New Project

Quantifying wood property variation and carbon sequestration from different loblolly pine families

CAFS.25.XXX

Joe Dahlen (UGA), Patrick Cumbie (ArborGen), Chungdu Tshering (UGA), Tom Eberhardt (USFS), others???

Joe Dahlen

Environment or Genetics?

Environment or Genetics?

Center for Advanced Forestry Systems

Environment or Genetics?

Center for Advanced Forestry Systems

Environment or Genetics?

Hypotheses or Objectives

APPLIED RESEARCH

For. Sci. 65(4):469–482
doi: 10.1093/forsci/fxz002

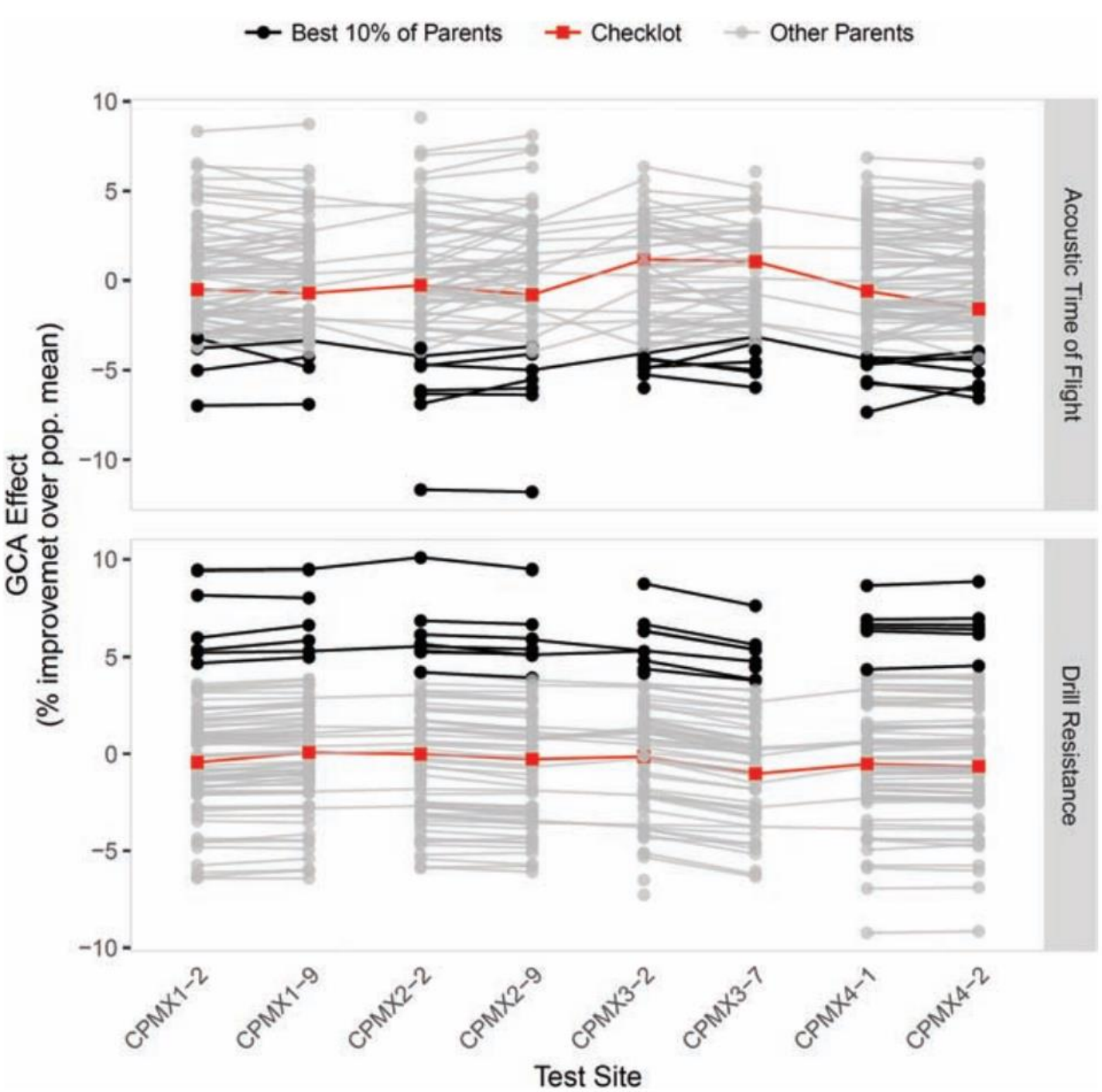
genetics & tree improvement

Genetic Variation in Acoustic Time of Flight and Drill Resistance of Juvenile Wood in a Large Loblolly Pine Breeding Population

