Continuing Project

Quantifying Silvicultural Treatment Effect on Lumber Quantity and Quality in Loblolly Pine

CAFS 21.88

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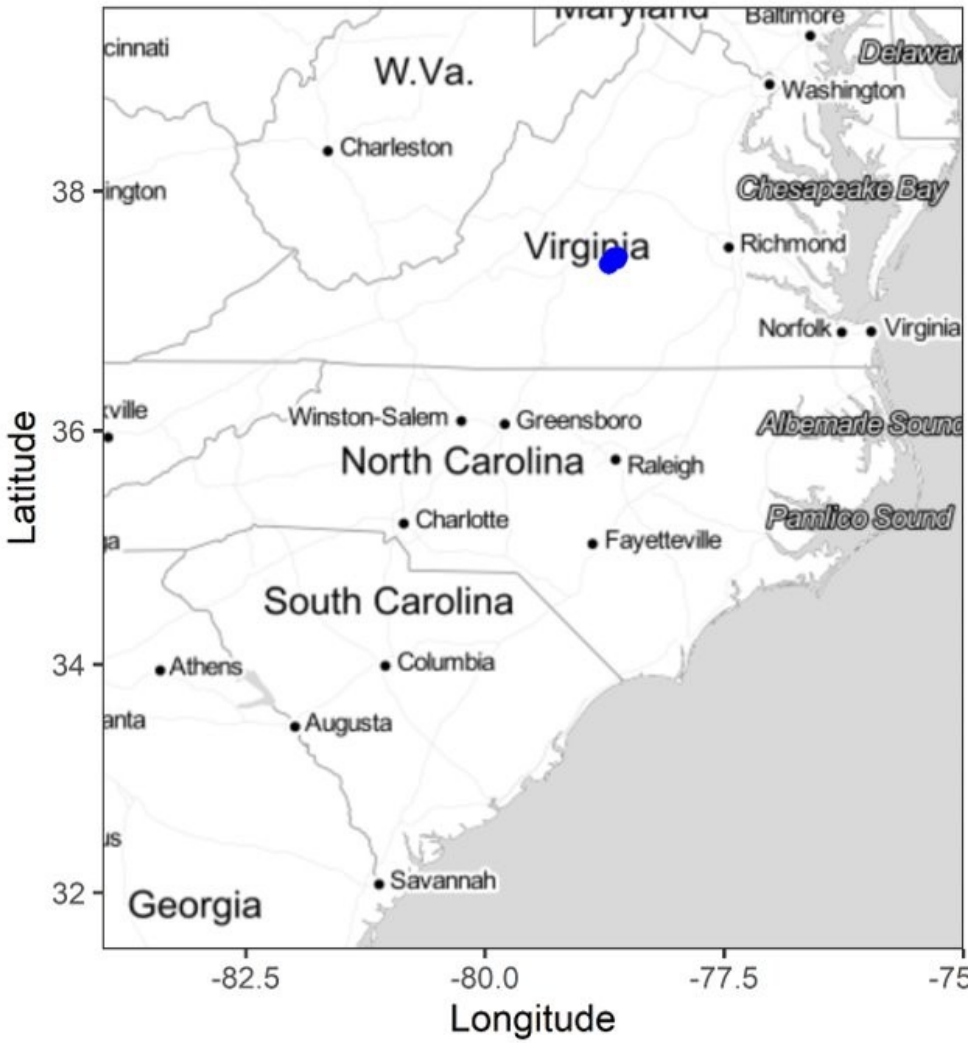
FMRC Intensively Managed Plantation (IMP) Trial

