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

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Site Index Equations
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by

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

REPORT   59

From
the

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:

Lenhart, J. D., E. V. Hunt, Jr. and J. A. Blackard. 1986. Site index equations for loblolly and slash pine plantations on non-old-field in East Texas. South. J. Appl. For. 10(2):109-112.

Vaughn, A. B., J. Lapongan and J. D. Lenhart. 1993. Site index equations for loblolly and slash pine plantations in East Texas - Update: 1993. ETPPRP Report 27. College of Forestry. SFASU. 6 p.

Members FOR 317 Class Spring '94. 1994. Site index equations for loblolly and slash pine plantations in East Texas - Update: 1994. ETPPRP Report 29. College of Forestry. SFASU. 7 p.

Members FOR 317 Class Spring '95. 1995. Site index equations for loblolly and slash pine plantations in East Texas - Update: 1995. ETPPRP Report 37. College of Forestry. SFASU. 6 p.

Members FOR 317 Class Spring '96. 1996. Site index equations for loblolly and slash pine plantations in East Texas - Update: 1996. ETPPRP Report 43. College of Forestry. SFASU. 6 p.

Members FOR 317 Class Fall '96. 1996. Site index equations for loblolly and slash pine plantations in East Texas - Update: 1996. ETPPRP Report 50. College of Forestry. SFASU. 6 p.

Each published set of equations was developed from analyses of East Texas Pine Plantation Research Project (ETPPRP) data collected from the array of ETPPRP 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:

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The 1986 equations:            150 loblolly and   75 slash.
The 1993 equations:            608 loblolly and  264 slash.
The 1994 equations:            653 loblolly and  296 slash.
The 1995 equations:          1,428 loblolly and  630 slash.
The Spring 1996 equations:   1,520 loblolly and  658 slash.
The Fall 1996 equations:     1,607 loblolly and  722 slash.
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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:

Plantation Age

Number
of
Years
Since Planting

(A)

LOBLOLLY...

Mean = 11.5 yrs.
Range = 1- 30 yrs

SLASH...

Mean = 11.1 yrs.
Range = 1- 27 yrs.

Plantation Height

Average total height
in feet
of tallest trees
in an area of interest

(H)

LOBLOLLY...

Mean = 38.1 ft.
Range = 2 - 100 ft.

SLASH...

Mean = 36.7 ft.
Range = 2 - 111 ft.

Site Index

Expected total height
in feet
of tallest trees
in an area of interest
at 25 years

(S)

LOBLOLLY...

Mean = 69.5ft.
Range = 18 - 199 ft.

SLASH...

Mean = 75.3ft.
Range = 15 - 142

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

$$H = 82.03809[1-EXP(-0.09368(A))]^{1.68800} \qquad (1)$$

SLASH

$$H = 120.99023[1-EXP(-0.04731(A))]^{1.29917} \qquad (2)$$

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:
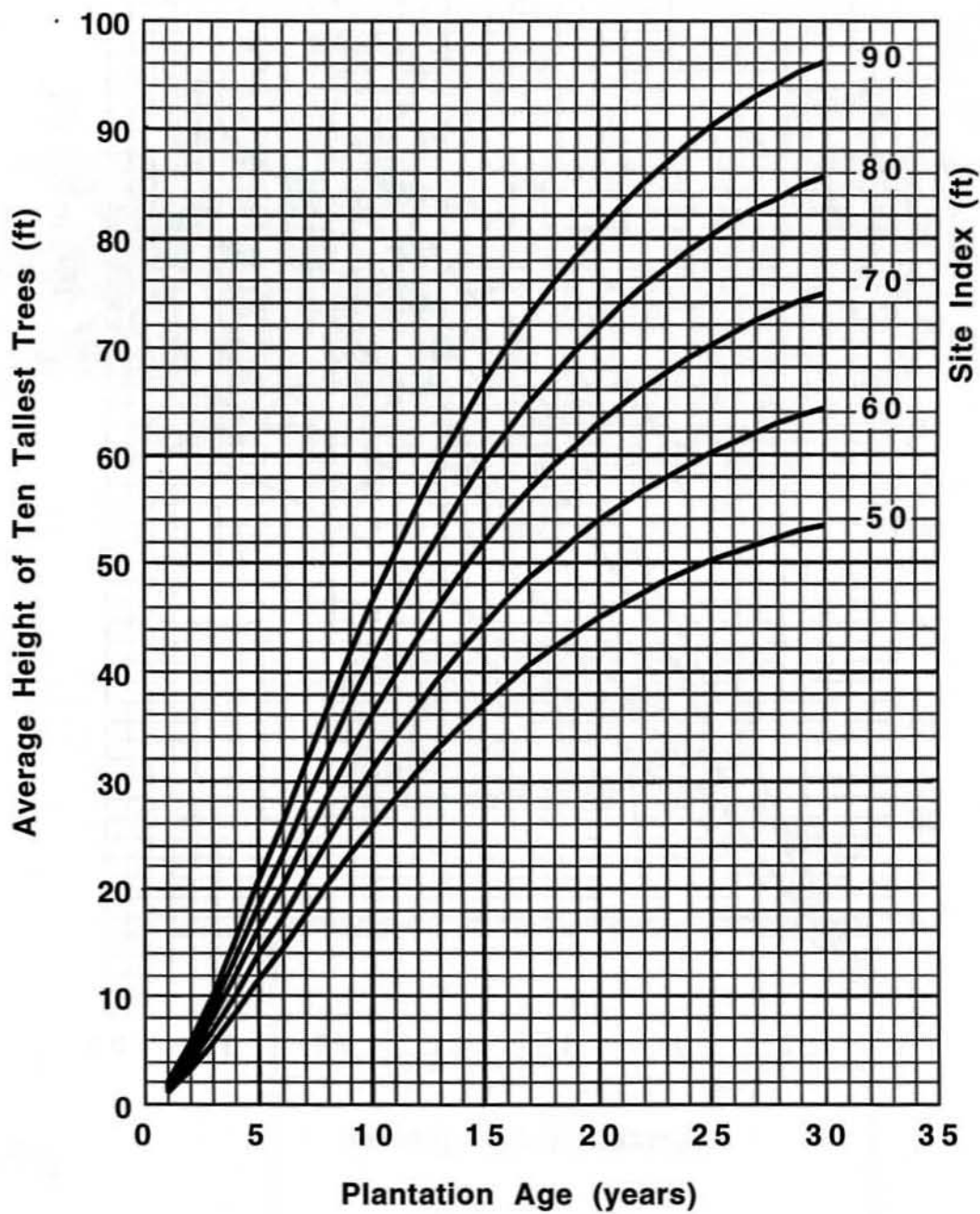
LOBLOLLY

