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Don Campbell

Steve Croft

Mark Dougharty

Doug Foster

John Hawkins

See next page for additional authors

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Authors

Don Campbell, Steve Croft, Mark Dougharty, Doug Foster, John Hawkins, William Howard, Young Jin Lee, Jason Love, Derek McKean, Kendall Watts, and Kurtis White

**Site Index Equations
for
Loblolly and Slash Pine Plantations
in
East Texas**

Update: 1996

by

Don Campbell
Steve Croft
Mark Dougharty
Doug Foster
John Hawkins
William Howard
Young-Jin Lee
Jason Love
Derek McKean
Kendall Watts
Kurtis White



(all of whom were FOR 317 students Spring '96)

REPORT 43

From
the

East Texas Pine Plantation Research Project

College of Forestry

SFASU

Nacogdoches, TX 75962

April ... 1996

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.

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

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.

In this update, after combining the data from the two subplots comprising each ETPPRP plot, the number of age-height pairs available for this analysis is 1,520 loblolly and 658 slash.

It is anticipated that the equations in this 1996 update may quantify the productivity of East Texas loblolly and slash pine plantations in a more accurate and reliable manner than the four previous sets of equations.

PLANTATION MEASUREMENTS

Each ETPRRP 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.

In this site index analysis, by combining the subplots, a larger data set for non-linear regression was obtained.

The characteristics of the 1,520 loblolly pine and 658 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 = 10.6 yrs.
Range = 1- 27 yrs

SLASH...

Mean = 10.2 yrs.
Range = 1- 25 yrs.

Plantation Height

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

(H)

LOBLOLLY...

Mean = 35.5 ft.
Range = 2 - 100 ft.

SLASH...

Mean = 34.3 ft.
Range = 2 - 89 ft.

Site Index

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

(S)

LOBLOLLY...

Mean = 68.8 ft.
Range = 24 - 248 ft.

SLASH...

Mean = 75.2 ft.
Range = 15 - 137 ft.

PREDICTING HEIGHT

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

LOBLOLLY

$$H = 80.07218[1 - \text{EXP}(-0.09702(A))]^{1.70549} \quad (1)$$

SLASH

$$H = 111.74109[1 - \text{EXP}(-0.05374(A))]^{1.33401} \quad (2)$$

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 four 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