VIRGINIA TECH | FOREST MODELING RESEARCH COOPERATIVE

3 Treatments
A. Control
B. Light thinning
C. Heavy thinning with pruning in butt log

Treatments applied when trees reached 40-46 ft

105 Total Trees
5 Stands
7 Trees/Plot



Logs &
resulting lumber
tracked thru sawmill

- Treatment
- Stand
- Tree #
- Log #
- Position within log

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Lumber

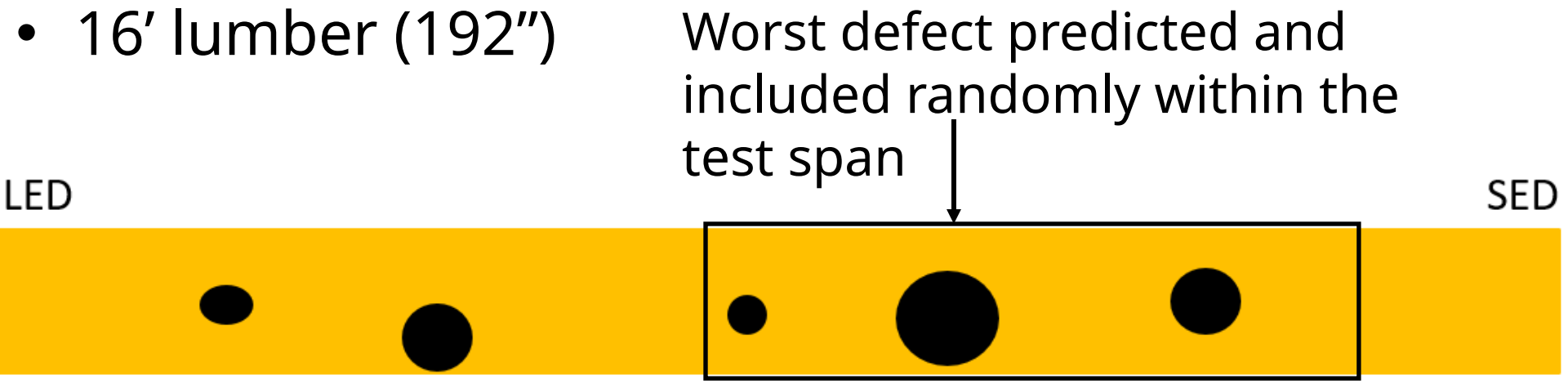
- Partnering mill only cuts 2×4 & 2×6 lumber
- 1099 total pieces cut
- Lumber left in 16.6’ lengths for tracking

- Lumber not graded or trimmed by mill

Lumber visually graded by certified SPIB graders in Athens
Ashley West, Daniel Carroll

Lumber Test Span

- ASTM testing standards
- Span to depth ratio of 17:1
- 2×4 span to depth = 59.5”
- 2×6 span = 93.5”
- 16’ lumber (192”)