$$S = H\{0.90386/[1-EXP(-0.09368(A))]\}^{1.68800} \qquad (3)$$

SLASH

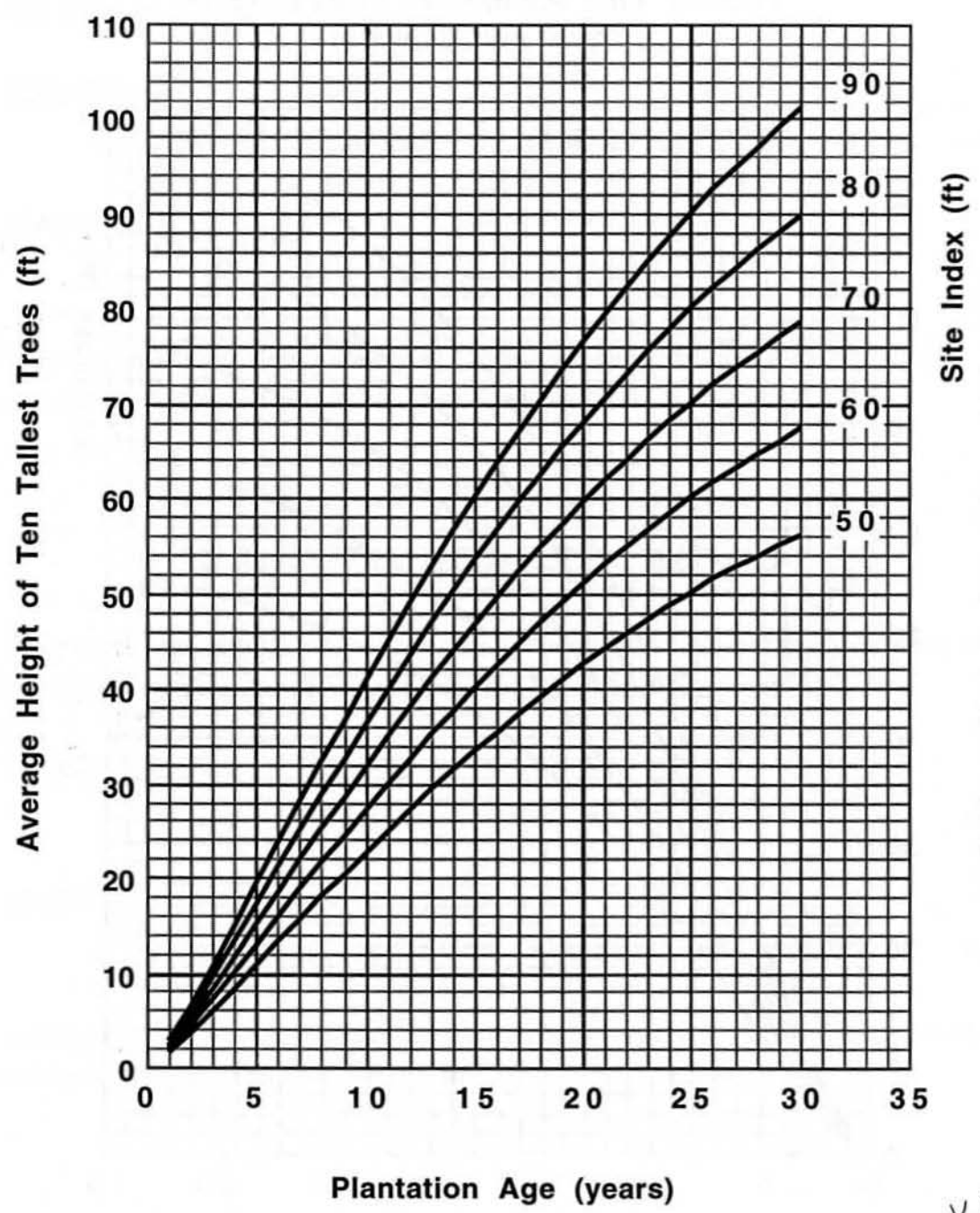$$S = H\{0.69356/[1-EXP(-0.04731(A))]\}^{1.29917} \qquad (4)$$

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)

KK

Site Index Curves for
Slash Pine Plantations in East Texas
(Base Age 25 years)

Average Height of Ten Tallest Trees (ft)

Site Index (ft)

90
80
70
60
50

Plantation Age (years)

KK