Trevor D. Walker, Fikret Isik, and Steven E. McKeand

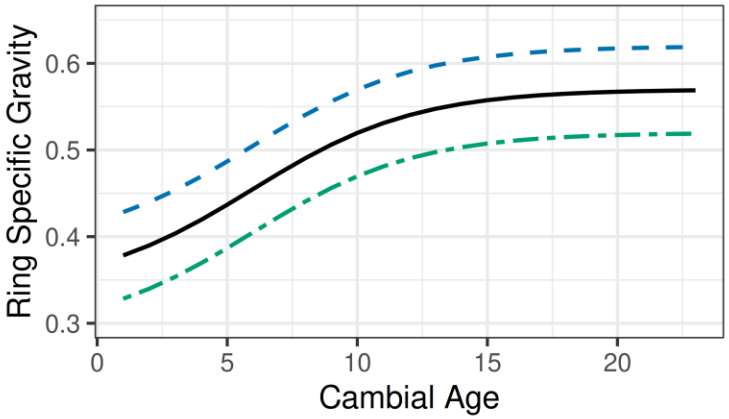
Acoustic time of flight and drill resistance (surrogates for wood stiffness and density, respectively) were measured on 11,097 standing trees from 269 pollen-mix families of loblolly pine (*Pinus taeda* L.) in 6- to 9-year-old progeny tests at eight sites across the southeastern United States. Specific gravity was measured on two test sites. The phenotypic correlation between specific gravity and drill resistance was moderate ($r = 0.68$), whereas the genetic correlation was very strong ($r_g = 0.96$). Narrow-sense heritabilities for acoustic time of flight and drill resistance were around 0.35 for individual trees and very strong (0.90) for family means. High genetic correlations (>0.80) between pairs of sites suggested a low genotype-by-environment interaction for both traits. Genetic correlations between wood quality traits and other economic traits (growth and stem straightness) were low except for a moderate correlation between acoustic time of flight and tree slenderness ($r_g = -0.64$). The checklot ranked near the middle for both wood quality traits, implying no inadvertent selection occurred in this population that has been selected intensively for volume productivity. This study is the first to apply these tools in a large breeding program, and results suggest they are effective for selecting genotypes for wood quality.

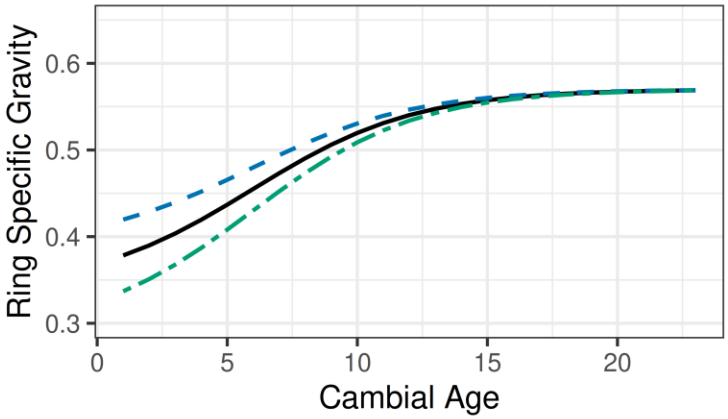
Keywords: resistograph, TreeSonic, wood quality, multivariate mixed model, multienvironmental trials, factor-analytic, genetic correlation