Non-destructive Testing

Acoustic Velocity
Sound velocity via impact and microphone
Wood Density

MOEdyn = density * velocity^2

Lumber Imaging for Knots

Industry grading systems operate up to 4500 feet/second

UGA's setup is a little slower…

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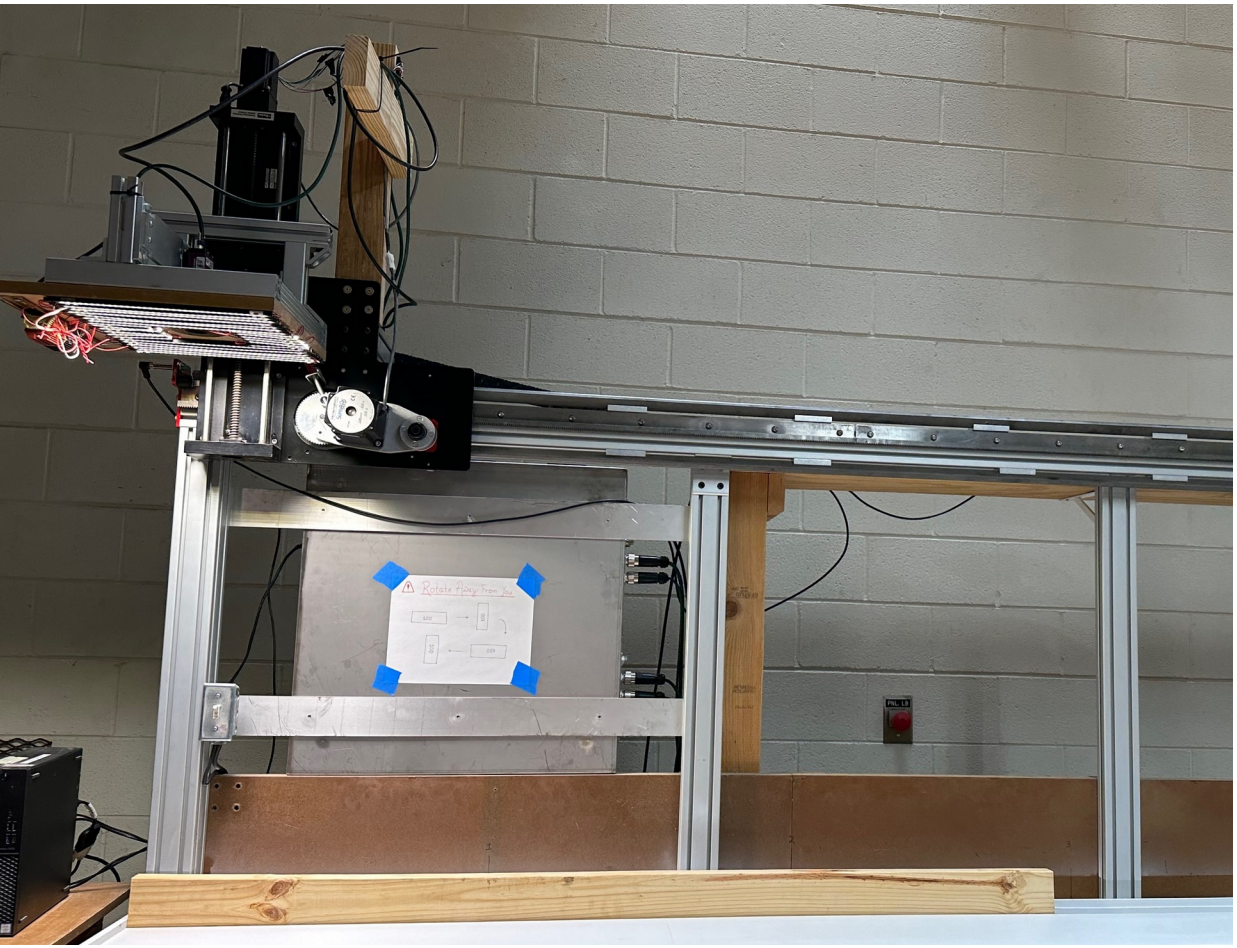
Lumber Imaging for Knots



