59	1	1	11.2[3]	61[3]
19	Cut only	1	1	11.2[3]	61[3]	1	1	11.2[3]	61[3]	1	1	11.2[3]	61[3]
24	Total	2	1	5.9	37	1	1	10.2[3]	60[3]	1	1	10.2[3]	60[3]
31	Cut & lv.	1	1	12.1[3]	68[3]	1	1	12.1[3]	68[3]	1	1	12.1[3]	68[3]
31	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
Hardwoods													
24	Total	8	2	5.9[3]	41[3]	8	2	5.9[3]	41[3]	0	0	----	----
31	Total	41	8	5.8[3]	44	35	8	6.0	46	1	0	9.7[3]	74[3]

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

APPENDIX TABLE 3. SLASH PINE PLANTED ON FLATS, 0.323 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
7	Total	792	43	2.9	16	72	11	5.2[3]	27[3]	0	0	----	----
10	Total	733	81	4.4	29	330	56	5.5	34	0	0	----	----
12	Cut & lv.	630	101	5.3	37	407	85	6.1	41	0	0	----	----
12	Cut only	182	24	4.8	34	92	19	5.9	41	0	0	----	----
19	Cut & lv.	391	131	7.8	55	351	128	8.2	57	64	38	10.0	63
19	Cut only	171	47	7.0	54	148	45	7.4	55	12	8	10.7	64
24	Total	194	106	10.0	67	190	106	10.1	68	113	75	11.0	69
31	Cut & lv.	191	149	12.0	77	191	149	12.0	77	173	141	12.3	78
31	Cut only	75	50	11.0	77	75	50	11.0	77	63	45	11.4	78
Other pines													
7	Total	54	4	3.8	23	14	2	5.5[3]	31[3]	0	0	----	----
10	Total	57	10	5.9	38	40	9	6.5	42	0	0	----	----
12	Cut & lv.	61	15	7.1	46	47	14	7.5	48	6	3	10.0[3]	55[3]
12	Cut only	38	11	7.5	48	34	11	7.7	49	3	2	10.1[3]	55
19	Cut & lv.	13	7	9.8	63	13	7	9.8	63	3	3	14.1[3]	71[3]
19	Cut only	3	1	6.5[3]	56[3]	3	1	6.5[3]	56[3]	0	0	----	----
24	Total	6	6	13.8[3]	79[3]	6	6	13.8[3]	79[3]	6	6	13.8[3]	79[3]
31	Cut & lv.	9	11	14.4	83	9	11	14.4	83	9	11	14.4	83
31	Cut only	3	2	10.4[3]	80[3]	3	2	10.4[3]	80[3]	3	2	10.4[3]	80[3]
Hardwoods													
24	Total	67	17	7.0	44	60	16	7.2	45	6	5	11.6	69
31	Total	100	31	7.5	55	86	30	7.9	56	10	10	14.6	87

[1] Except where noted, each value is the raw averageof 2 unequally sized replicates.
[2] Total, used when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

APPENDIX TABLE 4. SLASH PINE PLANTED IN SWAMPS, 0.808 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
7	Total	527	33	2.7	15	80	10	4.7[3]	26[3]	0	0	----	----
10	Total	471	57	4.4	27	252	42	5.9	35	0	0	----	----
12	Cut & lv.	388	75	5.7	36	292	64	6.8	42	0	0	----	----
12	Cut only	45	13	6.4	40	43	12	6.9	42	0	0	----	----
19	Cut & lv.	338	111	8.2	51	333	107	9.0	54	48	35	11.4	59
19	Cut only	164	47	9.6	55	164	47	9.6	55	2	2	12.1[3]	60[3]
24	Total	134	87	10.1	59	129	82	11.1	65	86	67	12.1	65
31	Cut & lv.	131	131	12.5	71	129	131	13.2	76	129	131	13.2	76
31	Cut only	2	2	10.5[3]	78[3]	2	2	10.5[3]	78[3]	2	2	10.5[3]	78[3]
Other pines													
7	Total	0	0	----	----	0	0	----	----	0	0	----	----
10	Total	2	0	2.0[3]	23[3]	0	0	----	----	0	0	----	----
12	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
12	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
19	Cut & lv.	2	0	5.0[3]	31[3]	2	0	5.0[3]	31[3]	0	0	----	----
19	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
24	Total	2	0	5.2[3]	57[3]	2	0	5.2[3]	57[3]	0	0	----	----
31	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
31	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
Hardwoods													
24	Total	123	26	5.9	38	108	25	6.1	40	10	8	12.3[3]	70[3]
31	Total	120	48	8.7	62	115	48	8.8	63	18	17	13.4[3]	81[3]