$$S = H(0.91157/[1 - \text{EXP}(-0.09702(A))])^{1.70549} \quad (3)$$

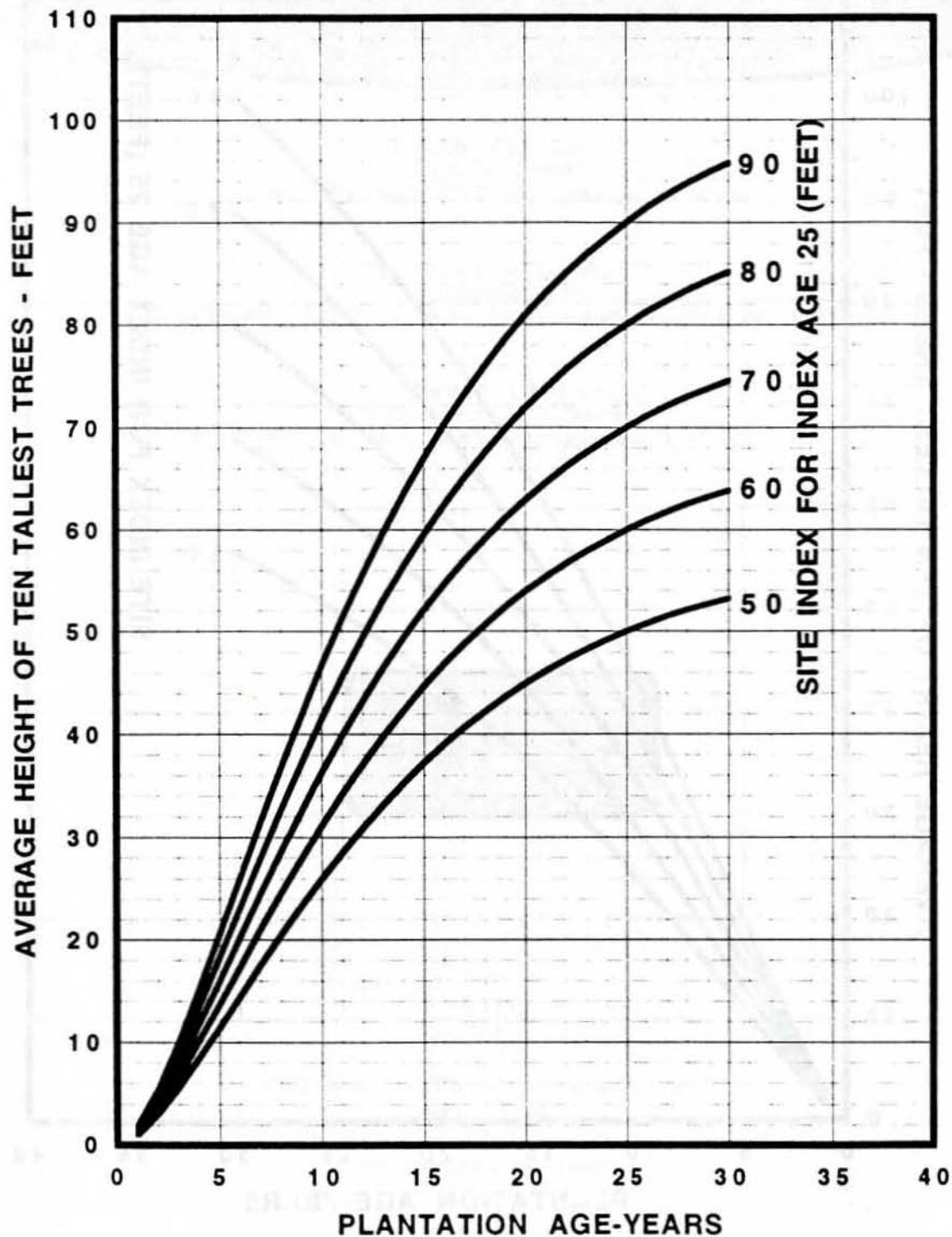
SLASH

$$S = H(0.73907/[1 - \text{EXP}(-0.05374(A))])^{1.33401} \quad (4)$$

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).

FEV 1963

SITE INDEX CURVES FOR LOBLOLLY PINE PLANTATIONS IN EAST TEXAS BASE AGE 25 YEARS.



What is the scenic beauty of unthinned East Texas loblolly and slash pine plantations?

...PERHAPS...

In 1988, as one facet of the East Texas Pine Plantation Research Project, a search of the literature plus consideration of the definition of beauty resulted in the creation of a scenic beauty tally sheet.

Working within a definition of beauty as...
The quality or aggregate of qualities in a thing that gives pleasure to the senses or pleasurably exalts the mind or spirit,
answers may be possible.

Six questions are on the tally sheet. For each question, the tally person ranks the plantation on a scale of 1 to 10 with 10 representing a high value. Therefore, the lowest possible total question score for a plantation is 6, which should represent a plantation with low scenic beauty. The highest total question score is 60, which should represent a plantation with a high scenic beauty.

...The Six Scenic Beauty Questions...

- Distracting works of man within plantation?
- Distracting works of nature within plantation?
 - Scenic diversity within plantation?
 - Is plantation beautiful?
 - Pleasing views within plantation?
 - Pleasing views into plantation?

Each summer, one member of the ETPPRP field crew is trained to use the scenic beauty tally sheet in a manner consistent with previous summers. This person develops a scenic beauty score for each ETPPRP plot visited by the crew.

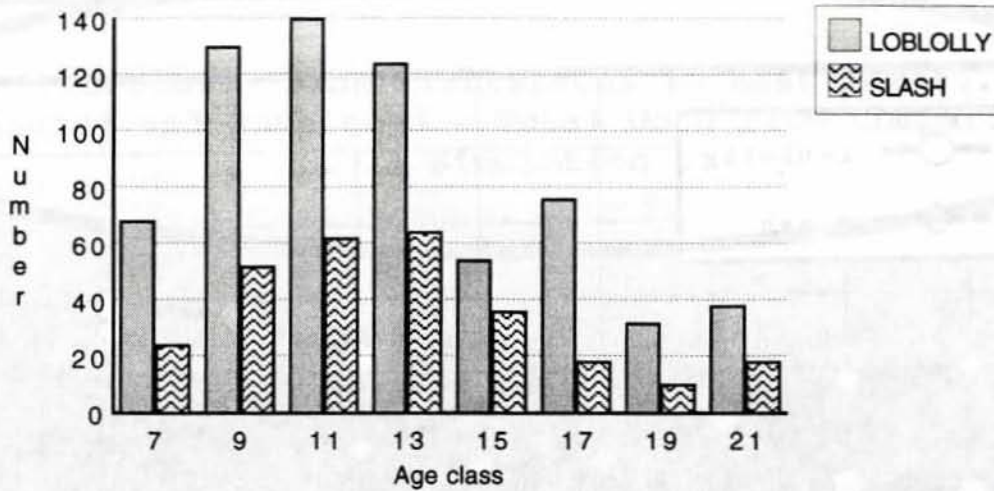
...TWO RESEARCH QUESTIONS...

**DO LOBLOLLY AND SLASH PINE PLANTATIONS DIFFER IN SCENIC BEAUTY?
IS SCENIC BEAUTY AFFECTED BY PLANTATION AGE?**

Possible answers to these research questions were obtained by analyzing the scenic beauty scores based on two visits to each of the ETPPRP plots during the period 1988-93.

Answers are depicted on the next 2 pages.

Number of observations by species by age class.



Reminder: Total scenic beauty is ranked on a scale from 6 & 60 points.

