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Project Report No. 53, Slash Pine Plantations in East Texas, Comparison of Two Harvest Schedules . . .

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TC

...Slash Pine Plantations in East Texas...
...Comparison of Two Harvest Schedules...
...No Thinning & Final Harvest at 30 years...
...Thin at 15 years & Final Harvest at 30 years...
...Sawlog/Veneer Wood Flows...
...A Simulation...



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REPORT 53

From
the

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

April ... 1997

BACKGROUND

In June, 1996, ETPPRP Report 45 presented the results of an investigation into the research question:

=> Does a thinning increase total wood flow of East Texas loblolly pine plantations? <=

The investigation compared unthinned and thinned management regimes by simulating four possible thinning schedules

Thin at 10 years => Final harvest at 25 years

Thin at 15 years => Final harvest at 25 years

Thin at 15 years => Final harvest at 30 years

Thin at 20 years => Final harvest at 30 years

Results indicated that in general => total wood flow was not increased by a thinning.

Which, in turn, precipitated two new research questions for loblolly pine plantations:

Does a thinning increase the wood flow of trees that may be suitable for sawlog/veneer?

Does a thinning increase net present value of all products?

Which were answered by a series of four ETPPRP Reports comparing plantation management regimes with no thinning to plantation management regimes with a thinning

Report 46 ... thin at 10 / final harvest at 25

Report 47 ... thin at 15 / final harvest at 25

Report 48 ... thin at 15 / final harvest at 30

Report 49 ... thin at 20 / final harvest at 30

Results indicated that in general => advantages of thinnings were sensitive to age, site index and trees per acre plus timing of thinnings in combination with rotation age.

After the four management simulations (#46 - #49) into loblolly pine plantation no thinning compared to thinning scenarios, we were curious if slash pine plantations would react in a similar manner?

One of the four regimes ... thin at 15 with final harvest at 30 ... was chosen as representative for this new simulation.

TOPIC OF THIS SLASH PINE REPORT

DOES A THINNING AT 15 YEARS WITH FINAL HARVEST AT 30 YEARS INCREASE SAWLOG/VENEER WOOD FLOW?

DOES A THINNING AT 15 YEARS WITH FINAL HARVEST AT 30 YEARS INCREASE NET PRESENT VALUE?

AS COMPARED TO NO THINNING WITH A FINAL HARVEST AT 30 YEARS?

An illustration depicting the research questions...

For example, let us say there is a slash pine plantation in Polk county:

- 5 years old.
- Site index base age 25 years = 60'.
- 500 surviving trees per acre.
- 50% of the trees have fusiform rust infection on the stem.
- Landowner plans a 30-year rotation age ... 25 more years until final harvest.

- During this 25-year period, landowner has two goals:
 - To maximize the production of trees with sawlog/veneer potential and
 - To maximize the net present value of all trees.

- To accomplish these goals, should the plantation remain unthinned until a final harvest 25 years hence?

- Or to accomplish these goals, should the plantation receive a thinning in 10 years, when it is 15 years old and a final harvest in 25 years at age 30 years?

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

Adams, D. E., J. D. Lenhart, A. B. Vaughn and J. Lapongan. 1995
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 REPRESENT THE SITUATION AND INVESTIGATE THE RESEARCH QUESTIONS**

Model Components are:

Plantation Parameters

01. Species - slash pine.
02. Establish, grow and harvest one rotation.
03. Two possible plantation management schedules are considered.
 - a. Final harvest at 30 years ... no thinning.
 - b. Final harvest at 30 years ... thinning @ 15 years.
04. Items defined and set by user.
 - a. Site index (base age 25 years).
 - b. Surviving number of trees per acre @ 5 years.
 - c. Percentage of trees with fusiform rust stem infection @ 5 years.
 - d. Merchantability/Utilization standards.
 - 01) Minimum dbh value for pulpwood utilization.
 - 02) Minimum upper stem dob value for pulpwood utilization.
 - 03) Minimum dbh value for sawlog/veneer utilization.
 - 04) Minimum upper stem dob for sawlog/veneer utilization.
 - 05) Percentage of unthinned yield expected to be suitable for sawlog/veneer harvest.
 - 06) Percentage of residual yield expected to be suitable for sawlog/veneer harvest.
05. Unit of measure = tons per acre green weight of wood only.

Thinning Specifications

06. Timing of thinning is at plantation age = 15 years.
07. Percent of wood removed at 15 years of age. Four settings included in simulation model.
 - a. 25%. c. 50%.
 - b. 33%. d. 67%.
08. Increase in growth of residual trees between thinning and final harvest relative to unthinned growth during same period of time. Five settings included in simulation model.
 - a. 0%. c. 20%. e. 40%.
 - b. 10%. d. 30%.

SIMULATION MODEL CONTINUED

Economic Values

09. Interest percent for alternative investments - compounded annually. For discounting future cash flows to 0 years hence.
10. Inflation percent - compounded annually. For compounding stumpage prices into the future.
11. Pulpwood stumpage price per ton at beginning of rotation (0 years hence).
12. Sawlog/veneer stumpage price per ton at beginning of rotation (0 years hence).
13. Establishment cost per acre (0 years hence).
14. Annual administration and operations cash flows each year for 30 years.

Mensurational Concepts

15. Future number of fusiform rust infected & uninfected trees per acre are estimated using the Adams et al. (1996) survival models.
16. For management schedule 3a above (no thinning), total yield (Q) at age 30 years (final harvest) is estimated using Lenhart (1996) prediction models.
17. For a management schedule with thinning at age 15 years, a thinning simulation was designed as:
 - a. Using Lenhart (1996), total yield (R) is predicted at age 15 years.
 - b. Using R & Q wood flow values as present value & future value, respectively, plus the number of years between thinning and final harvest as 15, a compound growth percentage (interest rate) can be calculated.
 - c. In turn, this growth percentage is increased by the values listed in 8a - 8e above to represent hypothetical increases in growth of residual trees following a thinning.
 - d. Thinning wood flow is determined by multiplying values listed in 7a - 7d above by the expected yield in year of thinning.
 - e. By subtraction, a residual yield is calculated after each thinning.
 - f. Using the modified growth %s from 17c above, residual yield is compounded year-by-year for a wood flow at final harvest 15 years later.
 - g. All yields are computed after consideration of merchantability standards listed in 4d above.
 - h. The percentage of unthinned yield expected to be available for sawlog/veneer utilization at 30 years can vary, see 4d above.
 - i. The percentage of residual trees expected to be available for sawlog/veneer utilization at 30 years can vary, see 4d above.

THE SIMULATION MODEL WAS TRANSLATED INTO A SPREADSHEET MODEL

A two-page spreadsheet was designed to represent the simulation model.

In the spreadsheet, the user can easily conduct simulation runs.

Runs that ascertain the effect of different combinations of biological and economical factors.
How sensitive are wood flow and net present value to varying plantation management attributes?

A forester can use the spreadsheet to investigate specific combinations of factors.

This spreadsheet is a versatile analytical tool for comparing management scenarios.

THE SIMULATION RUNS FOR THIS STUDY

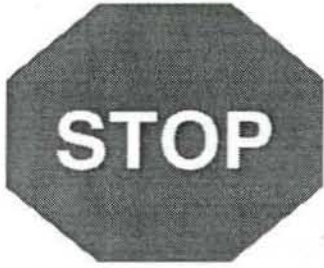
As an illustration of one possible combination of plantation management settings, the following representative values were designated

- Plantation parameters were:
 - Site index was defined as 50', 70' & 90'.
 - Trees per acre were defined as 300, 500 & 700.
 - Percent of fusiform rust infected stems = 50%.
- For each of the 9 sets of plantation parameters:
 - Economic factors were:
 - Alternative investment interest percent = 6% per year compounded annually.
 - Inflation interest percent = 2% per year compounded annually.
 - Stumpage price for pulpwood = \$10 per ton at beginning of rotation.
 - Stumpage price for sawlog/veneer = \$50 per ton at beginning of rotation.
 - No other cash flows were included in this study.
 - Pulpwood merchantability standards were set at: minimum dbh = 4" and minimum upper stem dob = 4".
 - Sawlog/veneer merchantability standards were set at: minimum dbh = 8" and minimum upper stem dob = 6".
 - Expected percentage of unthinned yield at 30 years that may be available for possible utilization as sawlog/veneer products = 90%.
 - Expected percentages of residual yield at 30 years that may be available for possible utilization as sawlog/veneer products were specified as 50%, 70% and 90%.
 - Residual yield situations were specified as:
 - Percent of wood removed values were set at: 25%, 33%, 50% & 67%.
 - Hypothetical increases in growth rates were set as: 0%, 10%, 20%, 30% & 40%.

Results are summarized in 9 charts.

CHARTS 1 - 9

- Results of the simulation runs are presented in 9 charts on the last 18 pages of this report.
- One chart for each plantation parameter combination.
- In turn, each chart consists of specified management parameters:
 - Three percentages of residual yield at final harvest expected to be sawlog/veneer merchantable.
 - Four percentages of possible yield removed at thinning.
 - Five percentages of possible increases in residual tree growth rate after thinning.
- Management information is presented in 60 pairs of ellipses.
- First ellipse in a pair is the difference of:
(sawlog/veneer wood flow/acre with a thinning) -
(sawlog/veneer wood flow/acre with no thinning).
- Second ellipse in a pair is the difference of:
(npv/acre for all products with a thinning) -
(npv/acre for all products with no thinning).
- Shaded ellipses depict management situations where a thinning at 15 years may be advantageous.



Rotation age = 30 years
Thin at 15 years?



Advantageous?

In this simulation, for site index 50 feet, a thinning is advantageous for slash pine plantations.

In comparison, for site index 50 feet, a thinning tended to be advantageous for loblolly pine plantations (see ETPPRP Report 48).