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

APPENDIX TABLE 5. LOBLOLLY PINE PLANTED ON HILLS, 0.853 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
5	Total	1,112	26	2.0	14	0	0	----	----	0	0	----	----
8	Total	1,093	63	3.2	20	69	9	4.9	28	0	0	----	----
13	Cut & lv.	1,036	112	4.4	29	470	76	5.5	35	0	0	----	----
13	Cut only	314	37	4.7	31	154	25	5.4	34	0	0	----	----
17	Cut & lv.	664	103	5.3	36	430	87	6.1	41	2	1	10.7[3]	49[3]
17	Cut only	278	34	4.7	34	139	23	5.5	39	0	0	----	----
22	Total	355	86	6.7	46	289	84	7.3	51	13	8	10.1	57
29	Cut & lv.	341	119	8.0	56	292	117	8.6	60	86	52	10.7	67
29	Cut only	147	42	7.3	56	140	42	7.4	57	9	5	10.3	69
Other pines													
5	Total	6	0	2.1	9	0	0	----	----	0	0	----	----
8	Total	3	0	2.4	19	0	0	----	----	0	0	----	----
13	Cut & lv.	5	0	4.0[3]	31[3]	0	0	----	----	0	0	----	----
13	Cut only	5	0	4.0[3]	31[3]	0	0	----	----	0	0	----	----
17	Cut & lv.	2	0	3.7[3]	25[3]	0	0	----	----	0	0	----	----
17	Cut only	2	0	3.7[3]	25[3]	0	0	----	----	0	0	----	----
22	Total	2	0	2.6[3]	24[3]	0	0	----	----	0	0	----	----
29	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
29	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
Hardwoods													
22	Total	3	0	4.3[3]	28[3]	1	0	4.8[3]	31[3]	0	0	----	----
29	Total	24	3	4.7	33	15	2	4.9	34	0	0	----	----

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

APPENDIX TABLE 6. LOBLOLLY PINE PLANTED ON SLOPES, 0.836 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
5	Total	1,076	23	2.0	10	0	0	----	----	0	0	----	----
8	Total	1,038	72	3.5	22	139	19	5.0	29	0	0	----	----
13	Cut & lv.	984	134	5.0	37	574	108	5.8	41	0	0	10.0[3]	52[3]
13	Cut only	393	52	4.9	36	224	40	5.7	41	1	1	----	----
17	Cut & lv.	549	121	6.4	46	436	114	6.9	49	18	11	10.4	58
17	Cut only	231	38	5.5	44	165	33	6.1	47	0	0	----	----
22	Total	296	114	8.4	58	264	113	8.8	62	80	52	10.9	69
29	Cut & lv.	283	158	10.1	69	262	157	10.5	72	160	121	11.8	77
29	Cut only	122	56	9.1	69	121	56	9.2	70	46	31	11.1	77
Other pines													
5	Total	1	0	2.1[3]	11[3]	0	0	----	----	0	0	----	----
8	Total	0	0	----	----	0	0	----	----	0	0	----	----
13	Cut & lv.	1	0	4.0[3]	32[3]	0	0	----	----	0	0	----	----
13	Cut only	1	0	4.0[3]	32[3]	0	0	----	----	0	0	----	----
17	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
17	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
22	Total	2	0	2.4[3]	15[3]	0	0	----	----	0	0	----	----
29	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
29	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
Hardwoods													
22	Total	10	1	4.6	30	6	1	5.3[3]	34[3]	0	0	----	----
29	Total	33	5	5.0	37	21	4	5.5	41	0	0	----	----

