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years after the first commercial thinning. In all other cases, the appropriate thinned stand equations should be used.

These decision rules were adopted because the thinned stands, from which our samples were drawn, had been commercially thinned at least 5 years previously and were at least 20 years old. Many had been thinned repeatedly at 5-year intervals for 15 years or more (4 or more thinnings). □

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Site Index Curves for Loblolly and Slash Pine Plantations in the Post Oak Belt of East Texas

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ABSTRACT. Stem analysis data collected from dominant and codominant trees growing in loblolly (*Pinus taeda* L.) and slash pine (*Pinus elliottii* Engelm.) plantations were used to develop site index curves. These data were collected from loblolly and slash pine plantations growing in

the Post Oak Belt of East Texas. The height prediction curves were based on the Chapman-Richards function and will provide an indication of site productivity based on plantation age.

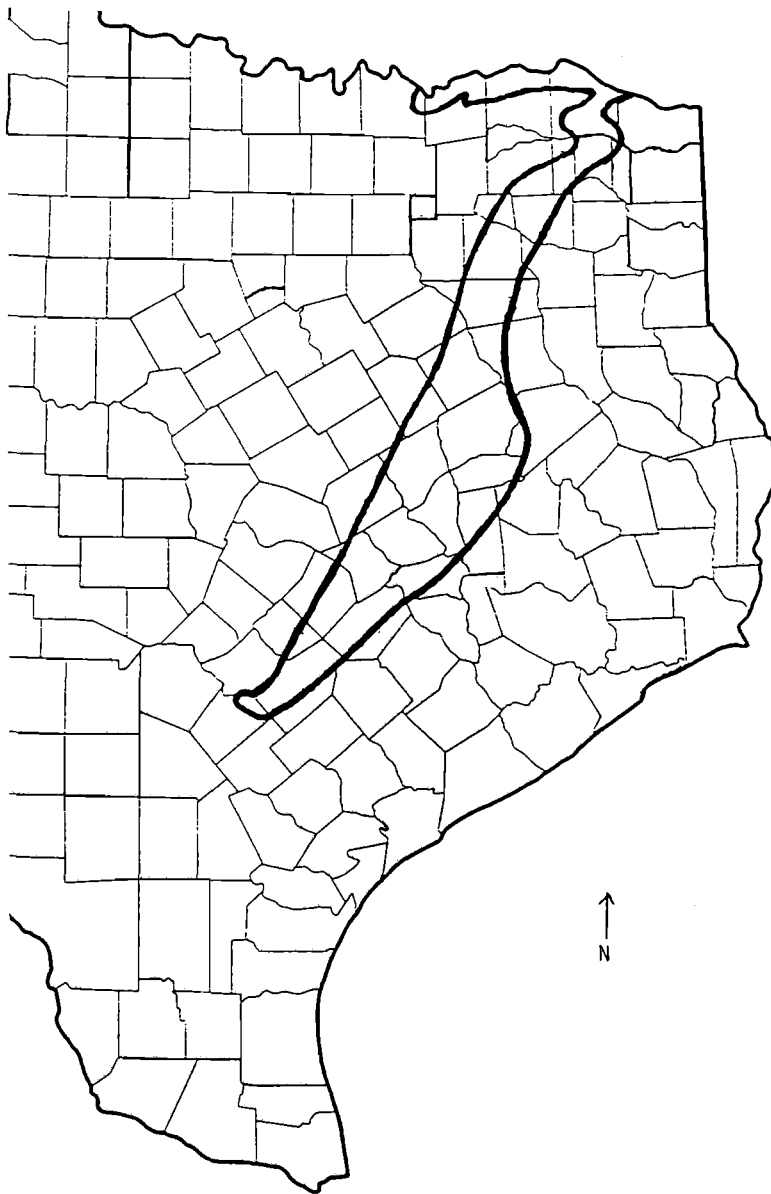
South. J. Appl. For. 15(2):97-100.

The Post Oak Belt of East Texas is an area of transition between the pine forest to the east and the prairies to the west. This area extends from the Red River south-

ward, contiguous with the western edge of the pine forest and extending into Central Texas (Figure 1). The forests of this zone are dominated by post oak (*Quercus stellata* Wang.) and blackjack oak (*Q. marilandica* Muenchh.) in association with other dry site oaks, hickories (*Carya* spp.), and elms (*Ulmus* spp.) (Tharp 1939, Daubenmire 1978, Diamond et al. 1987). Pine does occur naturally in some areas of this zone. Loblolly pine (*Pinus taeda* L.) occurs in Bastrop, Caldwell, and Fayette counties (Tharp 1939). Shortleaf pine (*P. echinata* Mill.) occurs in isolated natural stands (Wilson and Hacker 1986, Wilson 1989) further to the north in Lamar and Franklin counties.

The possibility of converting some of the land to pine has been postulated (Bray 1904, Walker 1972). Indeed, since 1930, many pine plantations were established with the majority between 1950 and 1965 (Hansen and Bilan

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25.9 years for loblolly pine and 26 years for slash pine.