In this simulation, for site index 70 feet, a thinning tends to have no advantage for slash pine plantations (except for higher tree quality situations).

In comparison, for site index 70 feet, a thinning tends to have no advantage for loblolly pine plantations (see ETPPRP Report 48).

In this simulation, for site index 90 feet, a thinning has no advantage for slash pine plantations.

In comparison, for site index 90 feet, a thinning tends to have no advantage for loblolly pine plantations (see ETPPRP Report 48).

Several caveats about the comparisons...

- A wide-ranging comprehensive sensitivity analysis was not conducted.
- Data on actual response of East Texas slash pine plantations to these types of thinnings are not available.
- Genetic considerations are not included.
- Herbicide applications are not included.
- Pruning treatments are not included.

A SLASH PINE PLANTATION IN EAST TEXAS WITH

- SITE INDEX BASE AGE 25 YRS = 50'
- TREES PER ACRE @ 5 YRS = 300
- PERCENT OF TREES WITH FUSIFORM RUST ON STEM = 50%
- INTEREST PERCENT = 6%
- INFLATION PERCENT = 2%
- STUMPAGE PRICE PER TON FOR PULPWOOD = \$10
- STUMPAGE PRICE PER TON FOR SAWLOG/VENEER = \$50

...One Possible Plantation Management Plan...

...Establish...

...Grow...

...Final harvest of pulpwood and sawlog/veneer at 30 yrs ...

...This Plan with no thinning is expected to produce...

...1 ton/acre of sawlog/veneer timber...

...Net present value of all products is \$56/acre...

...Another Possible Plantation Management Plan...

...Establish...

...Grow...

...Pulpwood thin at 15 yrs ...

...Grow residual...

...Final harvest of residual pulpwood and sawlog/veneer at 30 yrs...

Management question ... Is a thinning @ 15 years advantageous?

For each of the three following merchantability percentage values- 50%, 70% & 90%, there is a set of ellipse pairs. Each set has 20 combinations of percent of yield removed and possible increases in residual growth rates. The first ellipse of a pair = { tons/acre with a thinning } - { 1 ton/acre with no thinning } for sawlog/veneer only. The second ellipse of a pair = { npv/acre with a thinning } - { \$56 npv/acre with no thinning } for all products. Shaded ellipses indicate situations where thinning may be advantageous. Unshaded ellipses indicate situations where thinning may not be advantageous.

.....

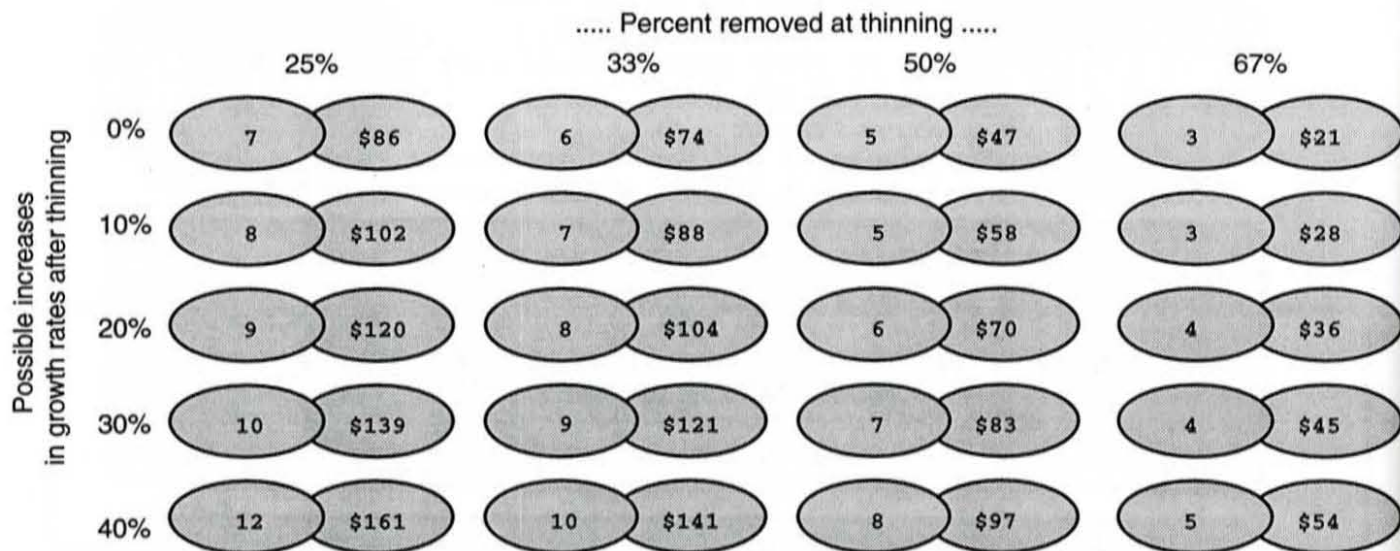
PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 50%

..... Percent removed at thinning

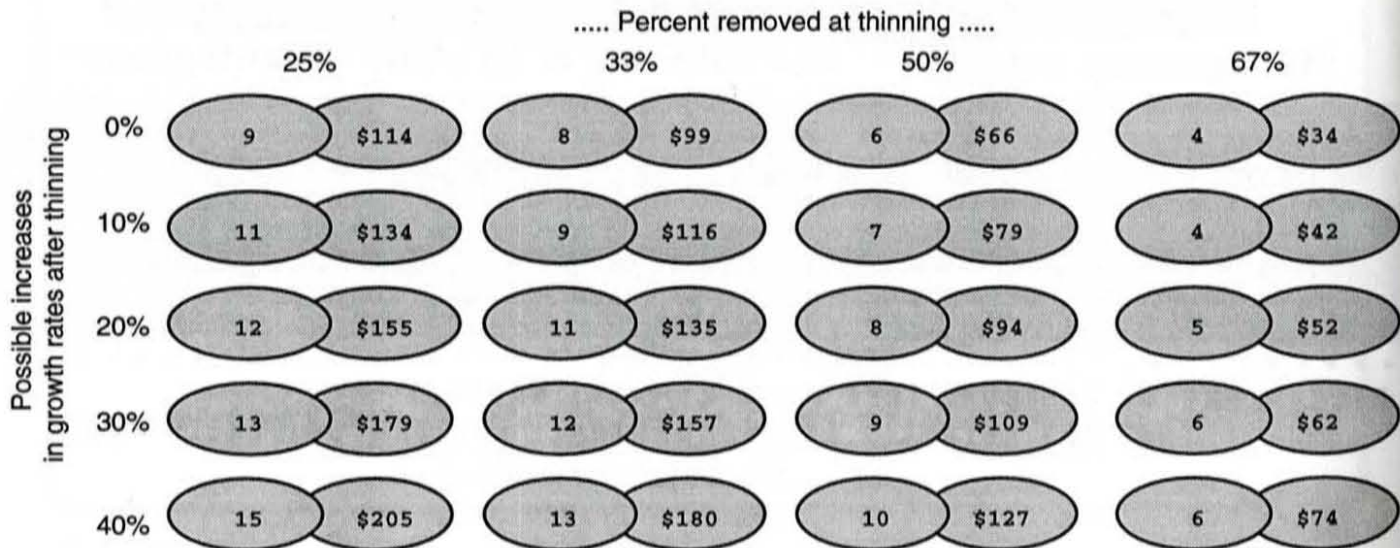
	25%	33%	50%	67%
0%	5 (\$58)	4 (\$48)	3 (\$29)	2 (\$9)
10%	6 (\$70)	5 (\$59)	4 (\$37)	2 (\$14)
20%	6 (\$84)	6 (\$72)	4 (\$46)	2 (\$20)
30%	7 (\$100)	6 (\$86)	5 (\$57)	3 (\$27)
40%	8 (\$117)	7 (\$101)	5 (\$68)	3 (\$35)

Possible increases in growth rates after thinning

**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 70%**



**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 90%**



Answers to Management Question...

On this relatively low productivity site with relatively low trees per acre, a thinning has an advantage over no thinning.

A SLASH PINE PLANTATION IN EAST TEXAS WITH

- SITE INDEX BASE AGE 25 YRS = 50'
- TREES PER ACRE @ 5 YRS = 500
- PERCENT OF TREES WITH FUSIFORM RUST ON STEM = 50%
- INTEREST PERCENT = 6%
- INFLATION PERCENT = 2%
- STUMPAGE PRICE PER TON FOR PULPWOOD = \$10
- STUMPAGE PRICE PER TON FOR SAWLOG/VENEER = \$50

...One Possible Plantation Management Plan...

...Establish...

...Grow...

...Final harvest of pulpwood and sawlog/veneer at 30 yrs ...

...This plan with no thinning is expected to produce...

...0 tons/acre of sawlog/veneer timber...

...Net present value of all products is \$73/acre...

...Another Possible Plantation Management Plan...

...Establish...

...Grow...

...Pulpwood thin at 15 yrs ...

