Research Project No. 15, Predicting Individual Tree Height of Planted Loblolly and Slash Pines in East Texas, Update: 1987

Cheryl R. Dixon
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
NACOODOCHES, TEXAS 75962

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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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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
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UPDATE: 1987

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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
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.
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:

\[
\ln(h) = \ln(TTH) + 0.012430 \\
+ (\ln(d) - \ln(DMAX))(0.345442 \\
+ 0.061878 \ln(DQMEAN))
\]

with \( R^2 = 69\% \) and \( \text{SEE} = 0.11553 \).

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):

\[
\text{DQMEAN} = \exp(2.6753 - 28.5809/TTH - 0.0005\text{STA}).
\]

In effect, TTH and STA play an indirect role in estimating \( h \).
An updated version of Blackard's model is:

\[
\ln(h) = \ln(TTH) + 0.009993 \\
+ (\ln(d) - \ln(DMAX))(0.018957 \\
+ 0.080091\ln(A) \\
+ 0.114679\ln(TTH/A) \\
+ 0.014514\ln(STA))
\]

with \( R^2 = 69\% \) and \( \text{SEE} = 0.11657 \).

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:

\[
\ln(h) = \ln(TTH) + 0.012032 \\
+ (\ln(d) - \ln(DMAX))(0.40347 \\
+ 0.097307\ln(DQMEAN))
\]

with \( R^2 = 70\% \) and \( \text{SEE} = 0.12286 \).

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

\[
DQMEAN = \exp(2.4641 - 25.8135/TTH - 0.0003STA)
\]

An updated version of Blackard's model is:

\[
\ln(h) = \ln(TTH) + 0.006995 \\
+ (\ln(d) - \ln(DMAX))(0.212079 \\
+ 0.114747\ln(A) \\
+ 0.149298\ln(TTH/A) \\
- 0.019744\ln(STA))
\]

with \( R^2 = 69\% \) and \( \text{SEE} = 0.12552 \).
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