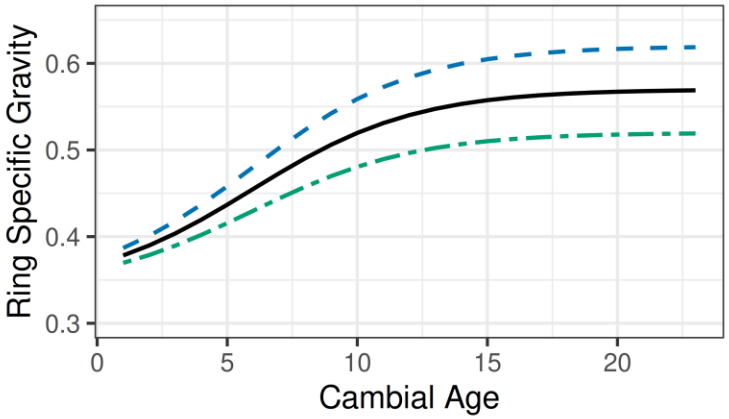


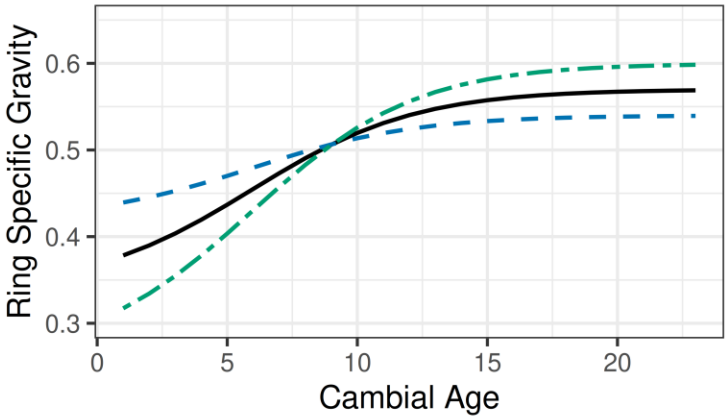
Center for Advanced Forestry Systems

Hypotheses or Objectives









Site selection

Rotation age loblolly pine