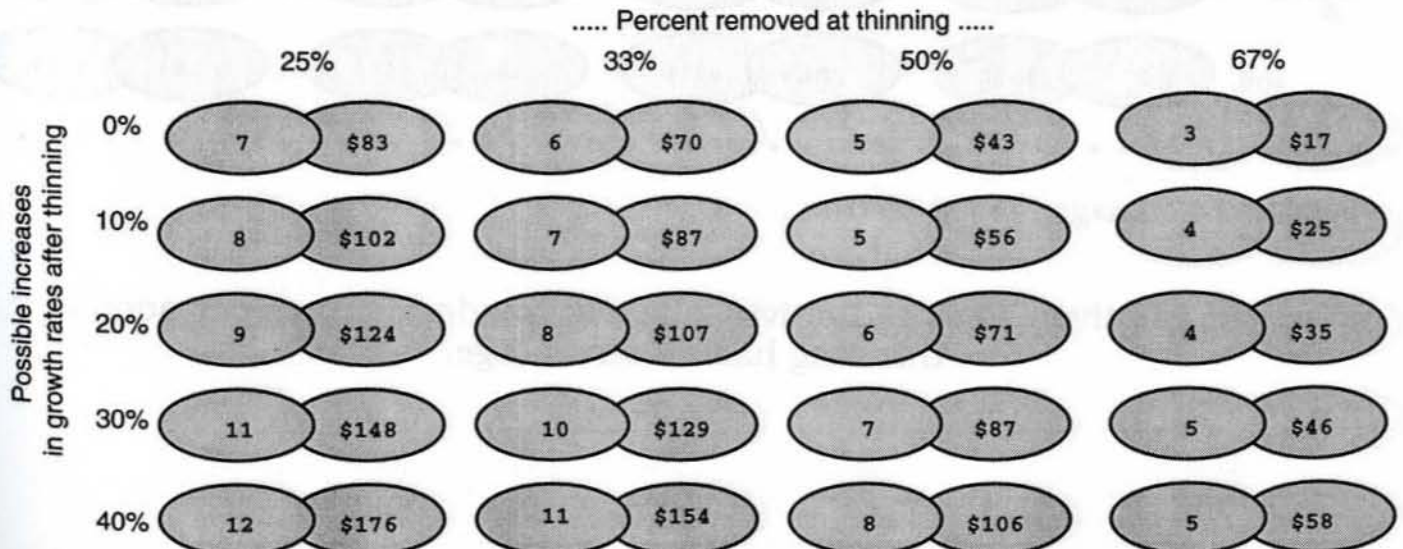
...Grow residual...

...Final harvest of residual pulpwood and sawlog/veneer at 30 yrs...

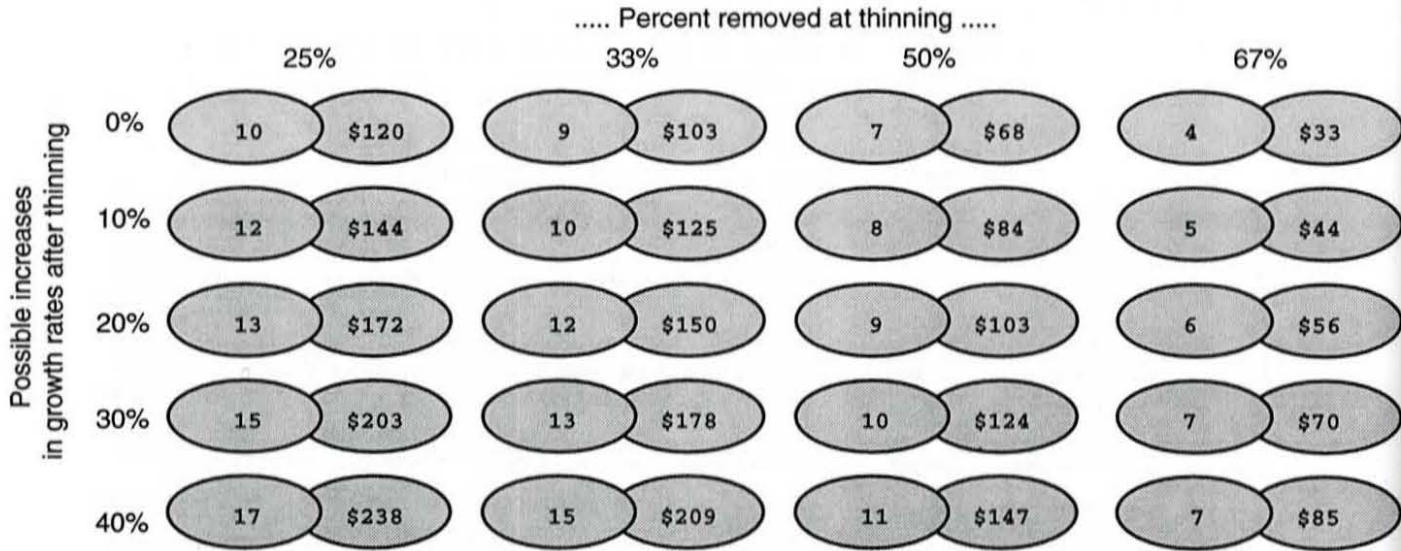
Management question ... Is a thinning @ 15 years advantageous?

For each of the three following merchantability percentage values- 50%, 70% & 90%, there is a set of ellipse pairs. Each set has 20 combinations of percent of yield removed and possible increases in residual growth rates. The first ellipse of a pair = { tons/acre with a thinning } - { 0 tons/acre with no thinning } for sawlog/veneer only. The second ellipse of a pair = { npv/acre with a thinning } - { \$73 npv/acre with no thinning } for all products. Shaded ellipses indicate situations where thinning may be advantageous. Unshaded ellipses indicate situations where thinning may not be advantageous.

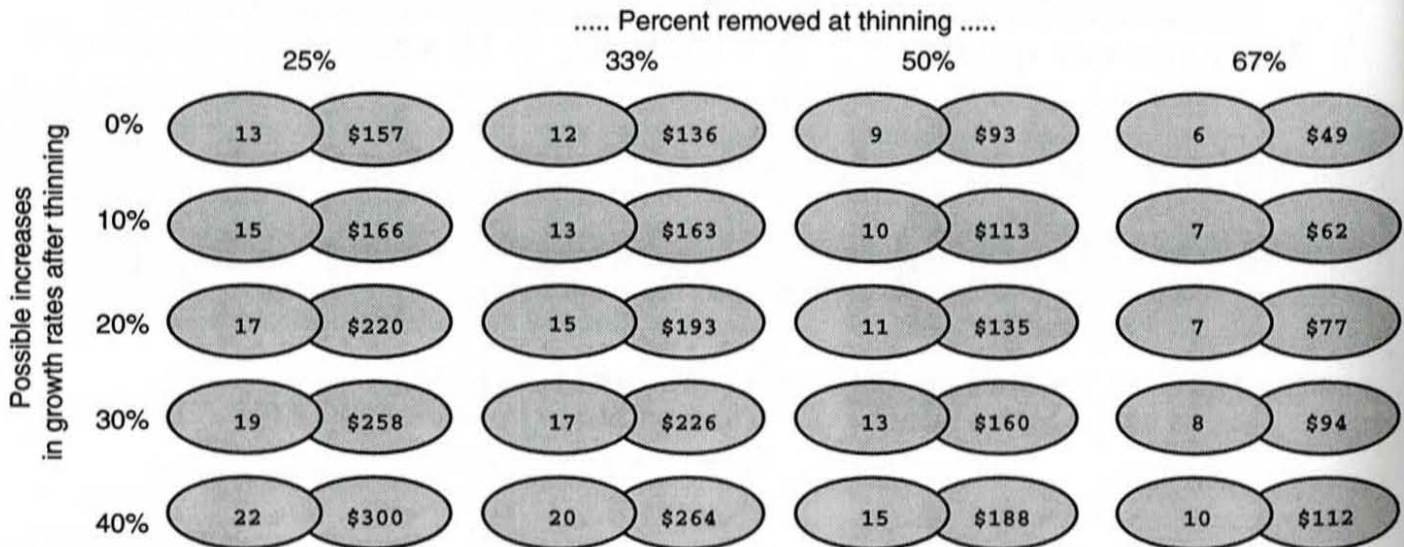
PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 50%



**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 70%**



**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 90%**



Answers to Management Question...

On this relatively low productivity site with moderate trees per acre, a thinning has an advantage.

A SLASH PINE PLANTATION IN EAST TEXAS

WITH

- SITE INDEX BASE AGE 25 YRS = 50'
- TREES PER ACRE @ 5 YRS = 700
- PERCENT OF TREES WITH FUSIFORM RUST ON STEM = 50%
- INTEREST PERCENT = 6%
- INFLATION PERCENT = 2%
- STUMPAGE PRICE PER TON FOR PULPWOOD = \$10
- STUMPAGE PRICE PER TON FOR SAWLOG/VENEER = \$50

...One Possible Plantation Management Plan...

...Establish...

...Grow...

...Final harvest of pulpwood and sawlog/veneer at 30 yrs ...

...This Plan with no thinning is expected to produce...

...0 tons/acre of sawlog/veneer timber...

...Net present value of all products is \$73/acre...

...Another Possible Plantation Management Plan...

...Establish...

...Grow...

...Pulpwood thin at 15 yrs ...

...Grow residual...

...Final harvest of residual pulpwood and sawlog/veneer at 30 yrs...

Management question ... Is a thinning @ 15 years advantageous?

For each of the three following merchantability percentage values- 50%, 70% & 90%, there is a set of ellipse pairs. Each set has 20 combinations of percent of yield removed and possible increases in residual growth rates. The first ellipse of a pair = { tons/acre with a thinning } - { 0 tons/acre with no thinning } for sawlog/veneer only. The second ellipse of a pair = { npv/acre with a thinning } - { \$73 npv/acre with no thinning } for all products. Shaded ellipses indicate situations where thinning may be advantageous. Unshaded ellipses indicate situations where thinning may not be advantageous.

PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST

THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 50%

..... Percent removed at thinning

25%

33%

50%

67%

Possible increases
in growth rates after thinning

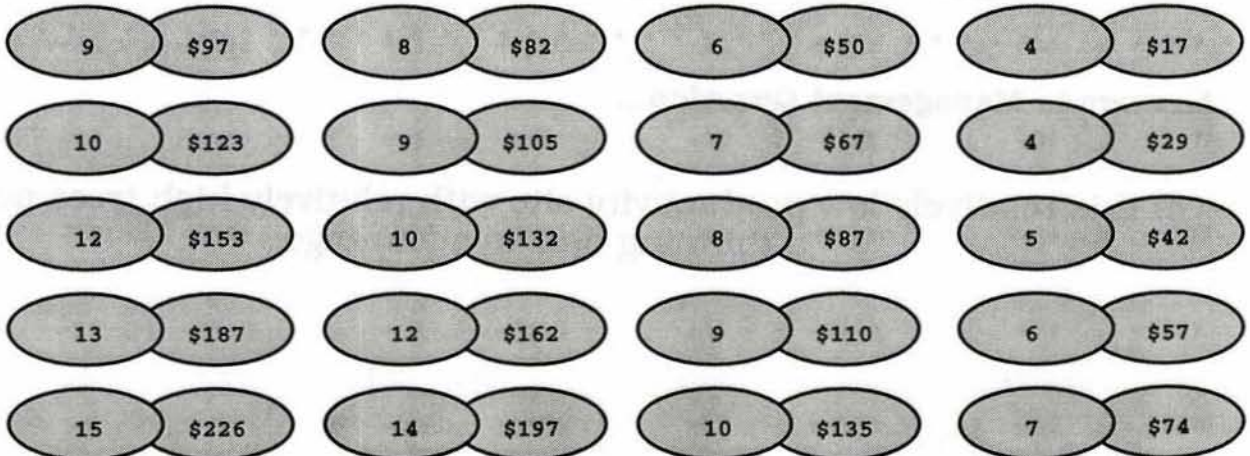
0%

10%

20%

30%

40%



**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 70%**

..... Percent removed at thinning

Possible increases in growth rates after thinning	25%		33%		50%		67%	
	0%	12	\$141	11	\$121	8	\$79	5
10%	14	\$174	12	\$150	9	\$101	6	\$51
20%	16	\$211	14	\$184	11	\$126	7	\$67
30%	19	\$255	17	\$223	12	\$154	8	\$86
40%	22	\$304	19	\$267	14	\$187	9	\$108

**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 90%**

..... Percent removed at thinning

Possible increases in growth rates after thinning	25%		33%		50%		67%	
	0%	16	\$184	14	\$160	10	\$108	7
10%	18	\$224	16	\$195	12	\$134	8	\$73
20%	21	\$270	19	\$236	14	\$165	9	\$93
30%	24	\$322	21	\$283	16	\$199	11	\$116
40%	28	\$382	25	\$336	19	\$239	12	\$142

Answers to Management Question...

On this relatively low productivity site with relatively high trees per acre,
a thinning has an advantage.

A SLASH PINE PLANTATION IN EAST TEXAS WITH

- SITE INDEX BASE AGE 25 YRS = 70'
- TREES PER ACRE @ 5 YRS = 300
- PERCENT OF TREES WITH FUSIFORM RUST ON STEM = 50%
- INTEREST PERCENT = 6%
- INFLATION PERCENT = 2%
- STUMPAGE PRICE PER TON FOR PULPWOOD = \$10
- STUMPAGE PRICE PER TON FOR SAWLOG/VENEER = \$50

...One Possible Plantation Management Plan...

...Establish...

...Grow...

...Final harvest of pulpwood and sawlog/veneer at 30 yrs ...

...This Plan with no thinning is expected to produce...

...33 tons/acre of sawlog/veneer timber...

...Net present value of all products is \$566/acre...

...Another Possible Plantation Management Plan...

...Establish...

...Grow...

...Pulpwood thin at 15 yrs ...

...Grow residual...

...Final harvest of residual pulpwood and sawlog/veneer at 30 yrs...

Management question ... Is a thinning @ 15 years advantageous?

For each of the three following merchantability percentage values- 50%, 70% & 90%, there is a set of ellipse pairs. Each set has 20 combinations of percent of yield removed and possible increases in residual growth rates. The first ellipse of a pair = { tons/acre with a thinning } - { 33 tons/acre with no thinning } for sawlog/veneer only. The second ellipse of a pair = { npv/acre with a thinning } - { \$566 npv/acre with no thinning } for all products. Shaded ellipses indicate situations where thinning may be advantageous. Unshaded ellipses indicate situations where thinning may not be advantageous.

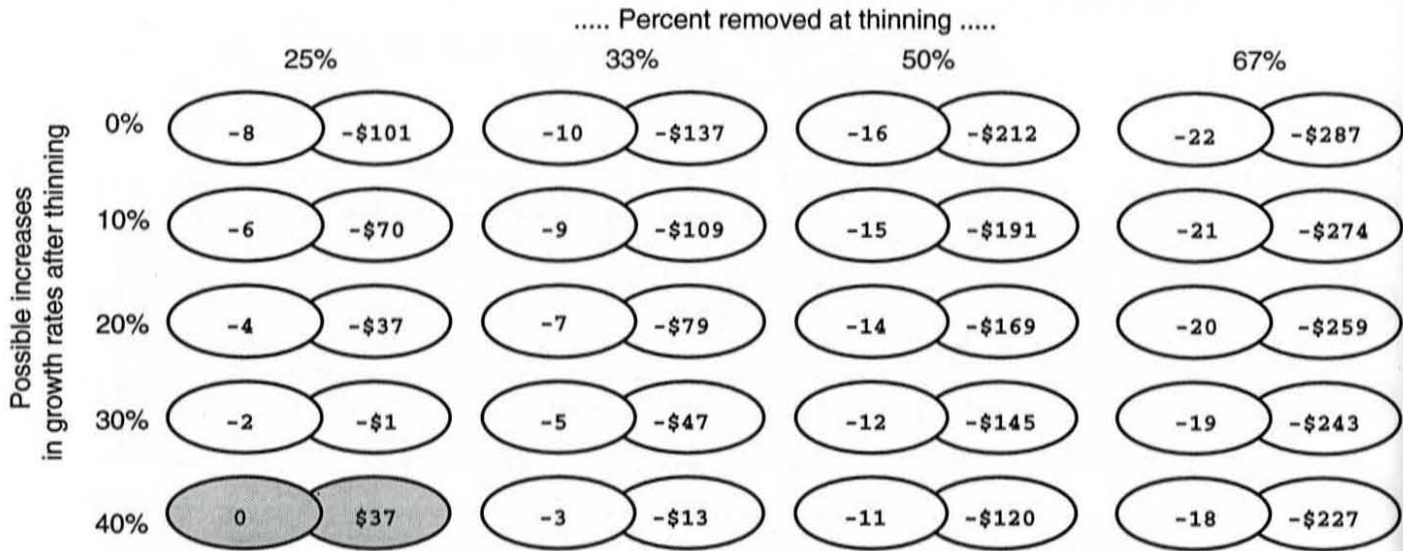
PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 50%

..... Percent removed at thinning

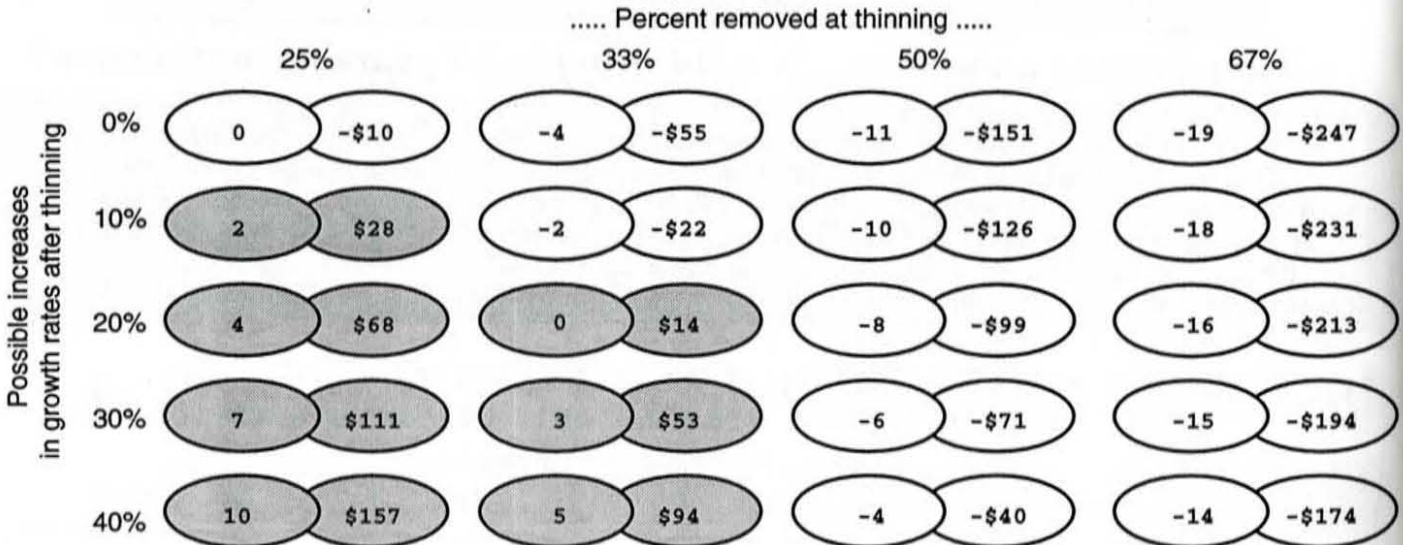
	25%	33%	50%	67%
0%	(-15, -\$192)	(-17, -\$218)	(-21, -\$273)	(-25, -\$327)
10%	(-14, -\$167)	(-16, -\$196)	(-20, -\$256)	(-24, -\$317)
20%	(-12, -\$141)	(-14, -\$172)	(-19, -\$239)	(-24, -\$305)
30%	(-11, -\$113)	(-13, -\$147)	(-18, -\$220)	(-23, -\$293)
40%	(-9, -\$83)	(-12, -\$120)	(-17, -\$200)	(-22, -\$280)

Possible increases in growth rates after thinning

**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 70%**



**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 90%**



Answers to Management Question...

On this average productivity site with relatively low trees per acre, a thinning tends to have no advantage.

However, a higher expected tree quality is helpful.