>88,000 images with 4 sides of each piece images

Lumber Imaging for Knots – S.S. Grade

Lumber Imaging for Knots – No. 1 Grade

Lumber Imaging for Knots – No. 2 Grade

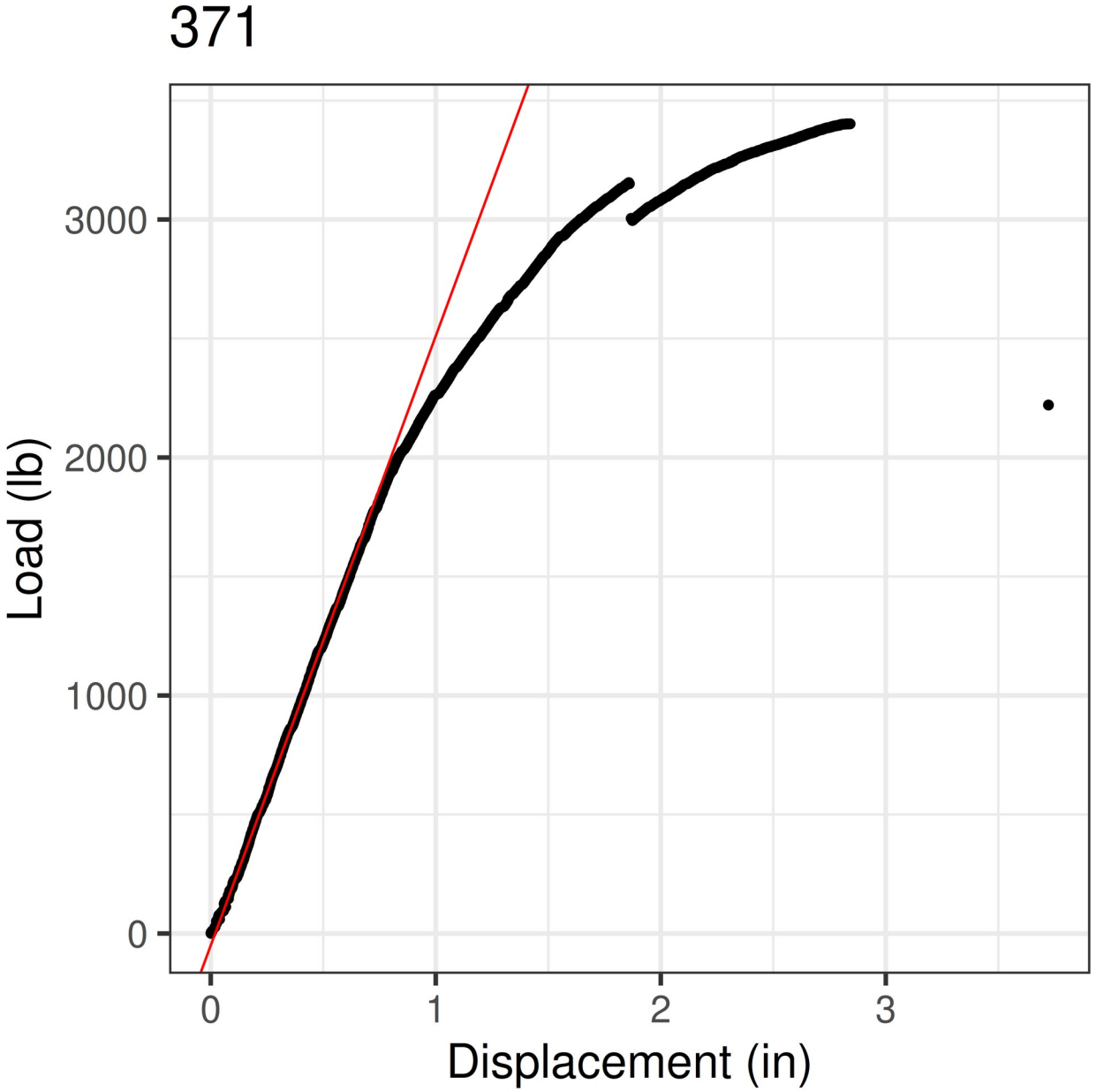
Lumber Imaging for Knots – No. 3 Grade

Lumber Imaging for Knots – No. 4 Grade

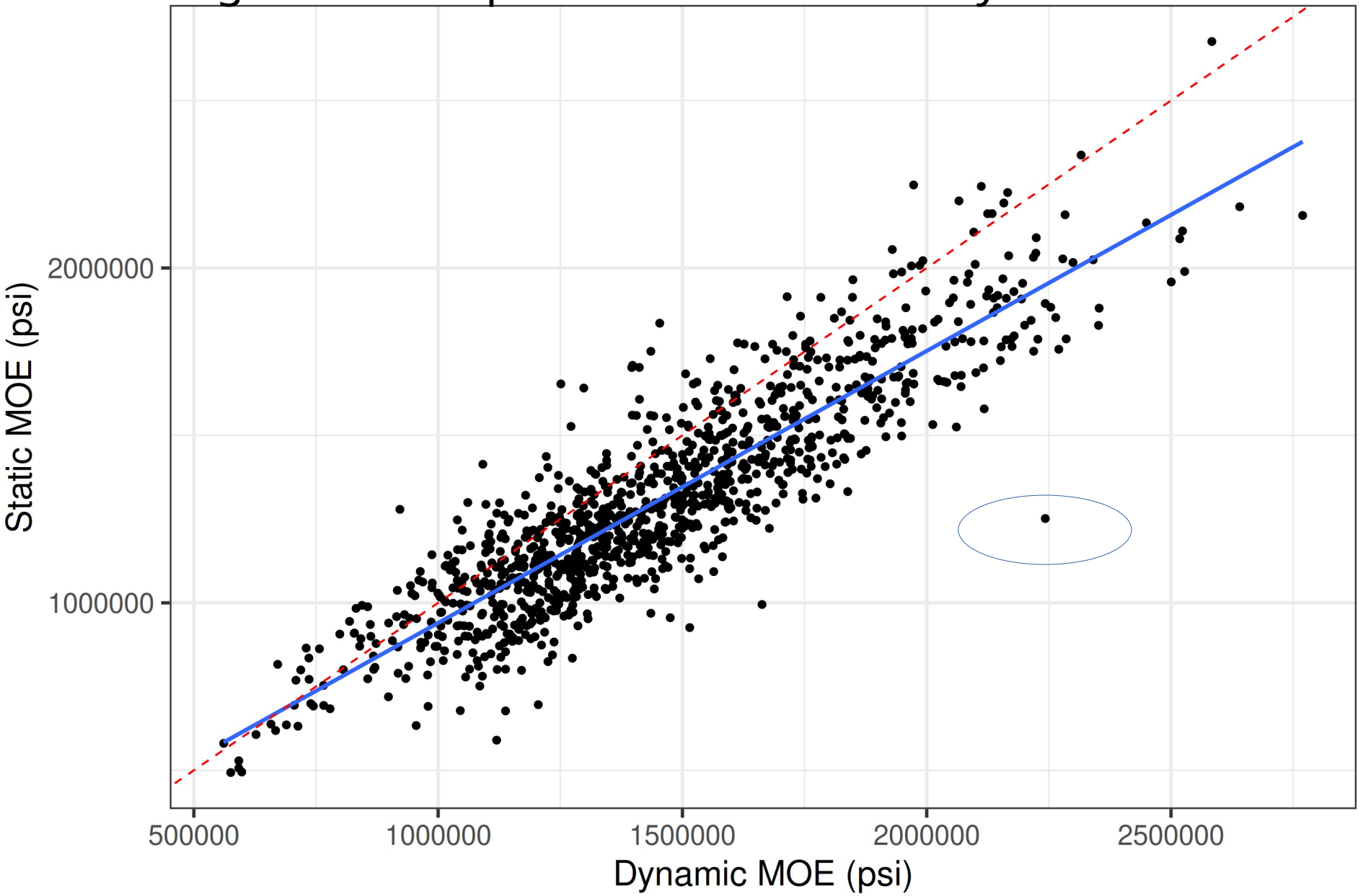
Destructive Testing

Destructive Testing

Destructive Testing



Strong relationship between static and dynamic MOE



The worst outlier for static vs dynamic MOE had few knots, high velocity, high SG, but a lot of wane

Lumber Grade by Treatment and Log Position
SS = 0, 1 = 1…

Treatment	Log 1	Log 2	Log 3
Control	1.50	1.93	2.25
Light Thinning	1.19	1.82	2.39
Heavy Thinning + Pruning	1.08	1.83	2.69

Static MOE_{15} (GPa) by Treatment and Log Position

Treatment	Log 1	Log 2	Log 3
Control	8.76	8.28	7.45
Light Thinning	9.33	8.31	7.40
Heavy Thinning + Pruning	8.89	7.85	6.80

Static MOE_{15} (GPa) by Treatment and Grade Light and Heavy Thinning significantly different