Different families planted in block plots

~Genetic material of interest today~

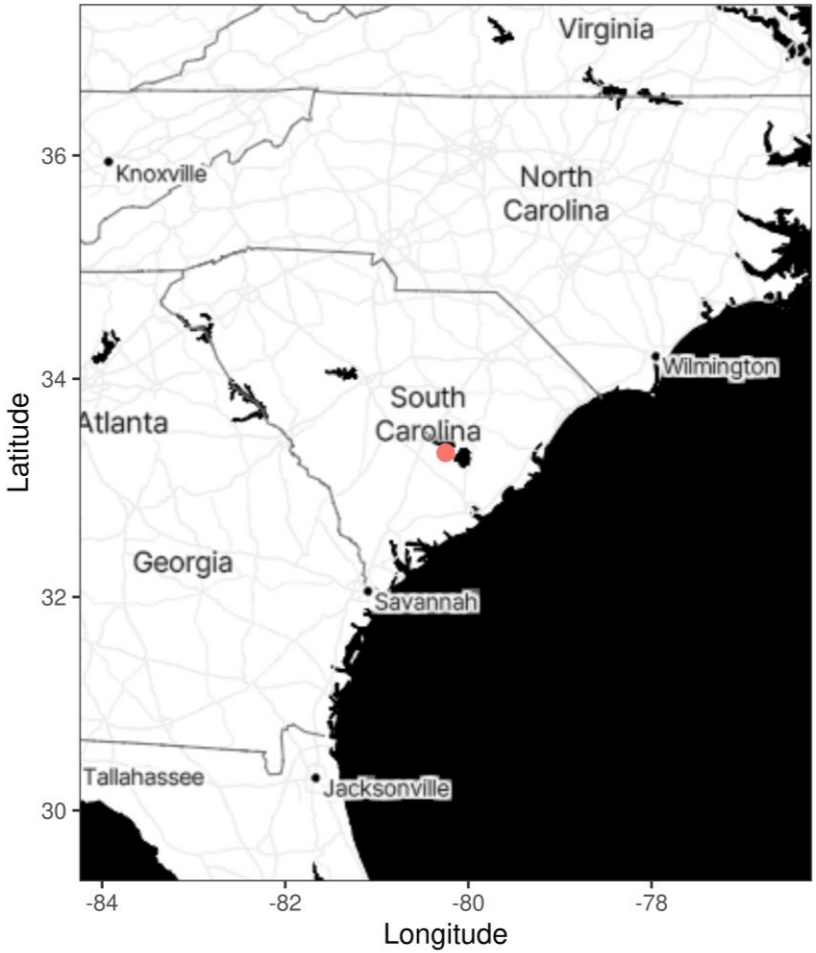
Site selection #1

Methods

Powell Bay

Planted in ~2003

Age ~22 in 2025

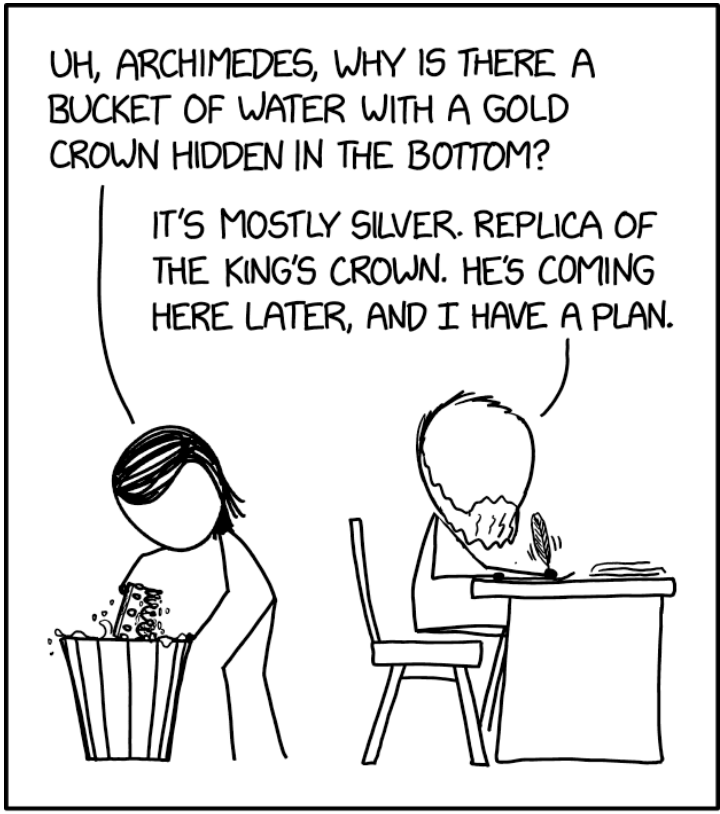