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

APPENDIX TABLE 7. LOBLOLLY PINE PLANTED ON FLATS, 0.340 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
5	Total	640	9	1.6	9	0	0	----	----	0	0	----	----
8	Total	551	37	3.5	24	90	12	5.0	32	0	0	----	----
13	Cut & lv.	443	77	5.6	42	275	66	6.6	47	8	6	11.0[3]	59[3]
13	Cut only	129	14	4.6	39	49	8	5.5	44	0	0	----	----
17	Cut & lv.	278	96	7.9	56	249	94	8.3	57	50	30	10.6	63
17	Cut only	109	28	6.8	53	91	26	7.2	55	6	3	10.1[3]	62[3]
22	Total	158	99	10.7	70	158	99	10.7	70	105	81	11.5	74
29	Cut & lv.	153	138	12.7	82	153	138	12.7	82	123	127	13.2	86
29	Cut only	66	47	11.5	79	66	47	11.5	79	45	40	12.8	86
Other pines													
5	Total	0	0	----	----	0	0	----	----	0	0	----	----
8	Total	0	0	----	----	0	0	----	----	0	0	----	----
13	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
13	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
17	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
17	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
22	Total	0	0	----	----	0	0	----	----	0	0	----	----
29	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
29	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
Hardwoods													
22	Total	156	38	7.0	41	127	35	7.4	43	20	16	11.8	67
29	Total	136	46	7.9	56	123	45	8.2	58	25	23	12.9	85

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

APPENDIX TABLE 8. LOBLOLLY PINE PLANTED IN SWAMPS, 0.334 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
5	Total	153	1	1.1	6	0	0	----	----	0	0	----	----
8	Total	98	4	2.8	19	7	1	5.4	30	0	0	----	----
13	Cut & lv.	40	7	5.7	42	22	6	6.8	46	0	0	----	----
13	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
17	Cut & lv.	34	11	8.0	53	29	11	8.4	54	7	5	11.8	59
17	Cut only	7	1	5.6	51	7	1	5.6	51	0	0	----	----
22	Total	22	15	11.2	68	22	15	11.2	68	20	15	11.5	68
29	Cut & lv.	18	17	12.6	77	18	17	12.6	77	16	16	13.1	78
29	Cut only	7	4	10.2[3]	65[3]	7	4	10.2[3]	65[3]	5	3	11.4[3]	78[3]
Other pines													
5	Total	0	0	----	----	0	0	----	----	0	0	----	----
8	Total	0	0	----	----	0	0	----	----	0	0	----	----
13	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
13	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
17	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
17	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
22	Total	0	0	----	----	0	0	----	----	0	0	----	----
29	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
29	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
Hardwoods													
22	Total	232	57	6.8	39	190	53	7.2	41	28	22	12.2	70
29	Total	170	65	8.2	56	153	63	8.6	58	35	37	14.3	85