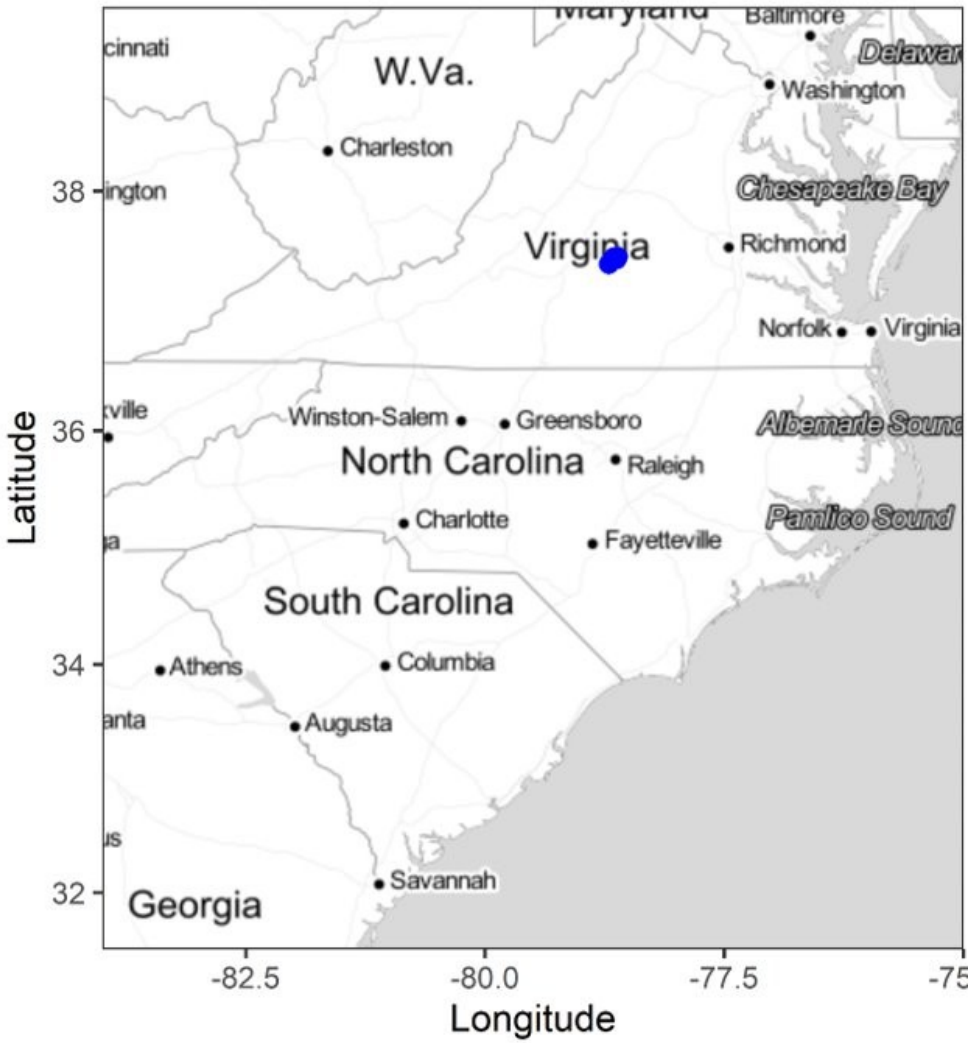
	Grade				
Treatment	**SS**	**No. 1**	**No. 2**	**No. 3**	**No. 4**
Control	9.97	8.64	8.35	7.21	7.32
Light Thinning	10.68	8.73	8.21	7.60	6.52
Heavy Thinning + Pruning	9.82	8.11	7.95	6.93	6.80

