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Some Site, Stand, and Tree Effects on Diameter Growth of East Texas Pine Trees

by

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In the industrial and national forests of East Texas, evenaged management of pine stands is a common practice, but there are millions of acres of unevenaged pine stands in these and other East Texas ownerships. To best manage these stands, foresters need to know what site, stand and tree factors affect diameter growth, and how great these effects are.

From remeasurements of more than 400 trees of each species in Alabama, Judson (1965) found shortleaf pine growth significantly slower than that of loblolly pine. He found no definite relation between growth and dbh because of the rather low stocking in the forests of that state. In a study of loblolly pine in Mississippi, Van Hooser (1970) was able to predict later dbh from measurements of initial dbh and tree basal area. In plantations, Goebel and Cool (1965) found that diameters of loblolly pines could be predicted from expressions using number of trees per acre, age in years and site index.

In a hardwood study, Trimble (1969) found that stand basal area had little value as a predictor of dbh growth rates for individual trees, and concluded that crown class was the best indicator of growth in unevenaged stands.

MEASUREMENTS

Data from 1631 shortleaf and loblolly pine trees were collected in a continuous forest inventory plot system installed and remeasured on a 2,358 acre tract of the Sabine National Forest.

The timber stand was unevenaged, largely pine, and averaged 121 trees per acre 5 inches dbh or larger. Average volume per acre was 4873 ± 278 board feet of saw timber and 329 ± 16 cubic feet of smaller trees. Basal area per acre for trees 5 inches dbh and larger was 70 ± 2 square feet.

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Individual records were available for 908 shortleaf pines and for 723 loblolly pines, each measured twice. Data were in four sets as follows:

1. Shortleaf pine remeasured after 4 years (580 trees)
2. Shortleaf pine remeasured after 5 years (328 trees)
3. Loblolly pine remeasured after 4 years (356 trees)
4. Loblolly pine remeasured after 5 years (367 trees)

The following measurements were available for each sample tree:

Tree dbh in inches, initial and at time of remeasurement

Tree crown class

Stand basal area in square feet per acre

The number of trees per 1/5-acre plot

Site evaluated from site index curves applicable to evenaged stands

Depth to the subsoil in 6-inch classes

ANALYSIS

Individual periodic tree dbh growth was plotted over each of the above listed variables in separate plottings to test for linearity. The results showed extreme variation, but the trends appeared to approach linear distributions.

Analysis of variance was used to test the relationship between periodic dbh growth and the variables and transformations shown below:

D	Initial tree dbh in inches
D^2	Square of tree dbh in inches
C	Crown class (coded 1, 2, 3, and 4 for dominant, codominant, intermediate and suppressed, respectively)
B	Initial basal area in square feet per acre, estimated from prism counts
B^2	The square of initial basal area per acre
N	Number of trees per 1/5-acre plot
S	Site evaluation
So	Depth to the subsoil in 6-inch classes at each plot
1/D	Reciprocal of initial tree dbh in inches
1/B	Reciprocal of basal area per acre in square feet.

The square and reciprocal of dbh and basal area were included to test for possible better linear relations with these transformed variables. Each set of data was processed separately, and the significant variables were used in multiple linear regression analysis.

RESULTS

Table 1 lists F values for each of the 10 variables in each of the four sets of data.

In each set, *crown class* has by far the highest F value, accounting for 70 to 88 percent of the variation accounted for by all significant variables combined. Also significant in each set was the *square of dbh*, although its influence on growth was minor compared to that of *crown class.*

Significant in three sets was *number of trees per fifth acre plot,* and in two sets each were *site quality* and *basal area. Reciprocal of basal area* proved significant in one set.

Neither *initial tree dbh, reciprocal of dbh, square of basal area* nor *depth to subsoil* proved significant in any of the four sets. Since in all sets the square of dbh was significant, and a measure of basal area was significant in three of the four sets, the lack of significance in these variables does not preclude their relation to rate of growth.

Table 1. Values of F from four analyses of variance of dbh growth, each with ten independent variables.

Independent Variable	4-Year Growth		5-Year Growth	
	Shortleaf Pine	Loblolly Pine	Shortleaf Pine	Loblolly Pine
Initial tree dbh in inches	4.04	1.03	0.70	0.03
Square of initial tree dbh in inches	3.80*	9.37*	7.77*	18.74*
Crown class (coded)	234.50*	155.29*	103.65*	266.37*
Basal area per acre in square feet	41.71*	52.36*	0.48	1.72
Square of basal area per acre in sq. ft.	0.04	1.38	0.85	2.14
Trees per 1/5-acre plot	20.91*	1.05	37.35*	12.34*
Site quality estimate	3.21*	0.80	0.13	3.06*
Soil depth	0.76	0.97	0.24	0.40
Reciprocal of initial tree dbh in inches	0.38	0.25	1.02	1.02
Reciprocal of basal area per acre in sq. ft.	0.07	1.70	0.00	3.17*
Number of observations	580	356	328	367

* Contribution of independent variable significant at 5 percent level of probability.