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

APPENDIX TABLE 9. SHORTLEAF PINE PLANTED ON HILLS, 0.659 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
7	Total	986	15	1.6	8	0	0	----	----	0	0	----	----
10	Total	950	35	2.6	14	12	1	4.8	21	0	0	----	----
15	Total	956	69	3.6	22	176	26	5.3	29	0	0	----	----
19	Cut & lv.	813	85	4.3	28	307	50	5.5	32	0	0	----	----
19	Cut only	351	35	4.3	27	122	19	5.4	31	0	0	----	----
24	Total	427	59	5.0	34	236	46	6.0	40	0	0	----	----
31	Cut & lv.	366	72	6.0	41	272	66	6.6	45	7	4	10.3	58
31	Cut only	181	30	5.5	40	137	26	5.9	43	0	0	----	----
Other pines													
7	Total	11	0	2.3	15	0	0	----	----	0	0	----	----
10	Total	4	0	3.8	21	0	0	----	----	0	0	----	----
15	Total	5	0	4.0[3]	30[3]	0	0	----	----	0	0	----	----
19	Cut & lv.	5	0	4.0[3]	32[3]	3	0	4.8[3]	36[3]	0	0	----	----
19	Cut only	3	0	4.8[3]	36[3]	3	0	4.8[3]	36[3]	0	0	----	----
24	Total	3	0	4.4[3]	34[3]	0	0	----	----	0	0	----	----
31	Cut & lv.	3	0	4.9[3]	40[3]	3	0	4.9[3]	40[3]	0	0	----	----
31	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
Hardwoods													
24	Total	5	1	4.5	32	3	0	5.0[3]	36[3]	0	0	----	----
31	Total	16	3	5.9	46	13	3	6.2	50	0	0	----	----

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

APPENDIX TABLE 10. SHORTLEAF PINE PLANTED ON SLOPES, 0.776 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
7	Total	1,210	24	1.9	9	0	0	----	----	0	0	----	----
10	Total	1,138	55	3.0	16	25	3	4.8	24	0	0	----	----
15	Total	1,067	88	3.9	25	272	41	5.3	30	0	0	----	----
19	Cut & lv.	900	105	4.6	31	433	73	5.6	35	0	0	----	----
19	Cut only	448	47	4.4	30	189	30	5.4	34	0	0	----	----
24	Total	360	61	5.6	37	251	53	6.2	42	3	2	10.5[3]	53[3]
31	Cut & lv.	277	70	6.8	46	235	66	7.2	49	19	12	10.7	56
31	Cut only	150	30	6.1	45	123	28	6.4	47	2	1	9.7[3]	42[3]
Other pines													
7	Total	25	1	3.1	18	1	0	4.6[3]	26[3]	0	0	----	----
10	Total	16	2	5.3	29	8	2	6.0	30	0	0	----	----
15	Total	5	1	4.9[3]	40[3]	4	1	5.3[3]	42[3]	0	0	----	----
19	Cut & lv.	5	1	6.4[3]	50[3]	5	1	6.4[3]	50[3]	0	0	----	----
19	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
24	Total	5	2	7.4[3]	45[3]	5	2	7.4[3]	45[3]	0	0	----	----
31	Cut & lv.	5	2	9.2[3]	55[3]	5	2	9.2[3]	55[3]	3	2	10.4[3]	57[3]
31	Cut only	1	0	6.8[3]	50[3]	1	0	6.8[3]	50[3]	0	0	----	----
Hardwoods													
24	Total	0	0	----	----	0	0	----	----	0	0	----	----
31	Total	14	2	5.0	49	7	1	5.3	53	0	0	----	----

