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Project Report No. 52, Location, Loblolly Pine

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...Location...

...Location...   ...Location...

...Loblolly Pine...

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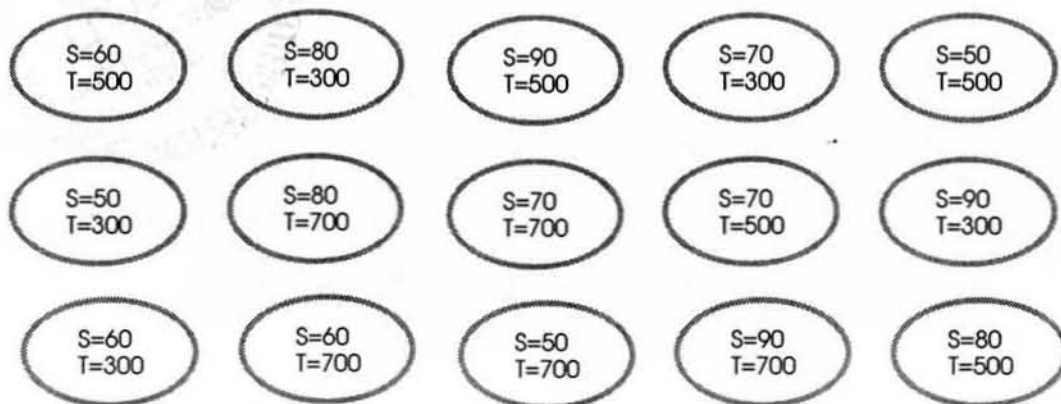*Arthur Temple College of Forestry, SFASU, Nacogdoches, TX, 75962*

REPORT 52

IS SITE SPECIFIC MANAGEMENT ADVANTAGEOUS FOR LOBLOLLY PINE PLANTATIONS IN EAST TEXAS ?

> **Let's investigate this research question by examining mean annual increment.**

In this investigation, please consider a hypothetical set of 15 loblolly pine plantations in Polk county:

(In a schematic fashion, each ellipse represents a mutually exclusive plantation.)

S=60 T=500	S=80 T=300	S=90 T=500	S=70 T=300	S=50 T=500
S=50 T=300	S=80 T=700	S=70 T=700	S=70 T=500	S=90 T=300
S=60 T=300	S=60 T=700	S=50 T=700	S=90 T=700	S=80 T=500

- Each plantation is 5 years old.
- S = site index base age 25 years - feet.
- T = planted surviving trees per acre.
- Each plantation is on a different site as quantified by site index and trees/acre.

- Landowner wants to time the harvest of each plantation, so as to maximize MAI.
- Is a common rotation age appropriate?
- Or should the timing of harvest be site specific?
- Are site-specific rotation ages advantageous?

Recent work by
the East Texas Pine Plantation Research Project
may provide avenues to investigate the research question

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Adams, D. E., J. D. Lenhart, A. B. Vaughn and J. Lapongan. 1996. Estimating survival of East Texas loblolly and slash pine plantations infected with fusiform rust. South. J. Appl. For. 20(1):30-35.

Lenhart, J. D. 1996. Total and partial stand-level yield prediction for loblolly and slash pine plantations in East Texas. South. J. Appl. For. 20(1):36-41.

A SIMULATION MODEL WAS CONSTRUCTED
TO DEPICT THE SITUATION AND INVESTIGATE THE RESEARCH QUESTION

Model Components are:

Plantation Parameters

01. Species - loblolly pine plantations.
02. Current age = 5 years; grow and harvest one rotation.
03. Nine possible plantation management schedules.
   a. Rotation length = 14 yrs ... 9 years until final harvest.
   b. Rotation length = 16 yrs ... 11 years until final harvest.
   c. Rotation length = 18 yrs ... 13 years until final harvest.
   d. Rotation length = 20 yrs ... 15 years until final harvest.
   e. Rotation length = 22 yrs ... 17 years until final harvest.
   f. Rotation length = 24 yrs ... 19 years until final harvest.
   g. Rotation length = 26 yrs ... 21 years until final harvest.
   h. Rotation length = 28 yrs ... 23 years until final harvest.
   i. Rotation length = 30 yrs ... 25 years until final harvest.
04. Items defined and set by user.
   a. Site index values (base age = 25 yrs).
   b. Trees per acre at 5 years.
   a. Percentage of trees with fusiform rust stem infections @ 5 yrs.
   b. Merchantability/Utilization standards ... lower dbh limit & upper stem dob limit
05. Unit of measure = tons per acre green weight of wood only.