Field sampling

Methods

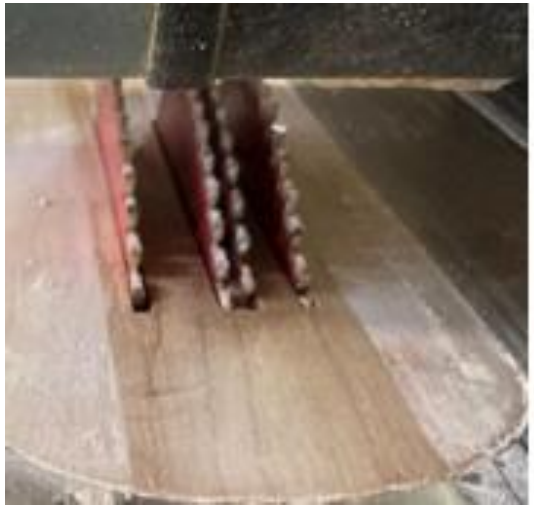
Whole-disk samples

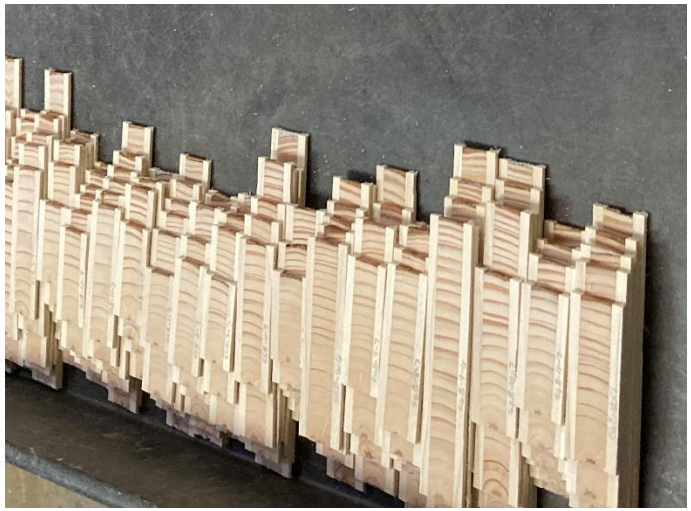
Methods



Ring-by-ring samples

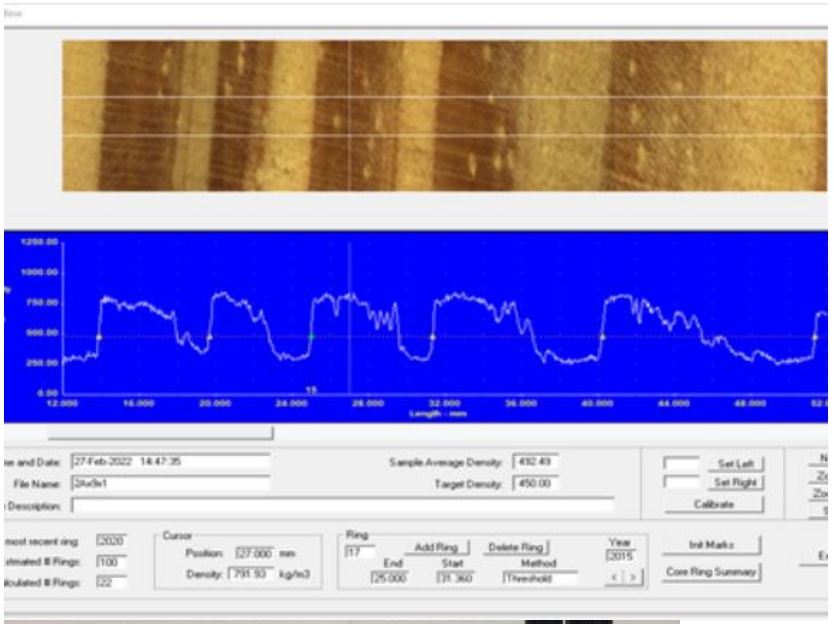