Sampling was done by approximating the center of each plantation and felling one to four dominant or codominant trees per plantation. Only one tree per plantation was sampled in some cases because of restrictions placed by land owners. A total of 140 trees were sampled. Only typical, single-stem individuals which appeared to be free of suppression were selected.

Examination of the individual trees was conducted by felling sample trees and then delimiting each up to the terminal leader. Cross-sectional cuts were then made at 24-in. intervals, and the rings at the top of each bolt were counted and recorded. The 140-stem analysis trees yielded 4194 height-age pairs, of which 2683 were from loblolly pine and 1511 were from slash pine. True heights were estimated using the adjustment recommended by Carmean (1972).

SITE INDEX

Loblolly Pine

The Chapman-Richards (Chapman 1959, Richards 1961) function:

$$H = b_1 (1 - \text{EXP}(-b_2 A))^{b_3}$$

where

A = tree age (yr)

H = height of tree at age A (ft)

b_i = coefficients to be determined

Figure 1. Texas east of the 100th meridian with the Post Oak Belt shown within the bold line.

1989). The purpose of this study was to develop site index curves applicable for old-field loblolly and slash pine plantations in the Post Oak Belt.

DATA

Data for this study came from 50 old-field plantations in the Post Oak Belt of East Texas. Of these, 32 (64%) were loblolly pine plantations, and 18 (36%) were slash pine plantations. Ages of the plantations ranged from 12 to 46 years (Table 1 and 2) with a mean age of

Table 1. Distribution of loblolly pine plantations by age and height.

Age	Height								Total
	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	
10-19	1	2	6						9
20-29				3	8	3	1		15
30-39				1	2	3		1	7
40-49								1	1
Total	1	2	6	4	10	6	1	2	32

Table 2. Distribution of slash pine plantations by age and height.

Age	Height								Total
	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	
10-19	1	1	3						5
20-29				1	1	7			9
30-39					1			1	2
40-49							1	1	2
Total	1	1	3	1	2	7	1	2	18

Table 3. Regression coefficients and asymptotic standard deviation estimates for loblolly and slash pine.

	Coefficient b_i	Asymptotic SE
Loblolly pine		
b_1	99.147004	3.100815
b_2	0.056610	0.003528
b_3	1.560103	0.053362
Slash pine		
b_1	98.221042	2.341171
b_2	0.062804	0.003272
b_3	1.602775	0.052457

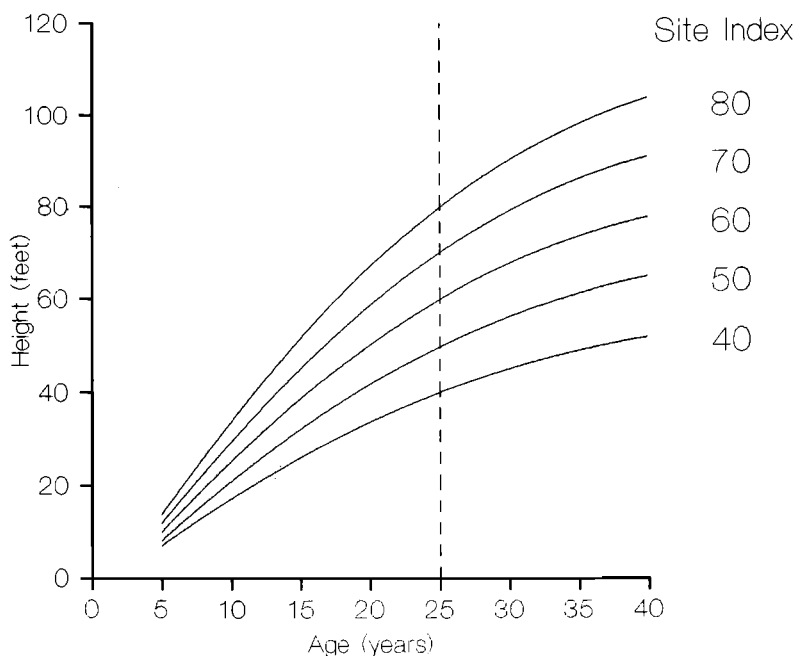


Figure 2. Loblolly pine site index curves, index age 25, for plantations on old-field sites in the Post Oak Belt.