Mensurational Concepts

06. Future number of fusiform rust infected & uninfected trees per acre are estimated using the Adams et al. (1996) survival models.
07. For each management schedule, yield at rotation age (tons of wood) is estimated using Lenhart (1996) prediction models.

THE SIMULATION MODEL
WAS TRANSLATED INTO AN EXCEL SPREADSHEET MODEL

THE SIMULATION RUNS

To depict the representative set of 15 loblolly pine plantations, values were set as:
- Site index was defined as: 50', 60', 70', 80' & 90'.
- Trees per acre were defined as: 300, 500 & 700.
- Percent of fusiform rust infected stems = 10%.
- Lower limit on dbh = 4" and upper stem dob limit = 4".

Possible rotation ages ranged from 14 to 30 years by 2-year increments for 9 alternatives.

For each combination of site index and trees per acre within each rotation age, a mean annual increment (MAI) was calculated.

The MAI values of the simulation runs are summarized in a chart on pages 5, 6, 7 & 8.

ANSWERS TO THE RESEARCH QUESTION

In East Texas loblolly pine plantations, is the magnitude of MAI sensitive to different locations of the stand?
(Different locations are represented
by different combinations of site index and trees per acre)

After reviewing the chart, the answer appears to be => yes.

In East Texas loblolly pine plantations, is the optimum rotation age at which MAI is maximized site specific?

After considering the chart, the answer appears to be => no.

For each of the 15 hypothetical loblolly pine plantations,
MAX MAI
occurs within a 4-year window of 26-30 years.

Several caveats...

- Study was limited to the situations within the range of specified plantation parameters.
- Study was limited to planted loblolly pine in East Texas.
- Merchandising specifications were not considered.
- Cash flows were not a part of this study.

FIFTEEN LOBLOLLY PINE PLANTATIONS IN EAST TEXAS

- Each of the 15 hypothetical plantations is currently 5 years old.
  - Fifteen combinations of site index and trees per acre:
    - Site indexes (S) : 50', 60', 70', 80' and 90'.
    - Trees per acre (T) : 300, 500 and 700.
  - Nine rotation ages (beginning at age14 every two years to age 30).
  - Percent of trees with Fusiform Rust on stem = 10%
- Values within ellipses = mean annual increment (MAI) of tons of wood per acre.
- Merchantability standards = dbh ≥ 4" and upper stem dob ≥ 4".

- A shaded ellipse indicates the optimum rotation age for that particular plantation.

- For each possible plan, the set of 15 ellipses represent in a schematic manner the 15 different 5-year old loblolly pine plantations.

A POSSIBLE PLANTATION TIMBER MANAGEMENT PLAN (1 OF 9) ....
CURRENT AGE =5YRS ...GROW ...FINAL HARVEST IN 9 YRS AT 14 YRS OF AGE

Comments:

- Magnitude of MAI is sensitive to location.

- After comparing to possible older rotation ages, no maximum MAI values have been obtained.

- Recommend continue growing the 15 plantations.

..... Trees per acre .....

Site Index	300	500	700
50	.59	.62	.59
60	1.37	1.61	1.74
70	2.54	3.12	3.35
80	4.19	5.27	6.07
90	6.43	8.17	9.51

A POSSIBLE PLANTATION TIMBER MANAGEMENT PLAN (2 OF 9) ....
CURRENT AGE = 5 YRS ...GROW...FINAL HARVEST IN 11 YRS AT 16 YRS OF AGE

Comments:

- Magnitude of MAI is sensitive to location.

- After comparing to possible older rotation ages, no maximum MAI values have been obtained.

- Recommend continue growing the 15 plantations.

..... Trees per acre .....

Site Index	300	500	700
50	.75	.84	.86
60	1.64	1.98	2.20
70	2.97	3.70	4.24
80	4.84	6.12	7.11
90	7.37	9.40	11.00

A POSSIBLE PLANTATION TIMBER MANAGEMENT PLAN (3 OF 9) ....
CURRENT AGE = 5 YRS ...GROW...FINAL HARVEST IN 13 YRS AT 18 YRS OF AGE

..... Trees per acre .....

Site Index	300	500	700
50	.87	1.01	1.07
60	1.84	2.25	2.54
70	3.28	4.12	4.75
80	5.30	6.47	7.86
90	8.03	10.27	12.05

Comments:

• Magnitude of MAI is sensitive to location.