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

APPENDIX TABLE 11. SHORTLEAF PINE PLANTED ON FLATS, 0.489 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
7	Total	622	13	1.9	8	0	0	----	----	0	0	----	----
10	Total	517	28	3.2	18	15	2	4.8	22	0	0	----	----
15	Total	382	40	4.4	30	160	25	5.4	33	0	0	----	----
19	Cut & lv.	245	38	5.3	37	171	32	5.8	39	0	0	----	----
19	Cut only	112	16	5.1	37	79	14	5.7	38	0	0	----	----
24	Total	87	19	6.3	43	71	18	6.7	45	1	1	10.0[3]	57[3]
31	Cut & lv.	52	17	7.8	56	51	17	7.8	56	3	2	11.5[3]	71[3]
31	Cut only	18	5	7.2	52	16	5	7.4	52	0	0	----	----
Other pines													
7	Total	22	1	2.1	14	3	0	5.7[3]	32[3]	0	0	----	----
10	Total	13	2	5.3[3]	24[3]	8	2	6.3[3]	27[3]	0	0	----	----
15	Total	12	4	7.5[3]	50[3]	9	4	8.3[3]	53[3]	3	2	12.0[3]	63[3]
19	Cut & lv.	12	5	9.0[3]	52[3]	12	5	9.0[3]	52[3]	4	4	13.0[3]	69[3]
19	Cut only	3	1	8.2[3]	58[3]	3	1	8.2[3]	58[3]	1	1	10.5[3]	65[3]
24	Total	11	7	11.2[3]	58[3]	11	7	11.2[3]	58[3]	4	6	15.8[3]	77[3]
31	Cut & lv.	11	9	12.6[3]	65[3]	11	9	12.6[3]	65[3]	4	7	18.1[3]	82[3]
31	Cut only	4	4	13.2[3]	59[3]	4	4	13.2[3]	59[3]	1	3	20.9[3]	72[3]
Hardwoods													
24	Total	138	38	6.7	43	103	33	7.3	46	13	10	12.3[3]	73[3]
31	Total	135	60	8.5	58	131	60	8.6	59	41	35	12.0	76

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

APPENDIX TABLE 12. SHORTLEAF PINE PLANTED IN SWAMPS, 0.332 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
7	Total	57	1	1.4	6	3	1	6.1[3]	17[3]	0	0	----	----
10	Total	34	1	1.7[3]	12[3]	0	0	----	----	0	0	----	----
15	Total	12	1	3.1[3]	27[3]	0	0	----	----	0	0	----	----
19	Cut & lv.	6	1	3.1[3]	33[3]	0	0	----	----	0	0	----	----
19	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
24	Total	0	0	----	----	0	0	----	----	0	0	----	----
31	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
31	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
Other pines													
7	Total	3	0	1.0[3]	9[3]	0	0	----	----	0	0	----	----
10	Total	0	0	----	----	0	0	----	----	0	0	----	----
15	Total	21	7	7.9[3]	50[3]	15	7	8.9[3]	53[3]	6	4	10.5[3]	55[3]
19	Cut & lv.	15	5	7.7[3]	55[3]	12	5	8.3[3]	57[3]	3	2	10.9[3]	60[3]
19	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
24	Total	25	18	11.6[3]	63[3]	25	18	11.6[3]	63[3]	18	17	12.9[3]	65[3]
31	Cut & lv.	21	23	14.1[3]	70[3]	21	23	14.1[3]	70[3]	18	23	15.0[3]	74[3]
31	Cut only	6	4	11.2[3]	65[3]	6	4	11.2[3]	65[3]	3	3	14.4[3]	84[3]
Hardwoods													
24	Total	160	42	7.9	46	137	39	8.3	49	9	9	12.4	70
31	Total	159	58	8.3	56	150	57	8.5	57	21	22	15.1	80

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

APPENDIX TABLE 13. LONGLEAF PINE PLANTED ON HILLS, 0.808 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
6	Total	347	5	1.7	8	0	0	----	----	0	0	----	----
9	Total	328	14	2.8	16	7	1	4.7	25	0	0	----	----
14	Total	344	36	4.4	29	148	26	5.7	37	0	0	----	----
18	Cut & lv.	321	55	5.6	39	220	50	6.5	45	0	0	----	----
18	Cut only	115	16	5.0	38	64	12	5.9	43	0	0	----	----
23	Total	197	55	7.2	50	156	53	7.9	55	18	10	9.9	56
30	Cut & lv.	207	80	8.4	56	163	79	9.4	64	73	46	10.8	66
30	Cut only	68	27	8.5	64	65	27	8.6	64	20	12	10.5	66
Other pines													
6	Total	0	0	----	----	0	0	----	----	0	0	----	----
9	Total	0	0	----	----	0	0	----	----	0	0	----	----
14	Total	0	0	----	----	0	0	----	----	0	0	----	----
18	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
18	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
23	Total	0	0	----	----	0	0	----	----	0	0	----	----
30	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
30	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
Hardwoods													
23	Total	1	0	4.1[3]	28[3]	0	0	----	----	0	0	----	----
30	Total	4	1	5.0[3]	45[3]	3	0	5.5[3]	47[3]	0	0	----	----

