Project Report No. 59, Site Index Equations for Loblolly and Slash Pine Plantations in East Texas, Update: Fall 1997

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Update: Fall 1997

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(all of whom were FOR 317 students Fall '97)

REPORT 59

From the

East Texas Pine Plantation Research Project
Arthur Temple College of Forestry
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Nacogdoches, TX 75962

November ... 1997
SITUATION

Site index prediction equations for loblolly (Pinus taeda L.) and slash (Pinus elliottii Engelm.) pine plantations in East Texas have been previously developed and published by:


Each published set of equations was developed from analyses of East Texas Pine Plantation Research Project (ETPPRP) data collected from the array of ETPRP permanent research plots located throughout East Texas.

Since the ETPPRP plots are measured on a 3-year cycle, the number of age-height pairs available for site index analysis is increasing:

<table>
<thead>
<tr>
<th>Year</th>
<th>Loblolly</th>
<th>Slash</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>150</td>
<td>75</td>
</tr>
<tr>
<td>1993</td>
<td>608</td>
<td>264</td>
</tr>
<tr>
<td>1994</td>
<td>653</td>
<td>296</td>
</tr>
<tr>
<td>1995</td>
<td>1,428</td>
<td>630</td>
</tr>
<tr>
<td>Spring 1996</td>
<td>1,520</td>
<td>658</td>
</tr>
<tr>
<td>Fall 1996</td>
<td>1,607</td>
<td>722</td>
</tr>
</tbody>
</table>

This update utilizes height-age pairs measured from 1982 - 1997. As a result, the number of observations available for analysis is 1,713 loblolly and 764 slash.

It is anticipated that the equations in this Fall 1997 update may quantify the productivity of East Texas loblolly and slash pine plantations in a more accurate and reliable manner than the five previous sets of equations.
PLANTATION MEASUREMENTS

Each ETPPRP plot consists of two subplots separated by a 60' buffer zone. An experimental design of this manner provides the opportunity to:

- Evaluate models in an independent manner.
- Explore effects of different treatments.
- Investigate regression models.

As was the practice in the two previous site index analyses, each subplot was considered a separate sampling unit in this Fall 1997 study.

The characteristics of the 1,713 loblolly pine and 764 slash pine observations at least one year old and one foot in height that were utilized in this study can be summarized as:

<table>
<thead>
<tr>
<th>Plantation Age</th>
<th>Plantation Height</th>
<th>Site Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Years Since Planting</td>
<td>Average total height in feet of tallest trees in an area of interest</td>
<td>Expected total height in feet of tallest trees in an area of interest at 25 years</td>
</tr>
<tr>
<td><strong>LOBLOLLY...</strong></td>
<td><strong>LOBLOLLY...</strong></td>
<td><strong>LOBLOLLY...</strong></td>
</tr>
<tr>
<td>Mean = 11.5 yrs.</td>
<td>Mean = 38.1 ft.</td>
<td>Mean = 69.5 ft.</td>
</tr>
<tr>
<td>Range = 1-30 yrs</td>
<td>Range = 2-100 ft.</td>
<td>Range = 18-199 ft.</td>
</tr>
<tr>
<td><strong>SLASH...</strong></td>
<td><strong>SLASH...</strong></td>
<td><strong>SLASH...</strong></td>
</tr>
<tr>
<td>Mean = 11.1 yrs.</td>
<td>Mean = 36.7 ft.</td>
<td>Mean = 75.3 ft.</td>
</tr>
<tr>
<td>Range = 1-27 yrs.</td>
<td>Range = 2-111 ft.</td>
<td>Range = 15-142</td>
</tr>
</tbody>
</table>
PREDICTING HEIGHT

The same height prediction function used in 1986, 1993, 1994, 1995 and 1996 was utilized in this Fall 1997 update. As a result of fitting the Richards' function, using non-linear regression analysis, to the age and height pairs, height can estimated as:

LOBLOLLY

\[ H = 82.03809 \left[ 1 - \exp(-0.09368(A)) \right]^{1.68800} \]  \hspace{1cm} (1)

SLASH

\[ H = 120.99023 \left[ 1 - \exp(-0.04731(A)) \right]^{1.29917} \]  \hspace{1cm} (2)

A residual analysis of equations (1) and (2) compared the predicted and observed heights for the evaluation subplot data sets and indicated no bias or adverse trends for either species.

PREDICTING SITE INDEX

Using procedures from the five previous papers, the height estimation or guide curves (1) and (2) were converted into equations to estimate site index with index age = 25 years as:

LOBLOLLY

\[ S = H \left( 0.90386 / \left[ 1 - \exp(-0.09368(A)) \right] \right)^{1.68800} \]  \hspace{1cm} (3)

SLASH

\[ S = H \left( 0.69356 / \left[ 1 - \exp(-0.04731(A)) \right] \right)^{1.29917} \]  \hspace{1cm} (4)

Equations (3) and (4) were rearranged to estimate H for a given A and S, and anamorphic site index curves were developed for each species (last two pages in this update).
Site Index Curves for
Loblolly Pine Plantations in East Texas
(Base Age 25 years)
Site Index Curves for Slash Pine Plantations in East Texas (Base Age 25 years)

Plantation Age (years) vs. Average Height of Ten Tallest Trees (ft) vs. Site Index (ft)