• After comparing to possible older rotation ages, no maximum MAI values have been obtained.

• Recommend continue growing the 15 plantations.

A POSSIBLE PLANTATION TIMBER MANAGEMENT PLAN (4 OF 9) ....
CURRENT AGE = 5 YRS ...GROW...FINAL HARVEST IN 15 YRS AT 20 YRS OF AGE

..... Trees per acre .....

Site Index	300	500	700
50	.96	1.13	1.23
60	1.98	2.45	2.79
70	3.49	4.41	5.11
80	5.62	7.17	8.38
90	8.46	10.86	12.77

Comments:

• Magnitude of MAI is sensitive to location.

• After comparing to possible older rotation ages, no maximum MAI values have been obtained.

• Recommend continue growing the 15 plantations.

A POSSIBLE PLANTATION TIMBER MANAGEMENT PLAN (5 OF 9) ....
CURRENT AGE = 5 YRS ...GROW...FINAL HARVEST IN 17 YRS AT 22 YRS OF AGE

..... Trees per acre .....

Site Index	300	500	700
50	1.02	1.23	1.35
60	2.07	2.59	2.96
70	3.63	4.61	5.36
80	5.82	7.44	8.72
90	8.74	11.23	13.22

Comments:

• Magnitude of MAI is sensitive to location.

• After comparing to possible older rotation ages, no maximum MAI values have been obtained.

• Recommend continue growing the 15 plantations.

A POSSIBLE PLANTATION TIMBER MANAGEMENT PLAN (6 OF 9) ....
CURRENT AGE = 5 YRS ...GROW...FINAL HARVEST IN 19 YRS AT 24 YRS OF AGE

..... Trees per acre .....

Site Index	300	500	700
50	1.07	1.29	1.44
60	2.13	2.67	3.08
70	3.72	4.73	5.51
80	5.93	7.59	8.91
90	8.89	11.42	13.46

Comments:

- Magnitude of MAI is sensitive to location.

- After comparing to possible older rotation ages, no maximum MAI values have been obtained.

- Recommend continue growing the 15 plantations.

A POSSIBLE PLANTATION TIMBER MANAGEMENT PLAN (7 OF 9) ....
CURRENT AGE = 5 YRS ...GROW...FINAL HARVEST IN 21 YRS AT 26 YRS OF AGE

..... Trees per acre .....

Site Index	300	500	700
50	1.09	1.33	1.50
60	2.17	2.75	3.15
70	3.76	4.79	5.59
80	5.97	7.66	9.00
90	8.93	11.49	13.54

Comments:

- Magnitude of MAI is sensitive to location.

- MAX MAI has been reached for 8 of the 15 plantations.

- Recommend continue growing the remaining 7 plantations.

A POSSIBLE PLANTATION TIMBER MANAGEMENT PLAN (8 OF 9) ....
CURRENT AGE = 5 YRS ...GROW...FINAL HARVEST IN 23 YRS AT 28 YRS OF AGE

..... Trees per acre .....

Site Index	300	500	700
50	1.11	1.36	1.53
60	2.18	2.75	3.18
70	3.76	4.80	5.62
80	5.97	7.66	9.00
90	8.89	11.45	13.51

Comments:

- Magnitude of MAI is sensitive to location.

- MAX MAI has been reached for 4 of the remaining 7 plantations.

- Recommend continue growing the remaining 3 plantations.

A POSSIBLE PLANTATION TIMBER MANAGEMENT PLAN (9 OF 9) ....
CURRENT AGE = 5 YRS ...GROW...FINAL HARVEST IN 25 YRS AT 30 YRS OF AGE

..... Trees per acre .....

Site Index	300	500	700
50	1.11	1.37	1.56
60	2.18	2.75	3.19
70	3.75	4.78	3.60
80	5.92	7.60	8.95
90	8.81	11.35	13.39

Comments:

- Magnitude of MAI is sensitive to location.

- MAX MAI has been reached for the remaining 3 plantations.

A Few Thoughts...

- Across this span of possible rotation ages, the ability of the land to grow loblolly pines appears to influence MAI in a significant manner.

- Less influence is evident with number of trees per acre.

- It is interesting that in spite of these site influences, the timing of MAX MAI occurs within a relatively narrow band.

  - Within this band, MAX MAI tends to occur at shorter rotation ages on the more productive sites.

  - In contrast, MAX MAI tends to occur at longer rotation ages on the less productive sites.

- Additional work is needed to investigate the role of cash values and merchantability standards in determining the advantages of site specific management.