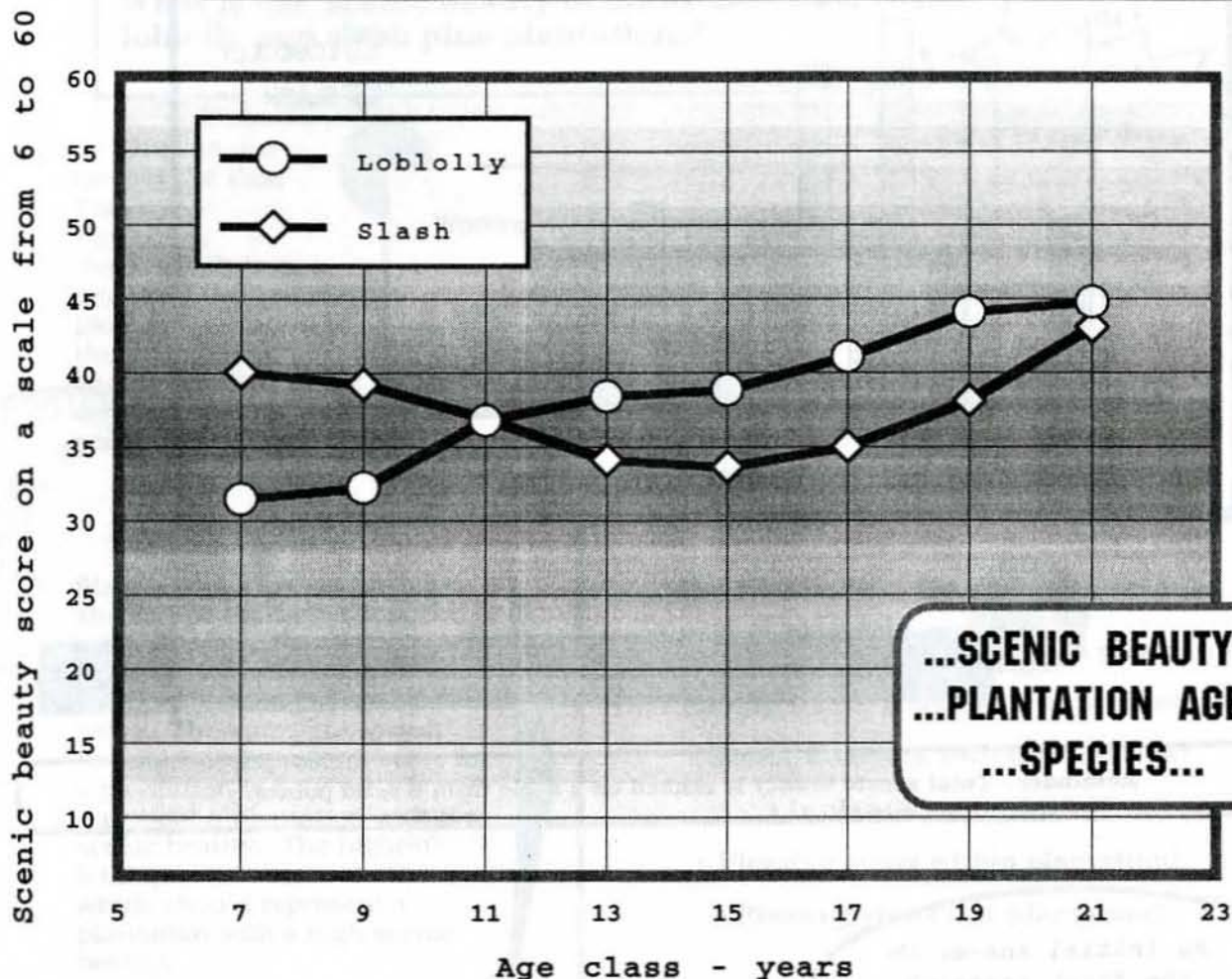
An initial answer to the first research question is

Average Overall Scenic Beauty is..... **37.1 for loblolly pine plantations** and **36.9 for slash pine plantations.**

(Overall means are not significantly different at 5% level.)

At first glance, scenic beauty appears similar between species.

A more detailed answer to both questions is depicted in the following chart, where average observed scenic beauty scores are plotted by age class for each species.



**...SCENIC BEAUTY...
...PLANTATION AGE...
...SPECIES...**

... Loblolly pine plantations ...

- Scenic beauty consistently increases with increasing age •

... Slash pine plantations ...

- Scenic beauty decreases then increases with increasing age •

... Between species ...

- In age classes 7 & 9, slash scenic beauty is significantly higher than loblolly •
 - In age class 11, scenic beauty values are not significantly different •
- In age classes 13, 15, 17 & 19, loblolly scenic beauty is significantly higher than slash •
 - In age class 21, scenic beauty values are not significantly different •

Based on this set of observations from the ETPPRP permanent plots, it appears the qualities in unthinned East Texas pine plantations which may give pleasure to the senses tend to be different between species and tend to be different between age classes.