A SLASH PINE PLANTATION IN EAST TEXAS WITH

- SITE INDEX BASE AGE 25 YRS = 70'
- TREES PER ACRE @ 5 YRS = 500
- PERCENT OF TREES WITH FUSIFORM RUST ON STEM = 50%
- INTEREST PERCENT = 6%
- INFLATION PERCENT = 2%
- STUMPAGE PRICE PER TON FOR PULPWOOD = \$10
- STUMPAGE PRICE PER TON FOR SAWLOG/VENEER = \$50

...One Possible Plantation Management Plan...
 ...Establish...
 ...Grow...
 ...Final harvest of pulpwood and sawlog/veneer at 30 yrs ...
 ...This Plan with no thinning is expected to produce...
 ...39 tons/acre of sawlog/veneer timber...
 ...Net present value of all products is \$699/acre...

...Another Possible Plantation Management Plan...
 ...Establish...
 ...Grow...
 ...Pulpwood thin at 15 yrs ...
 ...Grow residual...
 ...Final harvest of residual pulpwood and sawlog/veneer at 30 yrs...

Management question ... Is a thinning @ 15 years advantageous?

For each of the three following merchantability percentage values- 50%, 70% & 90%, there is a set of ellipse pairs. Each set has 20 combinations of percent of yield removed and possible increases in residual growth rates. The first ellipse of a pair = { tons/acre with a thinning } - {39 tons/acre with no thinning } for sawlog/veneer only. The second ellipse of a pair = { npv/acre with a thinning } - { \$699 npv/acre with no thinning } for all products. Shaded ellipses indicate situations where thinning may be advantageous. Unshaded ellipses indicate situations where thinning may not be advantageous.

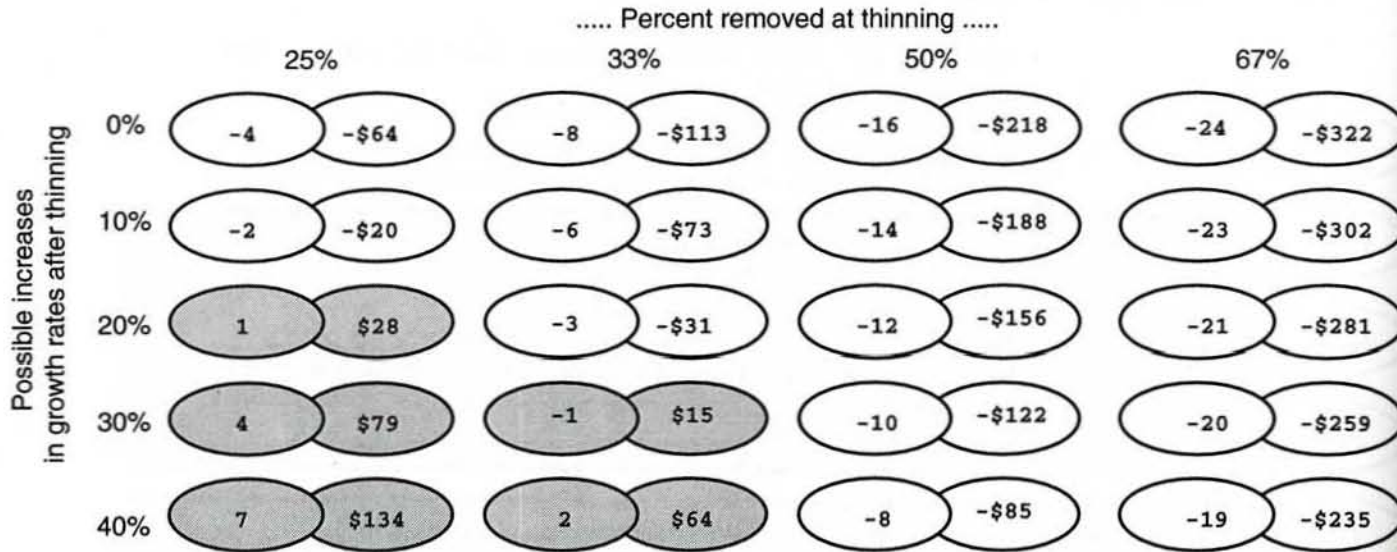
PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 50%

..... Percent removed at thinning

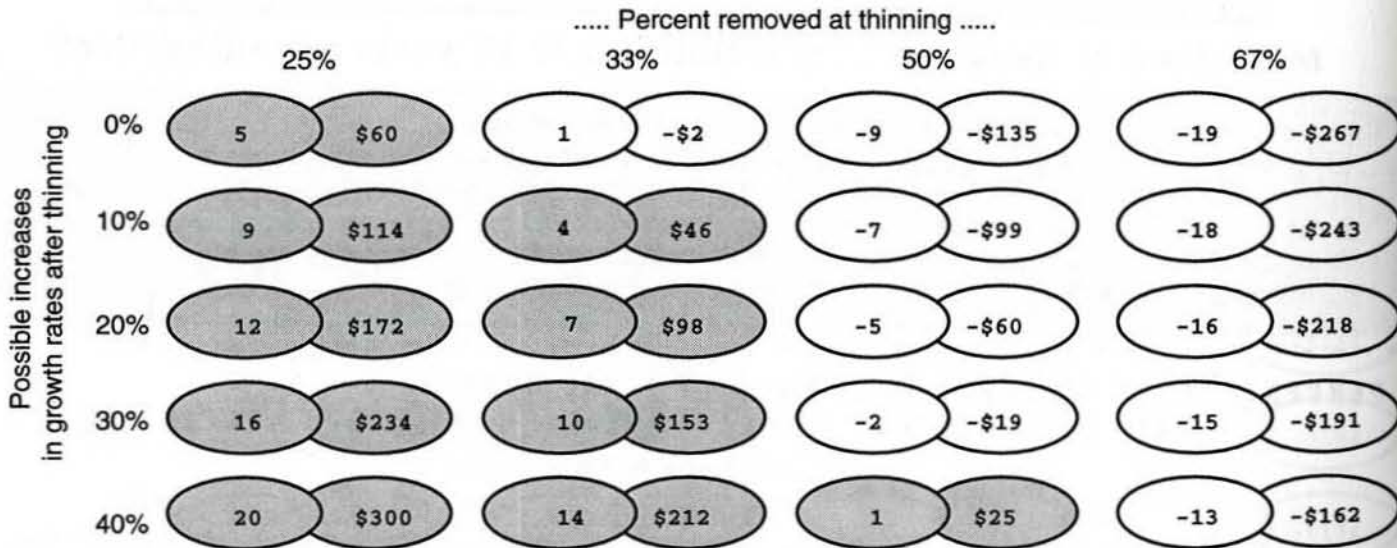
	25%	33%	50%	67%
0%	(-14, -\$189)	(-17, -\$225)	(-23, -\$301)	(-28, -\$377)
10%	(-12, -\$153)	(-15, -\$193)	(-21, -\$277)	(-27, -\$361)
20%	(-10, -\$116)	(-13, -\$159)	(-20, -\$252)	(-26, -\$345)
30%	(-8, -\$75)	(-12, -\$123)	(-19, -\$225)	(-25, -\$327)
40%	(-6, -\$32)	(-10, -\$85)	(-17, -\$196)	(-24, -\$308)

Possible increases in growth rates after thinning

**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 70%**



**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 90%**



Answers to Management Question...

On this average productivity site with moderate trees per acre, a thinning tends to have no advantage.

However, a higher expected tree quality is helpful.

A SLASH PINE PLANTATION IN EAST TEXAS WITH

- SITE INDEX BASE AGE 25 YRS = 70'
- TREES PER ACRE @ 5 YRS = 700
- PERCENT OF TREES WITH FUSIFORM RUST ON STEM = 50%
- INTEREST PERCENT = 6%
- INFLATION PERCENT = 2%
- STUMPAGE PRICE PER TON FOR PULPWOOD = \$10
- STUMPAGE PRICE PER TON FOR SAWLOG/VENEER = \$50

...One Possible Plantation Management Plan...

...Establish...

...Grow...

...Final harvest of pulpwood and sawlog/veneer at 30 yrs ...

...This Plan with no thinning is expected to produce...

... 42 tons/acre of sawlog/veneer timber...

...Net present value of all products is \$780/acre...

...Another Possible Plantation Management Plan...

...Establish...

...Grow...

...Pulpwood thin at 15 yrs ...

...Grow residual...

...Final harvest of residual pulpwood and sawlog/veneer at 30 yrs...

Management question ... Is a thinning @ 15 years advantageous?

For each of the three following merchantability percentage values- 50%, 70% & 90%, there is a set of ellipse pairs. Each set has 20 combinations of percent of yield removed and possible increases in residual growth rates. The first ellipse of a pair = { tons/acre with a thinning } - {42 tons/acre with no thinning } for sawlog/veneer only. The second ellipse of a pair = { npv/acre with a thinning } - { \$780 npv/acre with no thinning } for all products. Shaded ellipses indicate situations where thinning may be advantageous. Unshaded ellipses indicate situations where thinning may not be advantageous.