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used only when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

APPENDIX TABLE 14. LONGLEAF PINE PLANTED ON SLOPES, 0.589 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
6	Total	141	2	1.4	6	0	0	----	----	0	0	----	----
9	Total	125	5	2.6	14	4	1	4.9[3]	24[3]	0	0	----	----
14	Total	151	13	3.7	23	53	10	6.0	37	0	0	----	----
18	Cut & lv.	148	22	4.9	34	77	19	6.4	43	3	2	10.4[3]	59[3]
18	Cut only	27	5	5.7	40	17	4	6.4	43	0	0	----	----
23	Total	108	25	6.1	43	64	23	7.6	54	10	6	10.8[3]	62[3]
30	Cut & lv.	103	37	7.6	54	70	35	9.0	64	31	22	10.9	70
30	Cut only	32	12	8.0	61	28	12	8.3	63	7	4	10.9[3]	70[3]
Other pines													
6	Total	0	0	----	----	0	0	----	----	0	0	----	----
9	Total	0	0	----	----	0	0	----	----	0	0	----	----
14	Total	0	0	----	----	0	0	----	----	0	0	----	----
18	Cut & lv.	4	2	9.4[3]	57[3]	4	2	9.4[3]	57[3]	2	1	10.6[3]	59[3]
18	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
23	Total	4	3	10.8[3]	63[3]	4	3	10.8[3]	63[3]	2	2	12.4[3]	66[3]
30	Cut & lv.	4	3	11.9[3]	83[3]	4	3	11.0[3]	83[3]	2	2	13.9[3]	86[3]
30	Cut only	2	1	9.5[3]	80[3]	2	1	9.5[3]	80[3]	0	0	----	----
Hardwoods													
23	Total	20	3	5.1	34	9	2	6.0	38	0	0	----	----
30	Total	45	8	6.0	48	35	8	6.2	50	0	0	----	----

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used only when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

APPENDIX TABLE 15. LONGLEAF PINE PLANTED ON FLATS, 0.402 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
6	Total	89	2	1.2	7	0	0	----	----	0	0	----	----
9	Total	79	4	2.1	14	6	1	4.8[3]	30[3]	0	0	----	----
14	Total	61	10	5.5[3]	38[3]	41	9	6.4[3]	44[3]	0	0	----	----
18	Cut & lv.	87	18	5.8	44	51	15	6.9	51	8	4	10.2[3]	61[3]
18	Cut only	43	7	5.4	44	20	5	6.5	49	0	0	----	----
23	Total	39	16	7.8	58	37	16	7.9	58	16	11	11.2[3]	65[3]
30	Cut & lv.	31	21	11.0[3]	72[3]	31	21	11.0[3]	72[3]	20	17	12.6[3]	70[3]
Other pines													
6	Total	0	0	----	----	0	0	----	----	0	0	----	----
9	Total	0	0	----	----	0	0	----	----	0	0	----	----
14	Total	0	0	----	----	0	0	----	----	0	0	----	----
18	Cut & lv.	53	25	9.5	59	50	24	9.7	59	20	15	11.8	66
18	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
23	Total	50	38	12.6	72	50	38	12.6	72	40	34	13.0	72
30	Cut & lv.	54	56	14.0	78	54	56	14.0	78	47	54	15.2	82
30	Cut only	28	33	15.2	80	28	33	15.2	80	25	31	15.6	81
Hardwoods													
23	Total	181	49	7.1	41	136	45	8.3	46	20	19	13.2	73
30	Total	197	66	7.9	56	164	63	8.5	58	29	32	14.2	82

