Fall 2015 Forest Health Cooperative Business Meeting Update: A Focus on Products

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1

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Rationale & Problem Identification

Forest Products

- Need genetically superior families for stiffness and forest health.
- Need reliable tools.
- NIR for chemistry and stiffness.
- Acoustics for stiffness
  - What is the issue with acoustics and what are we doing to solve it?

Forest Health

- Pine Decline/Disease has been on the rise.
- There is a need to rapidly screen trees for disease resistance
- There is a need to identify genetic families with superior disease resistance.

2

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Key Objectives

- Find genetic families superior in stiffness and forest health.
- Develop a standardized method for acoustics such that industry can use in the field.
- Separate out sensitivity of acoustics to density, chemistry, and microfibril angle. Does it match that of real stiffness?

Genetic Family Research

Methods and Materials

- Acoustics measurements taken on Rayonier and Weyerhaeuser-Plum Creek Sites.
- Randomized Block Design at each Site
  - ~15 trees per family
  - 14 families
  - 15 years of age

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Assessment of 14 Genetic Families with Acoustics (15 year old trees)

Effect of site (Florida versus Georgia) on **dynamic MOE** of the 14 tree progenies – type III SS

Source	DF	Type III SS	Mean Square	F Value	Pr > F
site	1	16.01	16.01	5.61	0.0192
Block	14	42.49	3.035	1.06	0.3955
Family	14	62.22	4.44	1.56	0.0988
site*Family	14	58.45	4.17	1.46	0.1328
Family*Block	192	577.68	3.01	1.05	0.3718
site*Block	14	47.83	3.416	1.20	0.2840

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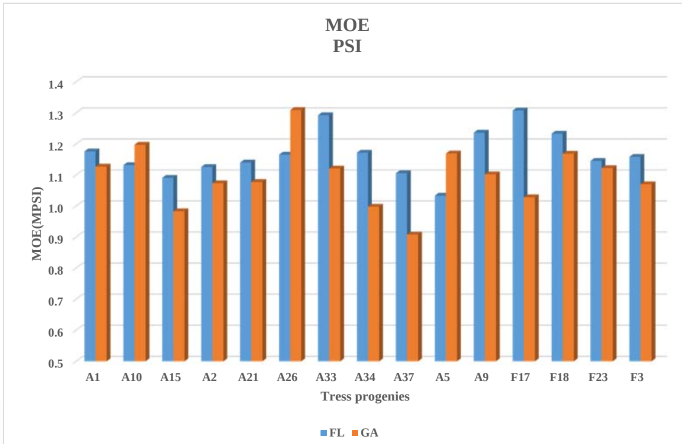
Assessment of 14 Genetic Families with Acoustics (15 year old trees)



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7

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Assessment of 14 Genetic Families with Acoustics (15 year old trees)

Table 2B: Effect of site (Florida versus Georgia) on **diameter growth** of the 14 tree progenies – type III SS

Source	DF	Type III SS	Mean Square	F Value	Pr > F
site	1	418.92	418.92	40.79	<.0001
Block	14	237.48	16.96	1.65	0.0734
Family	14	317.46	22.67	2.21	0.0104
site*Family	14	252.67	18.04	1.76	0.0516
Family*Block	191	1785.61	9.348	0.91	0.7253
site*Block	14	150.08	10.72	1.04	0.4146

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8

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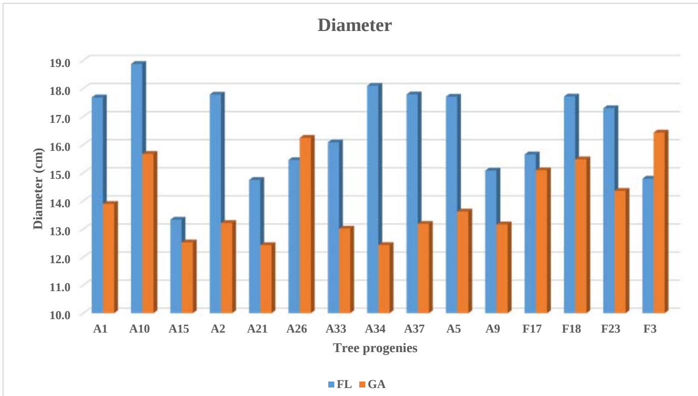
Assessment of 14 Genetic Families with Acoustics (15 year old trees)



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Differences Between Machines and Proposed Standardized Method