Methods

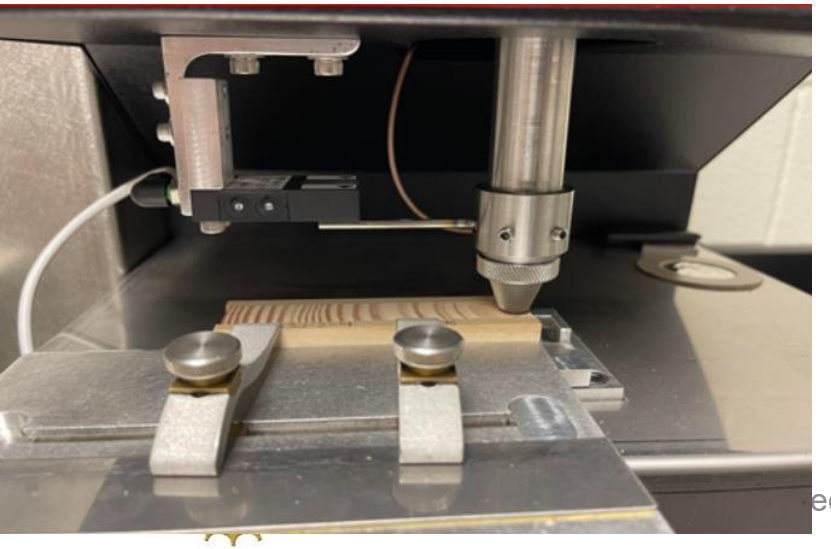


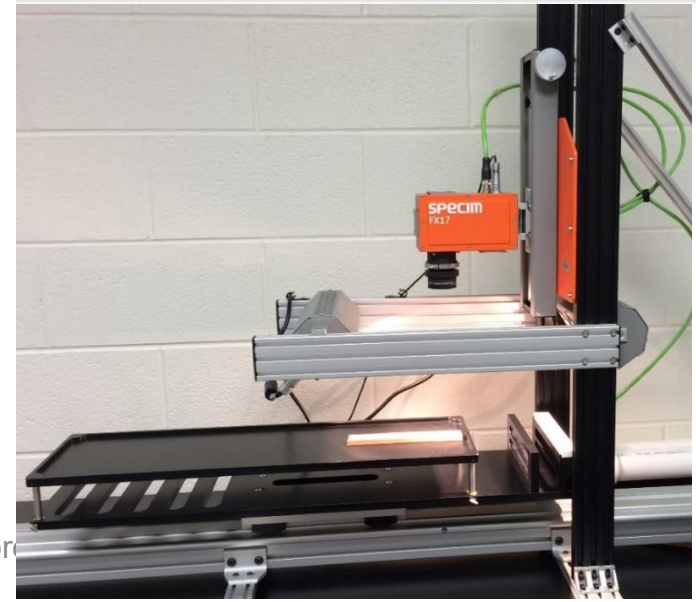


Ring-by-ring samples

Methods

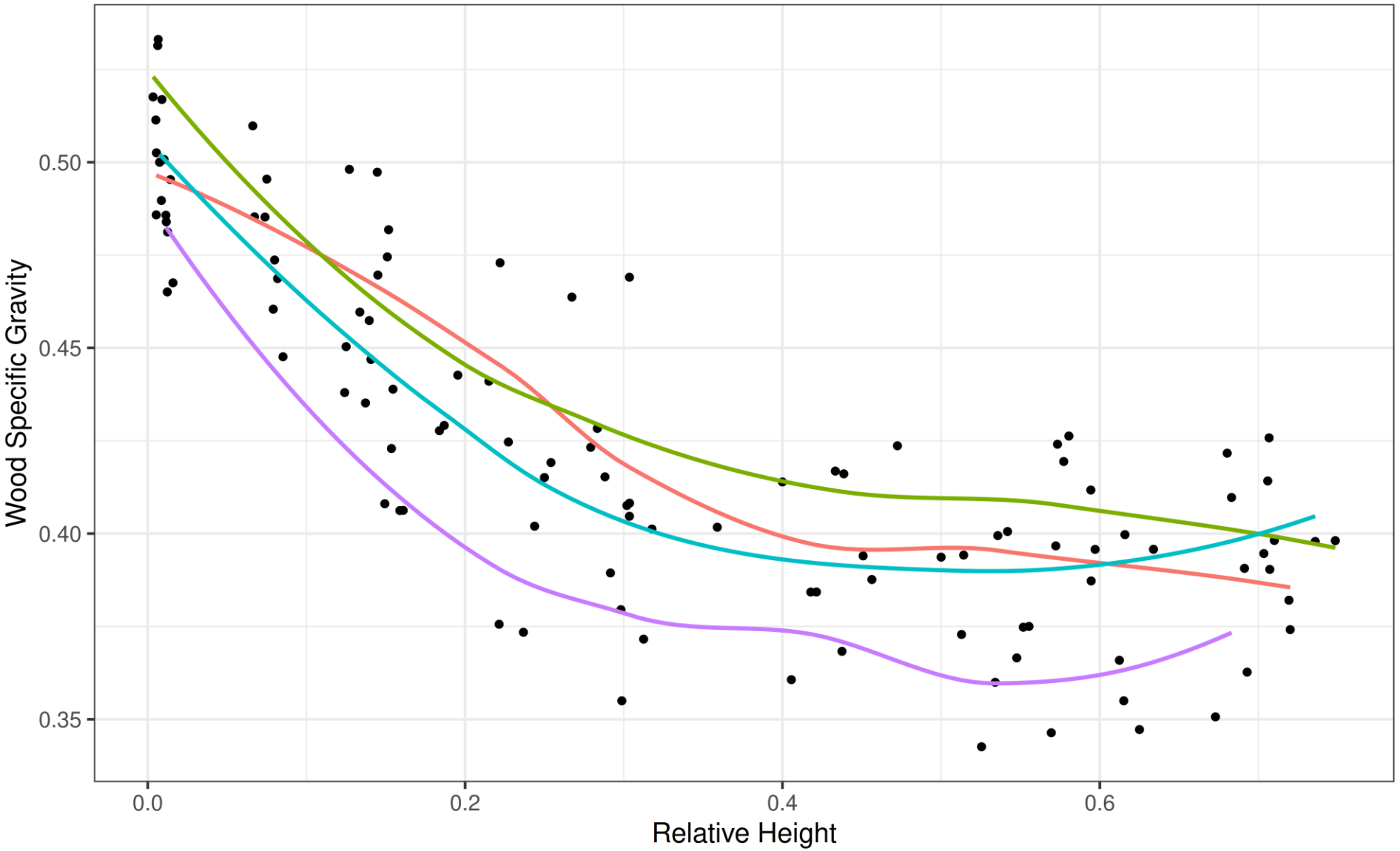






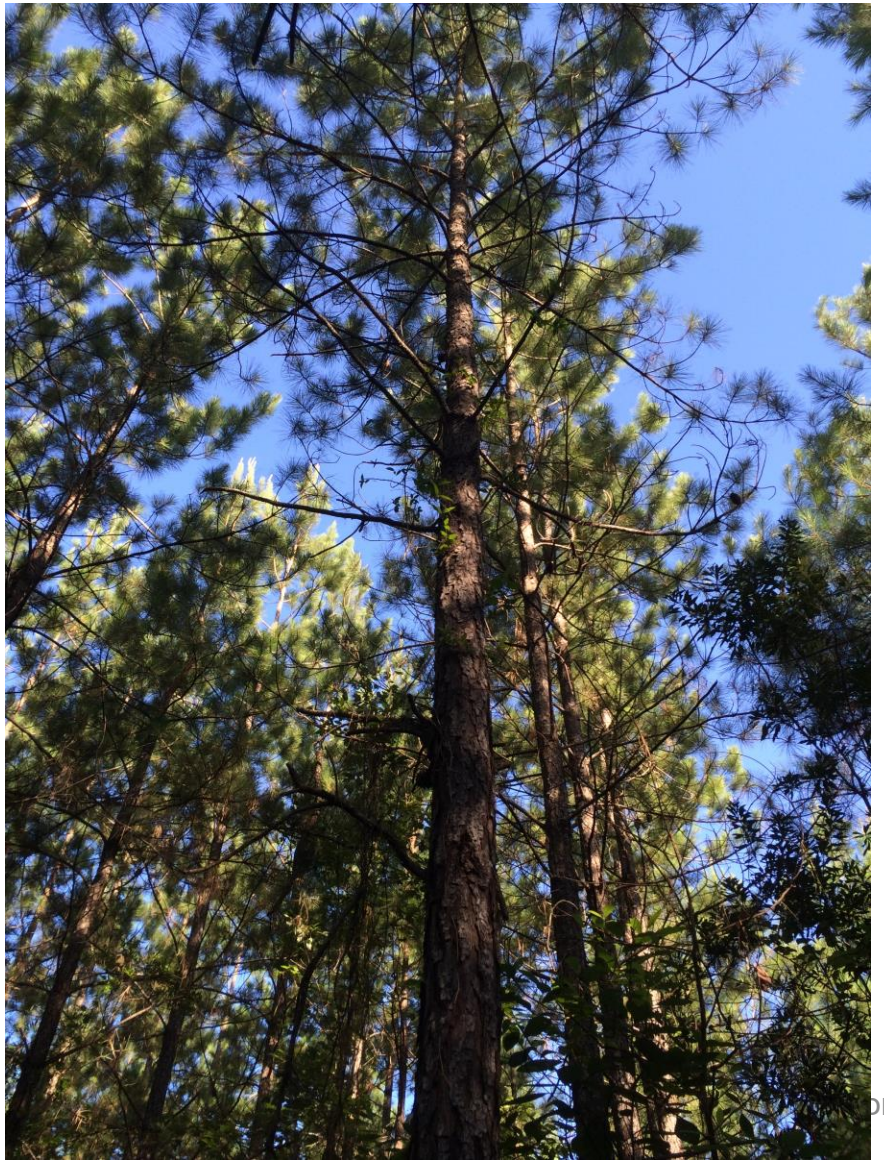
Center for Advanced Forestry Systems

Major Findings - from 2017 limited sampling



AGM22
Good growth, good form

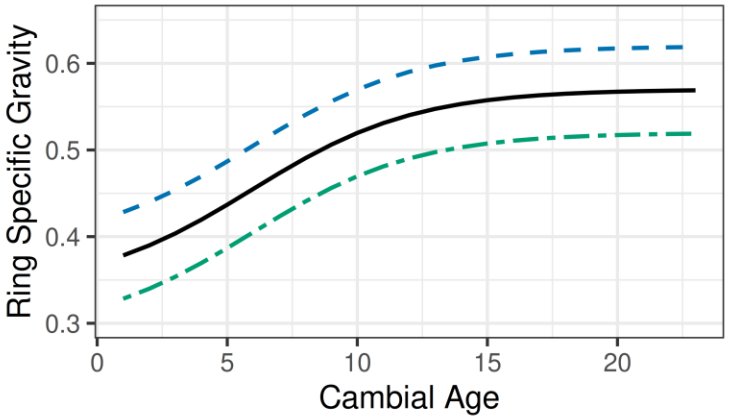
AA93
Tall skinny clone with smaller branches