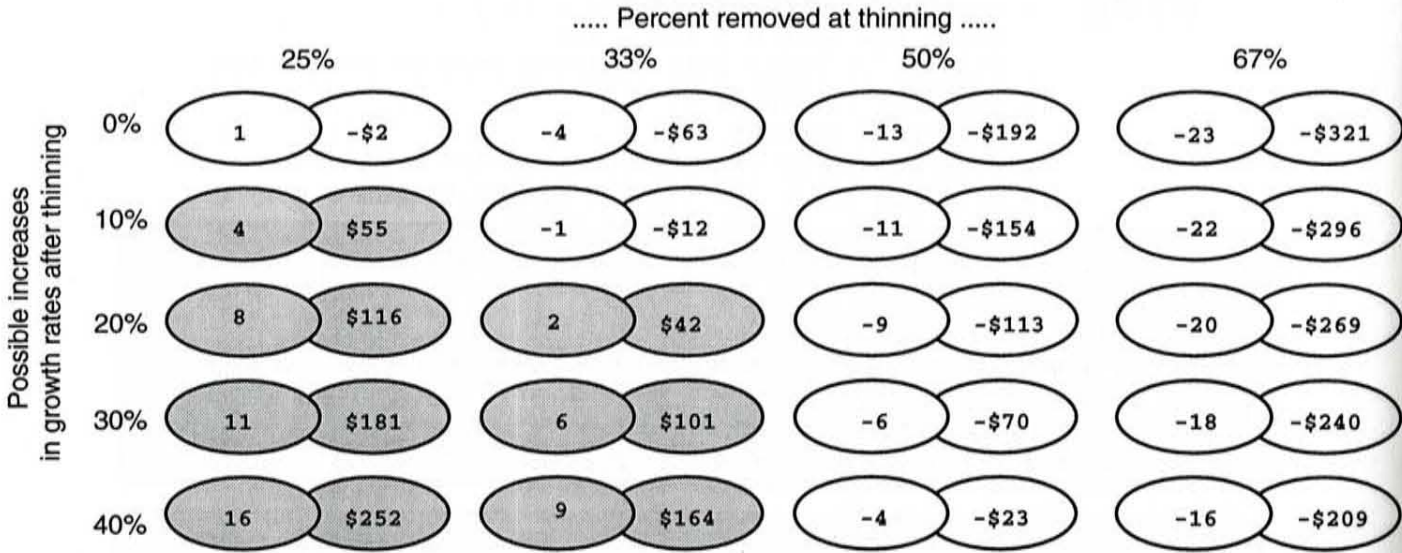
PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 50%

..... Percent removed at thinning

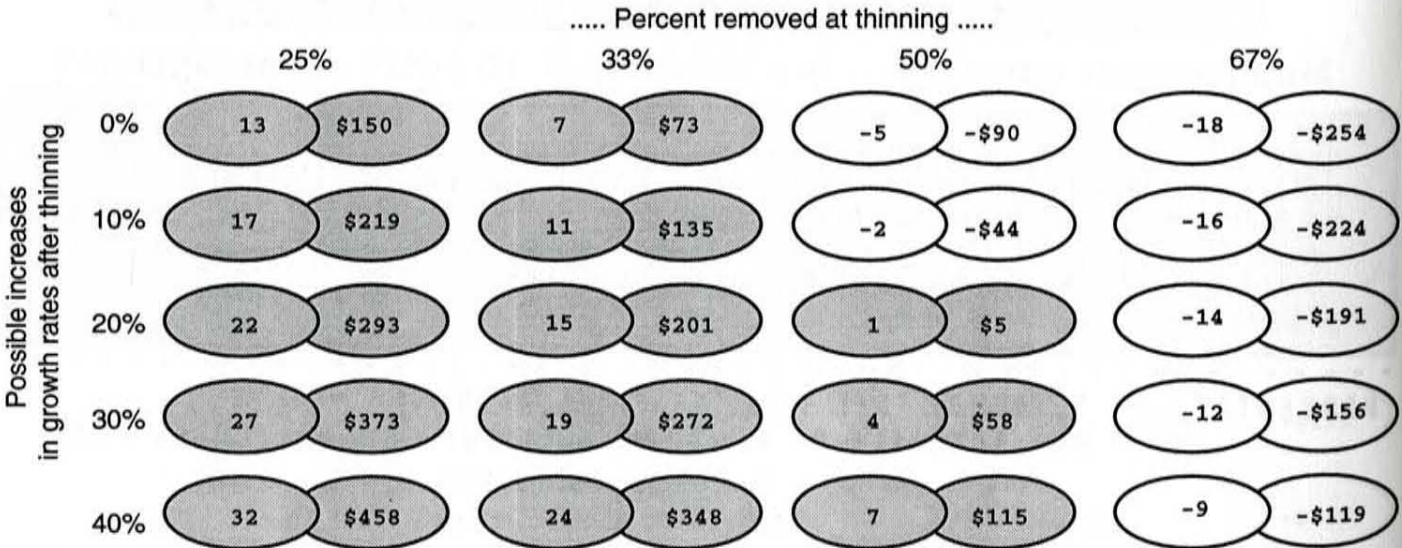
	25%	33%	50%	67%
0%	(-11, -\$155)	(-15, -\$200)	(-21, -\$294)	(-28, -\$388)
10%	(-9, -\$110)	(-12, -\$159)	(-20, -\$264)	(-27, -\$369)
20%	(-6, -\$62)	(-10, -\$116)	(-18, -\$232)	(-26, -\$347)
30%	(-4, -\$10)	(-8, -\$70)	(-16, -\$197)	(-25, -\$325)
40%	(-1, \$45)	(-5, -\$20)	(-14, -\$160)	(-24, -\$300)

Possible increases in growth rates after thinning

**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 70%**



**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 90%**



Answers to Management Question...

On this average productivity site with relatively high trees per acre, a thinning tends to have no advantage.

However, a higher expected tree quality is helpful.

A SLASH PINE PLANTATION IN EAST TEXAS WITH

- SITE INDEX BASE AGE 25 YRS = 90'
- TREES PER ACRE @ 5 YRS = 300
- PERCENT OF TREES WITH FUSIFORM RUST ON STEM = 50%
- INTEREST PERCENT = 6%
- INFLATION PERCENT = 2%
- STUMPAGE PRICE PER TON FOR PULPWOOD = \$10
- STUMPAGE PRICE PER TON FOR SAWLOG/VENEER = \$50

...One Possible Plantation Management Plan...

...Establish...

...Grow...

...Final harvest of pulpwood and sawlog/veneer at 30 yrs ...

...This Plan with no thinning is expected to produce...

...186 tons/acre of sawlog/veneer timber...

...Net present value of all products is \$1,405/acre...

...Another Possible Plantation Management Plan...

...Establish...

...Grow...

...Pulpwood thin at 15 yrs ...

...Grow residual...

...Final harvest of residual pulpwood and sawlog/veneer at 30 yrs...

Management question ... Is a thinning @ 15 years advantageous?

For each of the three following merchantability percentage values- 50%, 70% & 90%, there is a set of ellipse pairs. Each set has 20 combinations of percent of yield removed and possible increases in residual growth rates.

The first ellipse of a pair = { tons/acre with a thinning } - {86 tons/acre with no thinning } for sawlog/veneer only.

The second ellipse of a pair = { npv/acre with a thinning } - { \$1,405 npv/acre with no thinning } for all products.

Shaded ellipses indicate situations where thinning may be advantageous.

Unshaded ellipses indicate situations where thinning may not be advantageous.

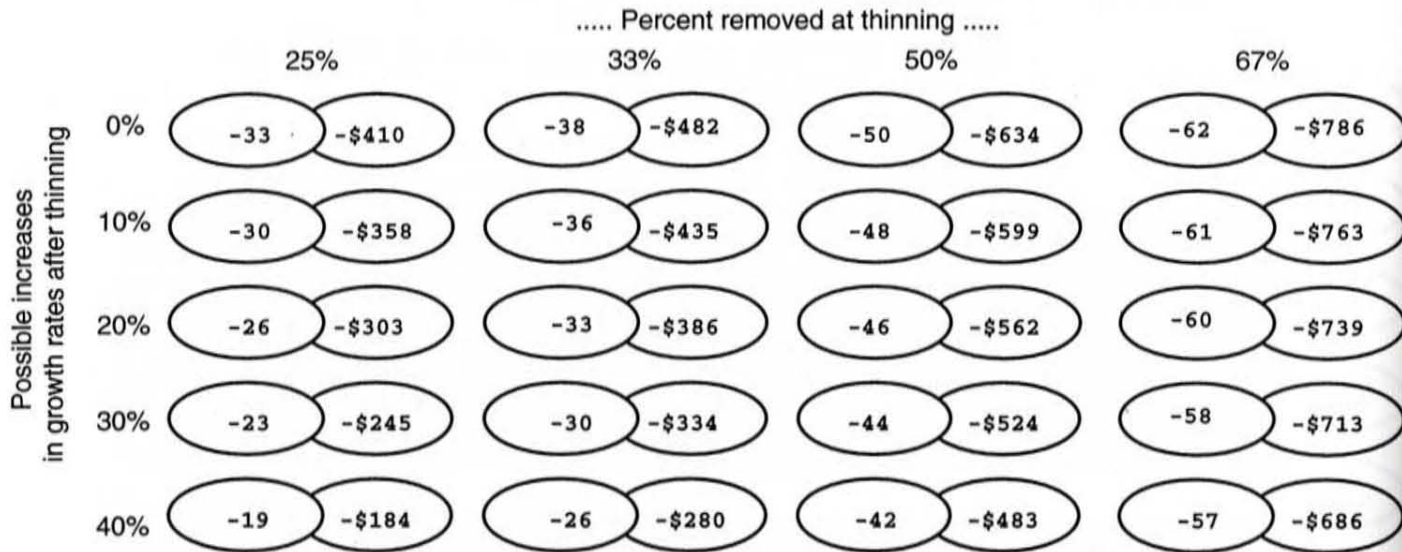
PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 50%