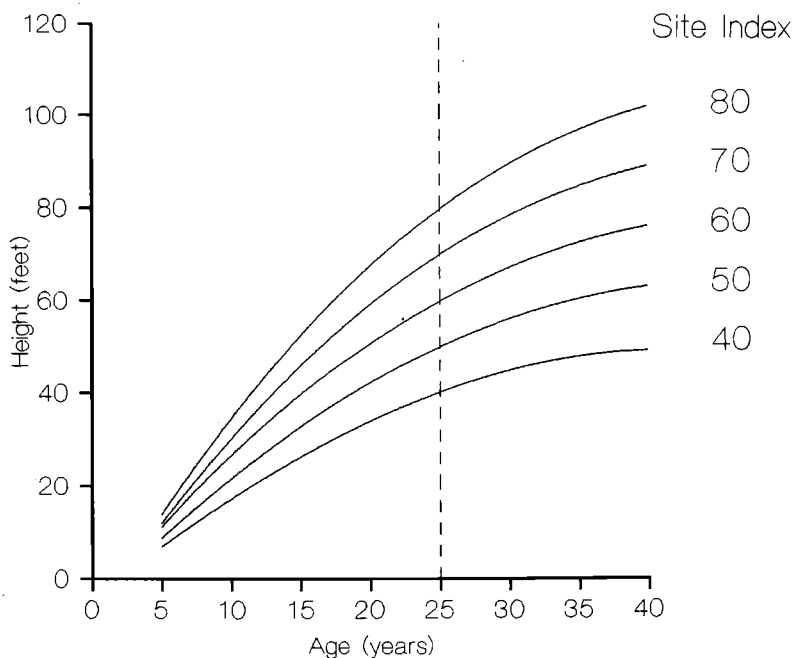


Figure 3. Slash pine site index curves, index age 25, for plantations on old-field sites in the Post Oak Belt.

was fitted to the data sets using nonlinear regression. The resulting regression coefficients for slash and loblolly pine are shown in Table 3. The equation explained 90.78% and 94.61% of the variation for loblolly and slash pine respectively. Plotting residuals over age and predicted height values indicated no adverse trends or biases.

The regression coefficients shown in Table 3 can be inserted into a generalized equation to estimate site index at any age using the procedure described by Clutter et al. (1983) and is expressed as:

$$S = H \left(\frac{1 - \text{EXP}(-b_2 I)}{1 - \text{EXP}(-b_2 A)} \right)^{b_3}$$

where

S = site index (ft) for index age I

I = index age (yr)

For an index of 25, the above equation can be algebraically rearranged as:

$$H = S_{25} \left(\frac{1 - \text{EXP}(-b_2 A)}{1 - \text{EXP}(-b_2 25)} \right)^{b_3}$$

Site index curves generated from this formula are shown in Figures 2 and 3.

SUMMARY

Height growth functions have been created to predict height of dominant and codominant loblolly and slash pine growing on old-field sites in the Post Oak Belt of Texas. Each function was transformed into an anamorphic site index equation. The site index equations resulting from these functions will indicate the productivity potential of old-field sites based on plantation age. □

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Weighted South-Wide Average Pulpwood Prices

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ABSTRACT. *Weighted average prices provide a more accurate representation of regional pulpwood price trends when production volumes vary widely by state. Unweighted South-wide average delivered prices for pulpwood, as reported by Timber Mart-South, were compared to average annual prices weighted by each state's pulpwood production from 1977 to 1986. Weighted average prices for pine roundwood and pine chips were significantly higher than unweighted averages; for hardwood roundwood and hardwood chips, there was no significant difference between the weighted and unweighted average prices.*

South. J. Appl. For. 15(2):100-102

Timber Mart-South (TMS) is a forest products price reporting service covering 13 southern states.² Stumpage and delivered wood prices are reported quarterly (monthly prior to 1988) by state, zones within each state, and for the South as a whole. In addition, average annual prices for

each state and the region are published in a yearbook (Norris 1987).

Data collection and reporting procedures used by TMS were recently described by Gunter and Cabbage (1987). As noted, average prices within specific zones of each state and statewide averages reported by TMS are weighted roughly according to the volumes produced within the respective areas. However, the South-wide prices are unweighted averages of all the states. Consequently, region-wide averages may not adequately reflect the variation in timber production by state. This study examines whether the unweighted South-wide average prices published by TMS for delivered pulpwood differ significantly from average annual prices weighted by each state's pulpwood production.

PROCEDURES

The 13 states included in the TMS survey are Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and

Virginia. Annual delivered price data for each state and the region from 1977—the first year available for TMS prices—to 1986 were obtained from the TMS yearbook for four pulpwood categories: pine roundwood, pine chips, hardwood roundwood, and hardwood chips. Production data used to weight state prices in each category were gathered from USDA Forest Service Resource Bulletins that report pulpwood production by state on an annual basis (May 1988a, Widman 1988).

To obtain a South-wide weighted average price for a particular year and category, each state's production was divided by the South-wide total for that year. The resulting quotients were then multiplied by each state's price for the year and were summed to determine the weighted annual average price. The final price was rounded to the nearest 10 cents, following the procedure used by TMS for presenting the unweighted averages. Weighted average annual prices were calculated in this manner for the four pulpwood production categories examined.

RESULTS

Tables 1 through 4 compare the weighted and unweighted average delivered prices for each pulpwood category examined. Weighted average prices for pine roundwood and pine chips were significantly higher than the TMS unweighted averages (Tables 1 and 2); for hardwood roundwood and chips, there was no significant

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