Treatments are different but we are bumping up to sample size limitation

3 Treatments
A. Control
B. Light thinning
C. Heavy thinning with pruning in butt log

Treatments applied when trees reached 40-46 ft

105 Total Trees -
35/treatment
5 Stands
7 Trees/Plot



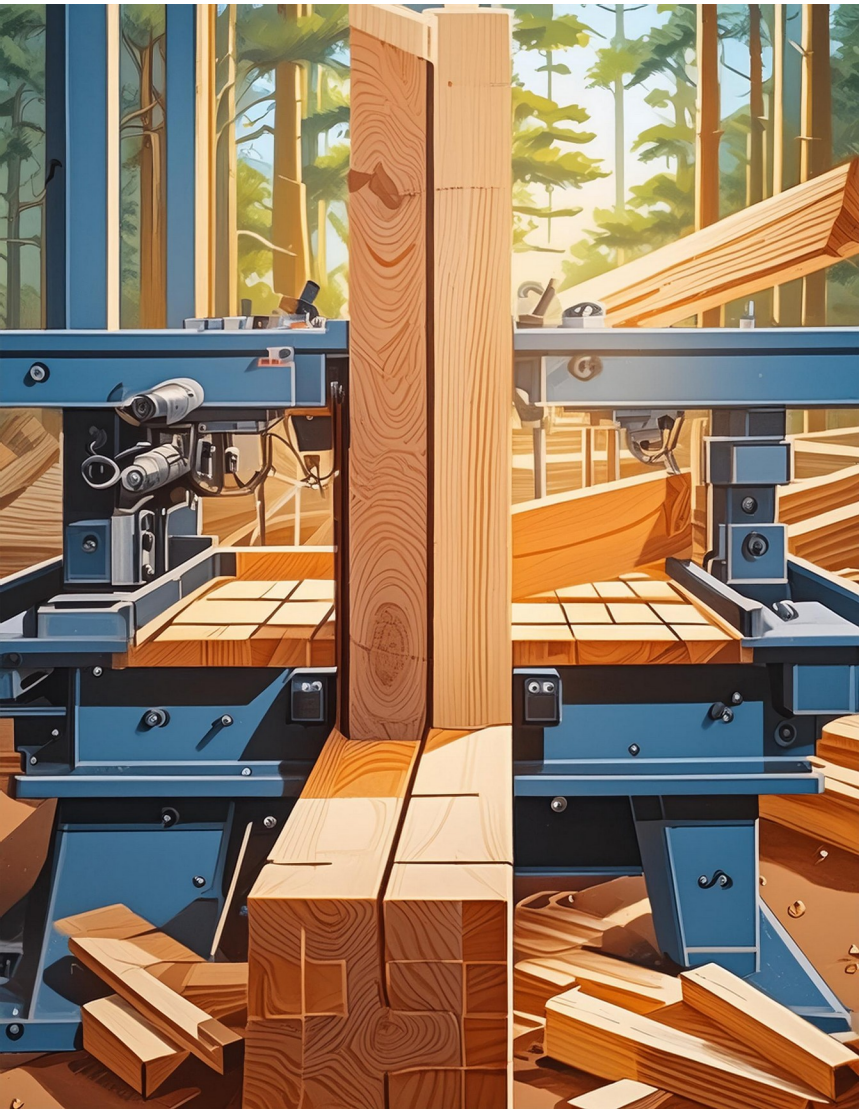
How to get more trees/treatment
How: hire stronger people!

How to get more trees/treatment
How: process the logs into lumber ourselves with new technology!

Deliverables and Company Benefits

- Lumber quality and quantity information as a result of silviculture from a designed experiment
- Evaluation on the impacts of 2 thinning regimes relative to no thinning

Thank You and Questions?



- NSF CAFS
- Wood Quality Consortium
- Forest Modeling Research Cooperative
- Plantation Management Research Cooperative
- Daniel Carroll and Ashlyn West from Southern Pine Inspection Bureau
- AI images via Adobe