..... Percent removed at thinning

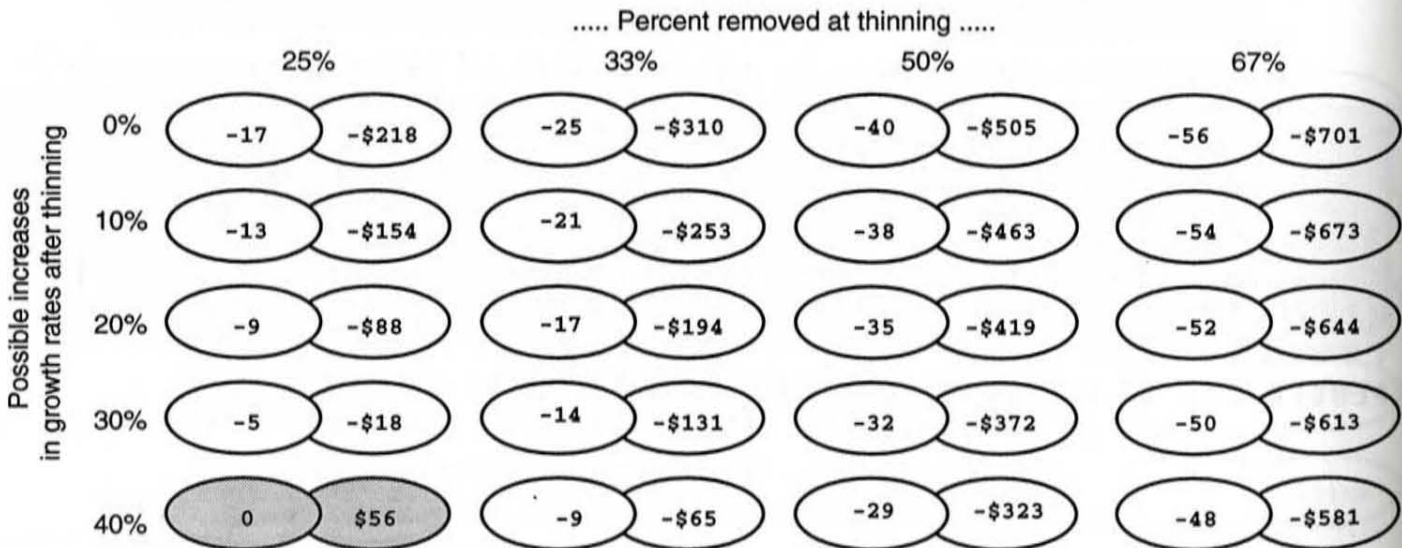
	25%	33%	50%	67%
0%	(-48) (-\$602)	(-52) (-\$653)	(-61) (-\$762)	(-69) (-\$870)
10%	(-46) (-\$561)	(-50) (-\$617)	(-59) (-\$734)	(-68) (-\$852)
20%	(-43) (-\$518)	(-48) (-\$578)	(-58) (-\$705)	(-67) (-\$833)
30%	(-41) (-\$472)	(-46) (-\$537)	(-56) (-\$675)	(-66) (-\$813)
40%	(-38) (-\$424)	(-43) (-\$494)	(-54) (-\$643)	(-65) (-\$792)

Possible increases
in growth rates after thinning

**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 70%**



**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 90%**



Answers to Management Question...

On this high productivity site with relatively low trees per acre, a thinning tends to have no advantage.

A SLASH PINE PLANTATION IN EAST TEXAS

WITH

- SITE INDEX BASE AGE 25 YRS = 90'
- TREES PER ACRE @ 5 YRS = 500
- PERCENT OF TREES WITH FUSIFORM RUST ON STEM = 50%
- INTEREST PERCENT = 6%
- INFLATION PERCENT = 2%
- STUMPAGE PRICE PER TON FOR PULPWOOD = \$10
- STUMPAGE PRICE PER TON FOR SAWLOG/VENEER = \$50

...One Possible Plantation Management Plan...

...Establish...

...Grow...

...Final harvest of pulpwood and sawlog/veneer at 30 yrs ...

...This Plan with no thinning is expected to produce...

...161 tons/acre of sawlog/veneer timber...

...Net present value of all products is \$1,905/acre...

...Another Possible Plantation Management Plan...

...Establish...

...Grow...

...Pulpwood thin at 15 yrs ...

...Grow residual...

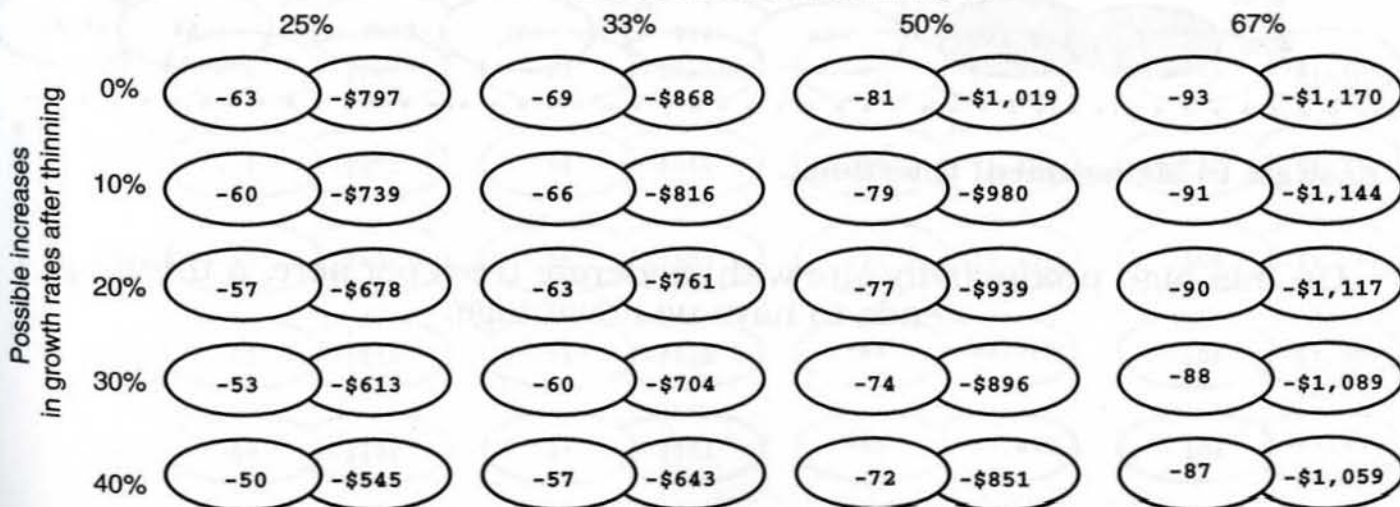
...Final harvest of residual pulpwood and sawlog/veneer at 30 yrs...

Management question ... Is a thinning @ 15 years advantageous?

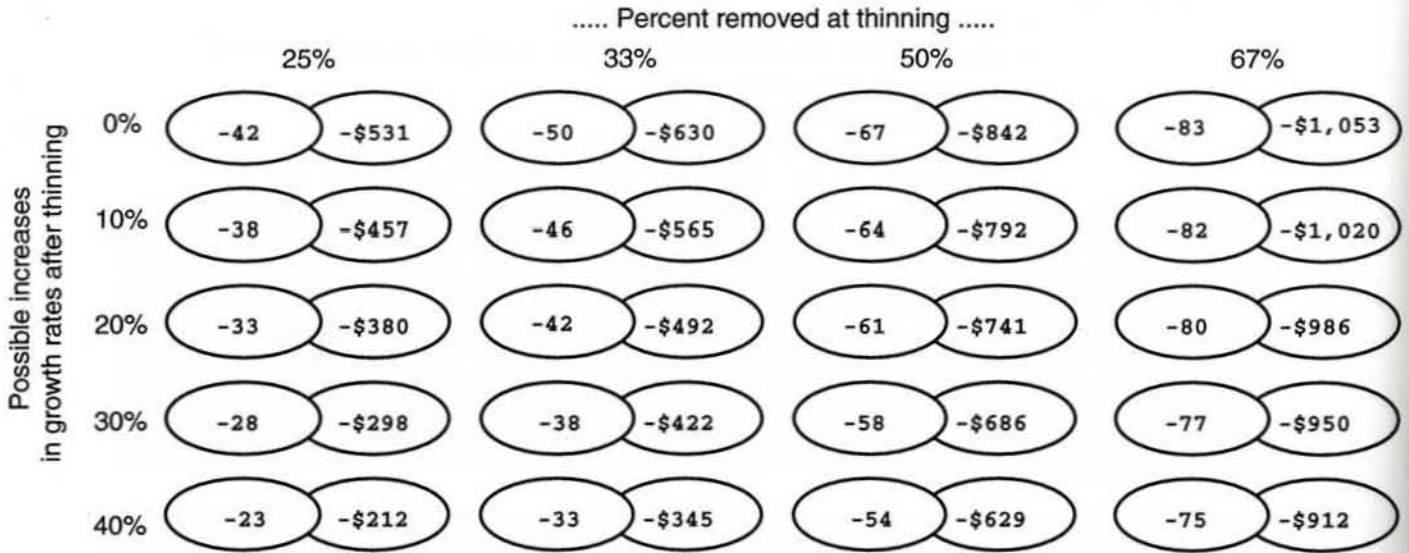
For each of the three following merchantability percentage values- 50%, 70% & 90%, there is a set of ellipse pairs. Each set has 20 combinations of percent of yield removed and possible increases in residual growth rates. The first ellipse of a pair = { tons/acre with a thinning } - {116 tons/acre with no thinning } for sawlog/veneer only. The second ellipse of a pair = { npv/acre with a thinning } - { \$1,905 npv/acre with no thinning } for all products. Shaded ellipses indicate situations where thinning may be advantageous. Unshaded ellipses indicate situations where thinning may not be advantageous.

PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 50%

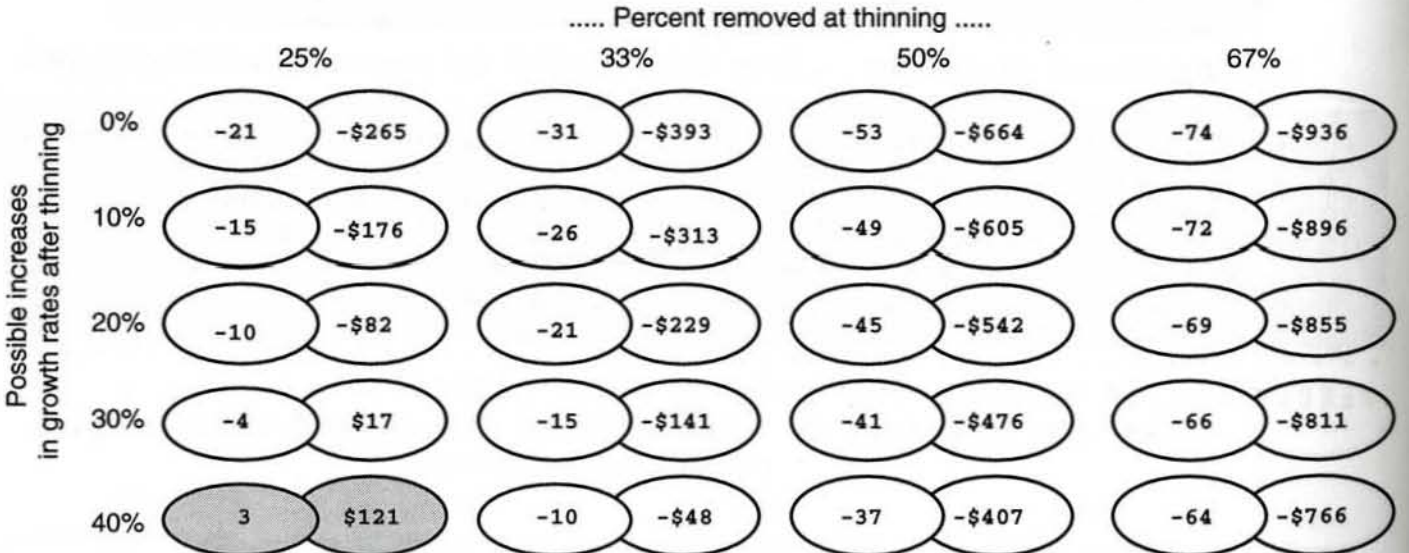
..... Percent removed at thinning



**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 70%**



**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 90%**



Answers to Management Question...

On this high productivity site with moderate trees per acre, a thinning tends to have no advantage.

A SLASH PINE PLANTATION IN EAST TEXAS

WITH

- SITE INDEX BASE AGE 25 YRS = 90'
- TREES PER ACRE @ 5 YRS = 700
- PERCENT OF TREES WITH FUSIFORM RUST ON STEM = 50%
- INTEREST PERCENT = 6%
- INFLATION PERCENT = 2%
- STUMPAGE PRICE PER TON FOR PULPWOOD = \$10
- STUMPAGE PRICE PER TON FOR SAWLOG/VENEER = \$50

...One Possible Plantation Management Plan...

...Establish...

...Grow...

...Final harvest of pulpwood and sawlog/veneer at 30 yrs ...

...This Plan with no thinning is expected to produce...

...140 ton/acre of sawlog/veneer timber...

...Net present value of all products is \$2,315...

...Another Possible Plantation Management Plan...

...Establish...

...Grow...

...Pulpwood thin at 15 yrs ...

...Grow residual...

...Final harvest of residual pulpwood and sawlog/veneer at 30 yrs...

Management question ... Is a thinning @ 15 years advantageous?

For each of the three following merchantability percentage values- 50%, 70% & 90%, there is a set of ellipse pairs. Each set has 20 combinations of percent of yield removed and possible increases in residual growth rates. The first ellipse of a pair = { tons/acre with a thinning } - {140 tons/acre with no thinning } for sawlog/veneer only. The second ellipse of a pair = { npv/acre with a thinning } - { \$1,315 npv/acre with no thinning } for all products. Shaded ellipses indicate situations where thinning may be advantageous. Unshaded ellipses indicate situations where thinning may not be advantageous.

PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST

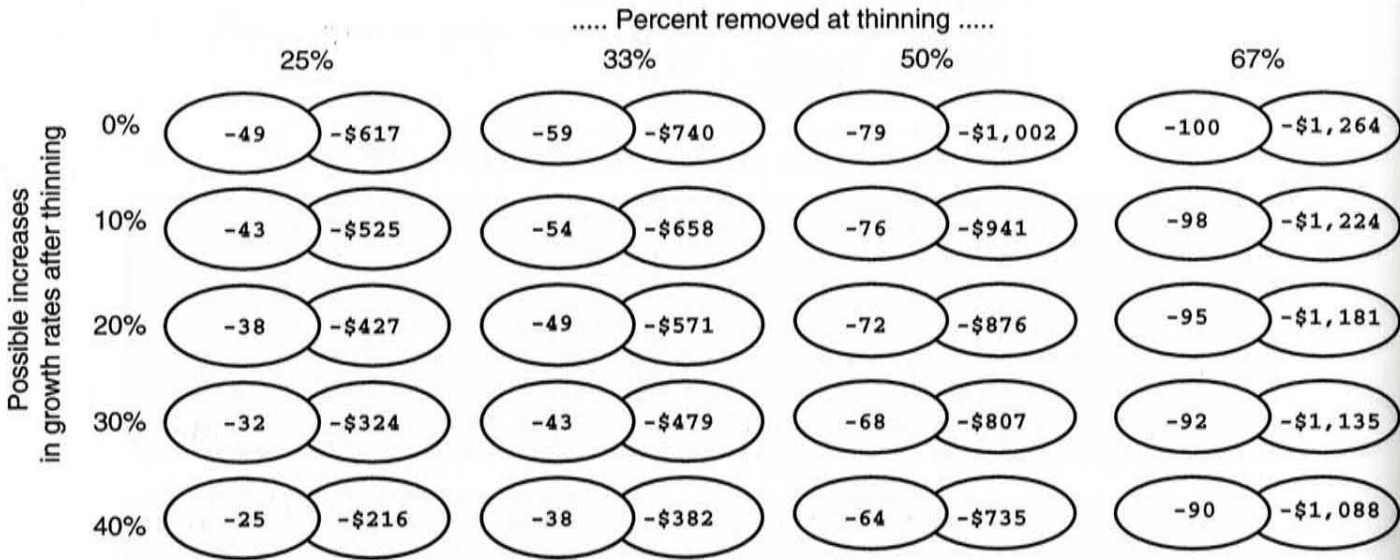
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 50%

..... Percent removed at thinning

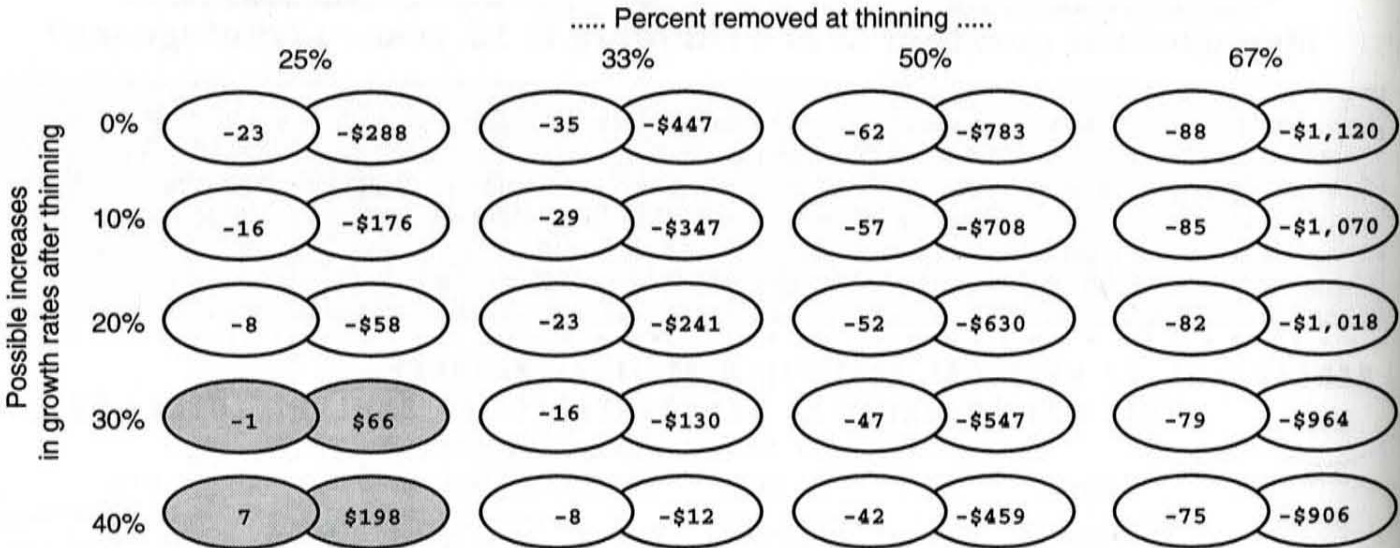
	25%	33%	50%	67%
0%	(-75) (-\$946)	(-82) (-\$1,034)	(-97) (-\$1,222)	(-111) (-\$1,409)
10%	(-71) (-\$873)	(-78) (-\$969)	(-94) (-\$1,173)	(-110) (-\$1,377)
20%	(-67) (-\$796)	(-75) (-\$900)	(-91) (-\$1,122)	(-108) (-\$1,343)
30%	(-63) (-\$715)	(-71) (-\$828)	(-88) (-\$1,067)	(-106) (-\$1,307)
40%	(-58) (-\$629)	(-67) (-\$751)	(-85) (-\$1,010)	(-104) (-\$1,269)

Possible increases
in growth rates after thinning

**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 70%**



**PERCENTAGE OF RESIDUAL TREE YIELD AT FINAL HARVEST
THAT MAY ACTUALLY BE MERCHANTABLE FOR SAWLOG/VENEER = 90%**



Answers to Management Question...

On this high productivity site with relatively high trees per acre, a thinning tends to have no advantage.