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Cheryl R. Dixon

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Janis Leonhart 1985

PREDICTING INDIVIDUAL TREE HEIGHT OF PLANTED LOBLOLLY AND SLASH PINES IN EAST TEXAS, UPDATE: 1987

by
Cheryl R. Dixon

REPORT NUMBER 15

TO

PARTICIPATING COMPANIES

IN THE

EAST TEXAS PINE PLANTATION RESEARCH PROJECT

A STUDY OF

LOBLOLLY AND SLASH PINE PLANTATIONS

IN

EAST TEXAS

CENTER FOR APPLIED STUDIES
SCHOOL OF FORESTRY
STEPHEN F. AUSTIN STATE UNIVERSITY
NACOGDOCHES, TEXAS 75962

December, 1987

This is the fifteenth in a continuing series of reports describing results from the East Texas Pine Plantation Research Project.

Subject and content of each ETPPRP report is regional in scope and of particular interest to loblolly and slash pine plantation owners in East Texas.

Any suggestions, ideas or comments will always be welcomed.

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Support from the participating companies...
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The author is a Senior in the School of Forestry, SFASU.

This report is based on research and analysis by Ms. Dixon as part of an individual studies course during Fall '87.

J. David Lenhart
Project Director
December 7, 1987

PREDICTING INDIVIDUAL TREE HEIGHT OF PLANTED LOBLOLLY AND SLASH PINES IN EAST TEXAS, UPDATE: 1987

by
Cheryl R. Dixon
Senior, School of Forestry, SFASU

ABSTRACT. Updated equations to estimate individual total tree height of loblolly pine (*Pinus taeda* L.) and slash pine (*Pinus elliottii* Engelm.) trees planted on non-old-fields in East Texas are presented. The new revised equations were developed using data from initial measurement and first remeasurement of the East Texas Pine Plantation Research Project permanent plots (1982-1987).

INTRODUCTION

After the completion of the first remeasurement cycle in 1987 for the East Texas Pine Plantation Research Project, it was possible to analyze the combined data sets (initial measurement plus first remeasurement) and compute new revised individual tree height prediction equations.

In this report, updated height estimation equations are presented for planted loblolly and slash pines on non-old-fields in East Texas.

PLANTATION MEASUREMENTS

Data for this study were obtained from 252 permanent monumented plots in unthinned loblolly and slash pine plantations located on non-old-fields throughout East Texas. Of the 252 plots, 173 are in loblolly pine plantations, and 79 are in slash pine plantations. Each plot consists of two subplots--one for model development and the other for model evaluation.

The height growth equations were developed using data from the model development subplots collected during initial measurement and first remeasurement (1982-87). Within a plot, each planted pine is tagged and numbered. Total height (h) and diameter at breast height (d) (among other values) were determined for each planted pine. These two tree values plus plantation characteristics--number of completed growing seasons (A), average total height of ten tallest trees (TTH), surviving number of trees per acre (STA), quadratic mean diameter (DQMEAN) and maximum diameter (DMAX)--were available for analyses.

All planted pines regardless of crown position in plantation canopy were considered for study. However, to be included in the sample, a pine was required to have a diameter at breast height greater than zero, which meant that height was at least 4.5 feet. As a result, sample sizes were reduced to 28,599 observations for loblolly pine and 12,138 observations for slash pine.

PREDICTING INDIVIDUAL LOBLOLLY PINE TREE HEIGHTS

Two equations--one a new version and the other a revised updated form of work by Blackard (1985, 1986)--have been developed to estimate the total height of individual loblolly pine trees in East Texas plantations.

The new version is:

$$\ln(h) = \ln(TTH) + 0.012430 + (\ln(d)-\ln(DMAX))(0.345442 + 0.061878\ln(DQMEAN)) \quad (1)$$

with R^2 = 69% and SEE = 0.11553.

Equation (1) may be useful in diameter distribution yield prediction systems, where DQMEAN is estimated from plantation values and used in Weibull distribution parameter recovery procedures. An equation to predict DQMEAN for loblolly pine plantations in East Texas is available as (Lenhart 1987a):

$$DQMEAN = EXP(2.6753 - 28.5809/TTH - 0.0005STA). \quad (2)$$

In effect, TTH and STA play an indirect role in estimating h.

An updated version of Blackard's model is.

$$\ln(h) = \ln(TTH) + 0.009993 + (\ln(d)-\ln(DMAX))(0.018957 + 0.080091\ln(A) + 0.114679\ln(TTH/A) + 0.014514\ln(STA)) \quad (3)$$

with R^2 = 69% and SEE = 0.11657.

Equation (3) represents the direct influence of A, TTH and STA in estimating individual tree height. It is interesting to note that the positive coefficient for STA implies that h increases with increasing STA for these pine plantations. This result is the opposite of what Blackard found in his analysis of the initial data set.

Across wide ranges of A, site index (index age = 25 years) and STA, the predicted values of equations (1) and (3) were compared to each other and to predicted values from Blackard's equation. Between the three equations, if a difference occurred, it was 1-foot at the most. Equation (3) from this paper is recommended for use in East Texas, because it represents the direct effect of plantation parameters.

PREDICTING INDIVIDUAL SLASH PINE TREE HEIGHTS

For slash pine, two equations were also developed.

The new version is:

$$\ln(h) = \ln(TTH) + 0.012032 + (\ln(d)-\ln(DMAX))(0.40347 + 0.0973071\ln(DQMEAN)) \quad (4)$$

with R^2 = 70% and SEE = 0.12286.

An equation to estimate DQMEAN for slash pine plantations in East Texas is available as (Lenhart 1987b):

$$DQMEAN = EXP(2.4641 - 25.8135/TTH - 0.0003STA) \quad (5)$$

An updated version of Blackard's model is:

$$\ln(h) = \ln(TTH) + 0.006995 + (\ln(d)-\ln(DMAX))(0.212079 + 0.114747\ln(A) + 0.149298\ln(TTH/A) - 0.019744\ln(STA)) \quad (6)$$

with R^2 = 69% and SEE = 0.12552.

In Equation (6) for slash pine, as STA increases, h decreases. Solving equations (4) and (6) across plantation parameter ranges, predicted heights between the three values, varied only a foot at the most. For the same reasons as mentioned earlier, equation (6) is recommended.

LITERATURE CITED

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