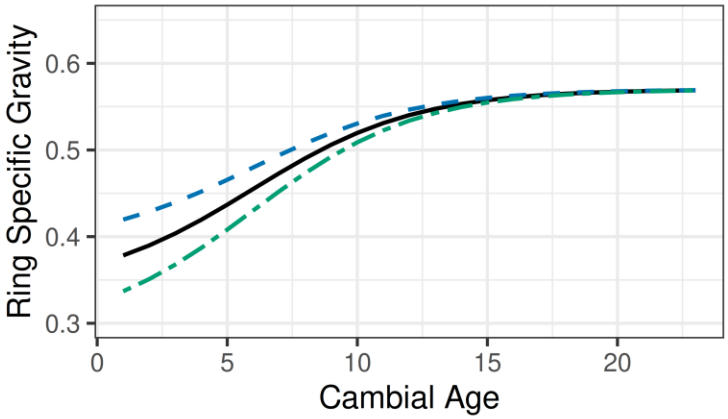


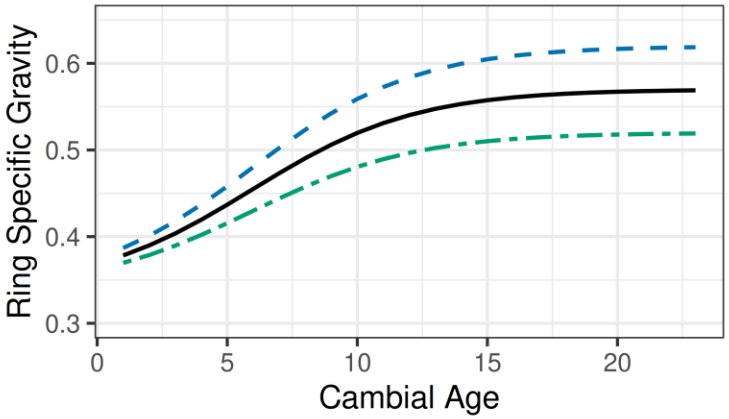
Sampled Trees

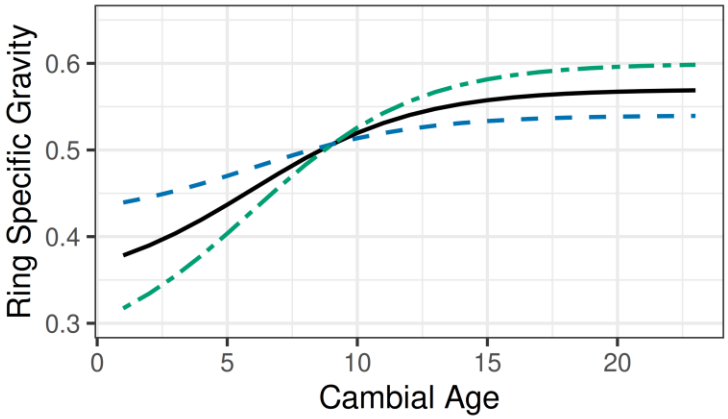
	DBH.in		Height.ft	
Family	Mean	SD	Mean	SD
7-56	12.7	2.3	77.1	5.6
AA-32	13.5	1.3	82.2	4.3
AA-93	13.1	0.9	89.2	2.8
M0014	13	2.0	76.8	8.9
M0016	12.6	2.0	78.5	8.6
M002	13.6	1.9	81.2	2.8

Deliverables









Company Benefits

Framework for ‘genetic modifiers’ for wood property models
Higher SG = More Carbon

Better wood properties = shorter rotations while maintaining quality

Better genetics needed for reduced planting densities

Thank You and Questions?

- NSF Center for Advanced Forestry Systems
- Members of CAFS
- Members of the Wood Quality Consortium and Plantation Management Research Cooperative
- USFS Forest Products Laboratory