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10

Methods and Materials





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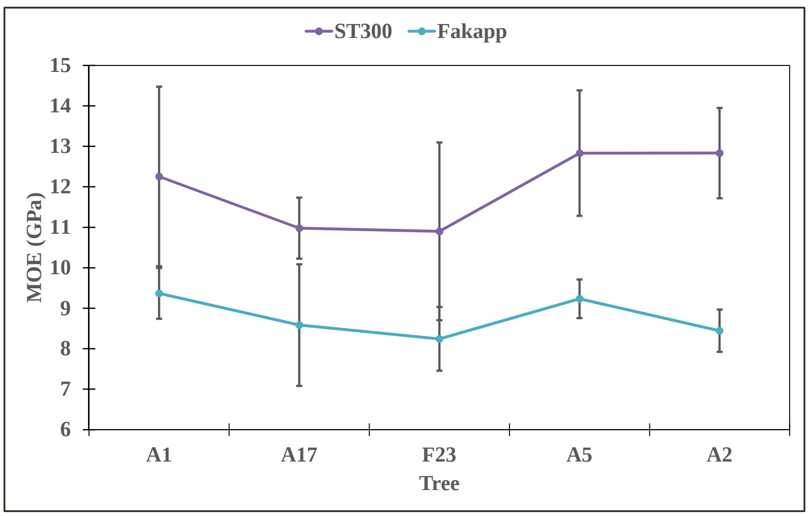
Machine Differences



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Industrial Solutions to the Problem

- MOE = V^2*density
- Estimate density by:
  - Send signal through cross section to estimate density.
  - Use pylodyn
  - Use increment core
- Calibrate each machine to lumber MOE.
- Develop a method to calibrate for Wood not Metal.

Machine Sensitivity to Anatomy, Chemistry, and Density

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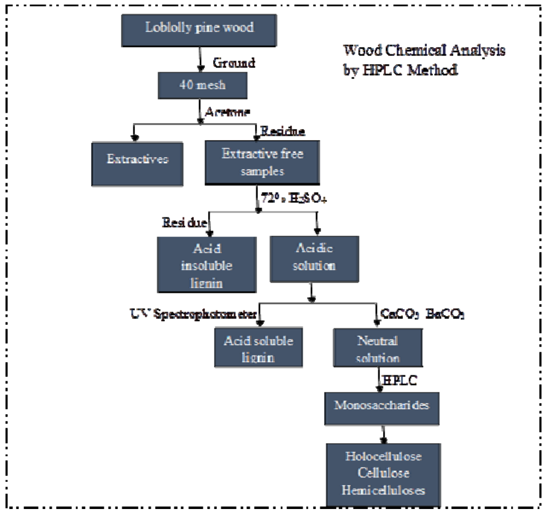

15

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Methods and Materials

16

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Machine Sensitivity to Real Stiffness Measurement

	MOR			MOE			Log velocity		
	Coefficient	R^2	Ad R^2	Coefficient	R^2	Ad R^2	Coefficient	R^2	Ad R^2
Model 1	-137.9***	76.09	71.82	-32.3***	73.03	68.22	-2.2***	59.84	52.67
Cellulose	0.83^ns			0.37**			0.09***		
Hemicelluloses	1.41**			0.27***			0.04*		
Lignin	1.45^ns			0.19^ns			-0.03^ns		
OWD	182.8***			21.8***			2.79***		
MFA	0.08^ns			0.05^ns			0.04*		

Essien, Via, Echkardt et al. 2015 In submission to PLOS-1

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Novel New Finding

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Correlation Matrix

	Cellulos	Hemi-cellulos	Green dens	Oven-dens	Basic dens	Tree vel	Log vel	Dynamic moe	Fiber length	Stat MoE	Stat MoR
Cellulose											
Hemicellulose	-0.05^{ns}										
Green densit	0.185^{ns}	0.38^{ns}									
Oven-dried	0.216^{ns}	0.67^{*}	0.00^{ns}								
Basic density	0.015^{ns}	0.60^{*}	0.04^{ns}	0.96^{***}							
Tree velocity	0.71^{**}	0.50^{ns}	0.06^{ns}	0.81^{**}	0.64^{*}						
Log velocity	0.65^{*}	0.39^{ns}	0.03^{ns}	0.85^{***}	0.72^{**}	0.96^{***}					
Dynamic moe	0.66^{*}	0.53^{ns}	0.44^{ns}	0.76^{**}	0.63^{*}	0.89^{***}	0.89^{***}				
Fiber length	0.84^{***}	0.25^{ns}	0.36^{ns}	0.42^{ns}	0.31^{ns}	0.76^{**}	0.60^{*}	0.76^{**}			
Static MoE	0.56^{ns}	0.69^{*}	0.31^{ns}	0.88^{***}	0.73^{**}	0.92^{***}	0.89^{***}	0.93^{***}	0.67^{*}		
Static MoR	0.42^{ns}	0.69^{*}	0.35^{ns}	0.87^{***}	0.75^{**}	0.80^{**}	0.80^{**}	0.87^{***}	0.52^{ns}	0.97^{***}	
Air-dried	0.37^{ns}	0.70^{*}	0.32^{ns}	0.93^{***}	0.86^{***}	0.84^{***}	0.86^{***}	0.92^{***}	0.57^{ns}	0.95^{***}	0.94^{*}

19

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Oven Dry Weight Across Scale?

20

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Acknowledgements

- Forest Health Cooperative
  - Weyerhaeuser-Plum Creek, Rayonier
- Forest Products Development Center
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