Control Treatment
Unthinned

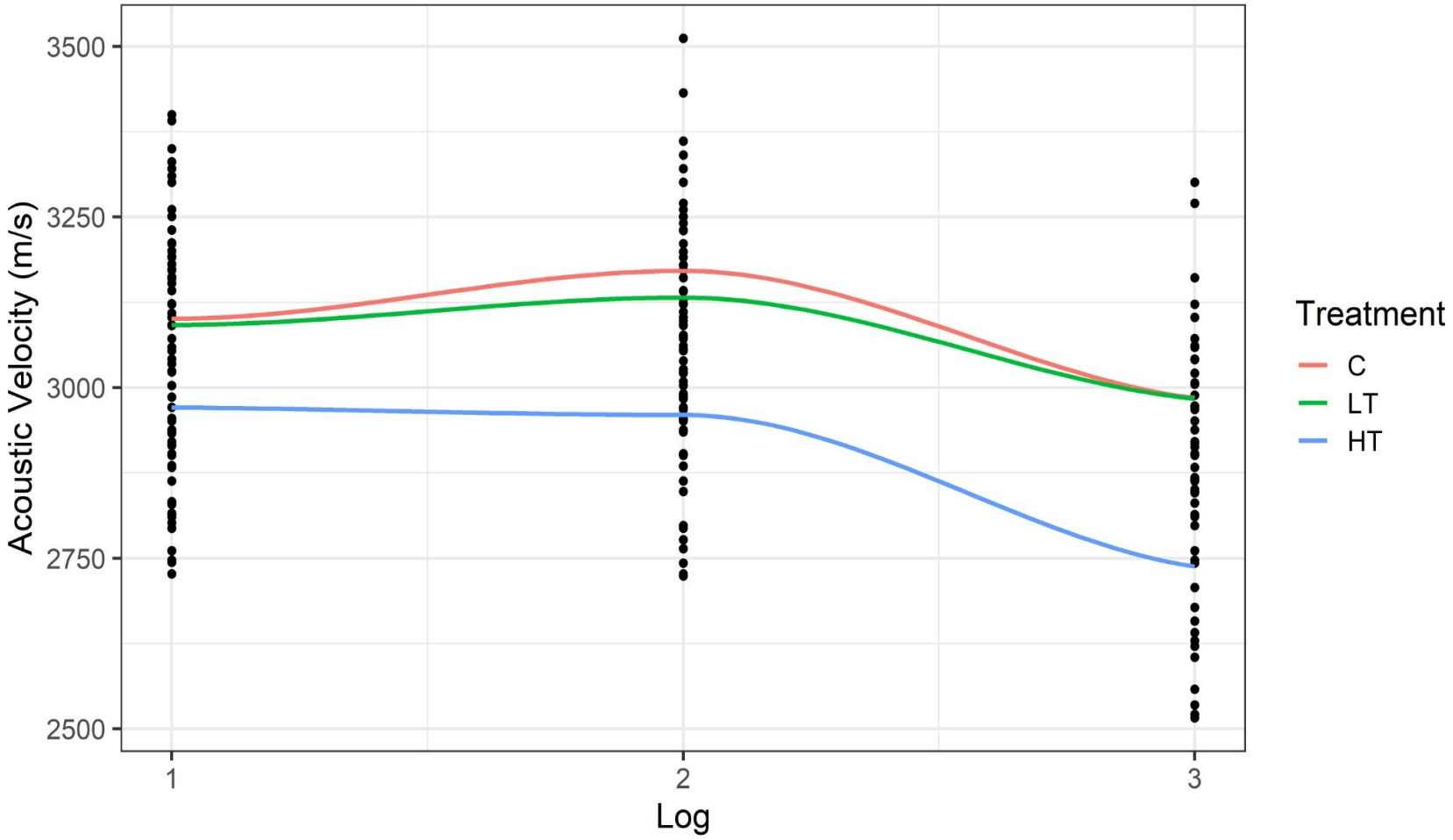
Light Thinning Treatment
~1/2 trees removed

Heavy Thinning Treatment + Butt Log Pruning
~¾ trees removed

Trees cut into 5 m logs

Disks collected for whole-disk and ring-by-ring properties at 0,5,10,15 m height levels

Log Acoustic Velocity by Treatment and Log Position



Log Acoustic Velocity by Treatment and Log Position

Treatment	# of Logs	Log 1 AV (m/s)	Log 2 AV (m/s)	Log 3 AV (m/s)
Control	82	3101	3171	2985
Light Thinning	91	3092	3132	2984
Heavy Thinning + Pruning	93	2971	2960	2738
Overall	266	3055	3086	2885

Lumber Yield by Treatment (Preliminary) FMRC scaling data to per acre basis

	2x4		2x6	
Treatment	**MBF**	**Mean Grade[1]**	**MBF**	**Mean Grade[1]**
Control	1.36	1.88	1.82	1.66
Light Thinning	1.37	1.93	3.38	1.44
Heavy Thinning + Pruning	1.14	2.23	5.40	1.41

[1]Mean grade is the average grade calculated Select Structural = 0, No. 1 = 1, No. 2 = 2, No. 3 = 3, No. 4 = 4

Lumber Dynamic MOE (GPa) (Acoustic Velocity method) by Treatment and Grade

	Grade				
Treatment	**SS**	**No. 1**	**No. 2**	**No. 3**	**No. 4**
Control	11.20	10.02	10.03	8.61	8.40
Light Thinning	12.39	10.36	9.89	9.16	8.33
Heavy Thinning + Pruning	11.69	9.58	9.57	8.58	8.30

Lumber Dynamic MOE (GPa) (Acoustic Velocity method) by Treatment and Log Position

Treatment	Log 1	Log 2	Log 3
Control	10.04	9.99	9.91
Light Thinning	10.78	10.27	9.12
Heavy Thinning + Pruning	10.35	9.73	8.53