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used only when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

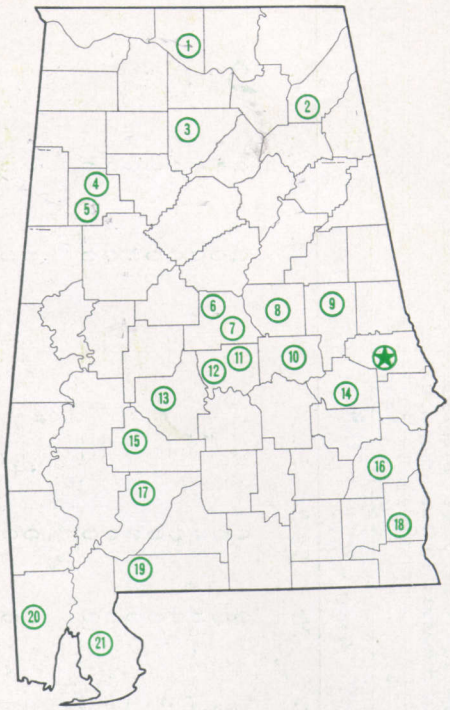
APPENDIX TABLE 16. LONGLEAF PINE PLANTED IN SWAMPS, 0.306 ACRE. STAND-PER-ACRE BY SIZE CLASS, SPECIES GROUP, STAND PORTION IN RELATION TO THINNING, AND AGE[1]

Age	Portion of stand[2]	All diameters				DBH larger than 4.5 in.				DBH larger than 9.5 in.			
		Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height	Trees	Basal area	Av. DBH (o.b.)	Average height
Yrs.		*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*	*No.*	*Sq. ft.*	*In.*	*Ft.*
Planted pines													
6	Total	0	0	----	----	0	0	----	----	0	0	----	----
9	Total	0	0	----	----	0	0	----	----	0	0	----	----
14	Total	0	0	----	----	0	0	----	----	0	0	----	----
18	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
18	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
23	Total	0	0	----	----	0	0	----	----	0	0	----	----
30	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
30	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
Other pines													
6	Total	0	0	----	----	0	0	----	----	0	0	----	----
9	Total	0	0	----	----	0	0	----	----	0	0	----	----
14	Total	0	0	----	----	0	0	----	----	0	0	----	----
18	Cut & lv.	0	0	----	----	0	0	----	----	0	0	----	----
18	Cut only	0	0	----	----	0	0	----	----	0	0	----	----
23	Total	12	2	6.2[3]	48[3]	12	2	6.2[3]	48[3]	0	0	----	----
30	Cut & lv.	12	5	8.9[3]	70[3]	12	5	8.9[3]	70[3]	4	3	10.9[3]	74[3]
30	Cut only	4	1	7.5[3]	70[3]	4	1	7.5[3]	70[3]	0	0	----	----
Hardwoods													
23	Total	272	77	7.2	42	218	72	7.8	45	52	35	11.1	62
30	Total	260	103	8.5	59	231	100	8.9	62	60	56	13.1	81

[1] Except where noted, each value is the raw average of 2 unequally sized replicates.
[2] Total, used when there was no thinning, is equivalent to cut and leave.
[3] One replicate only. The other is blank.

AGRICULTURAL EXPERIMENT STATION SYSTEM OF ALABAMA'S LAND-GRANT UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Thorsby Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. Tuskegee Experiment Field, Tuskegee.
15. Lower Coastal Plain Substation, Camden.
16. Forestry Unit, Barbour County.
17. Monroeville Experiment Field, Monroeville.
18. Wiregrass Substation, Headland.
19. Brewton Experiment Field, Brewton.
20. Ornamental Horticulture Field Station, Spring Hill.
21. Gulf Coast Substation, Fairhope.