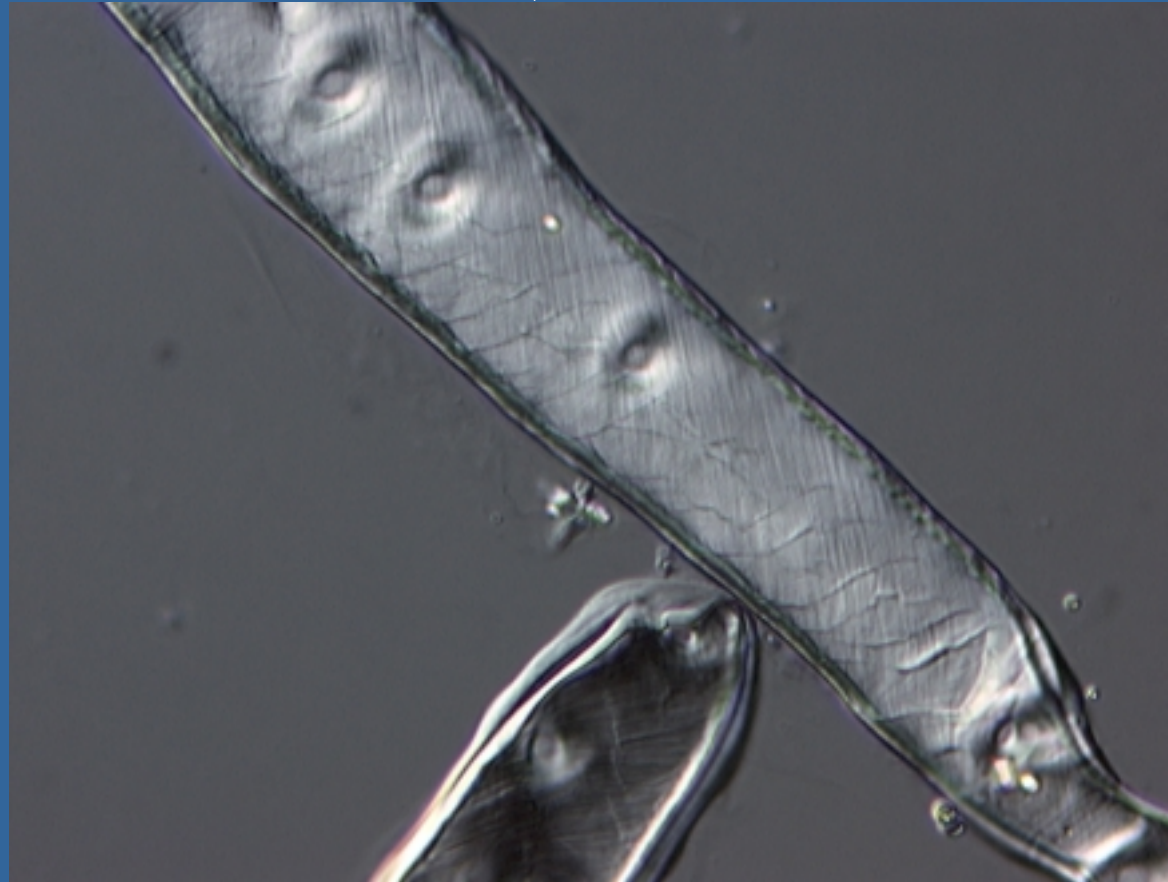


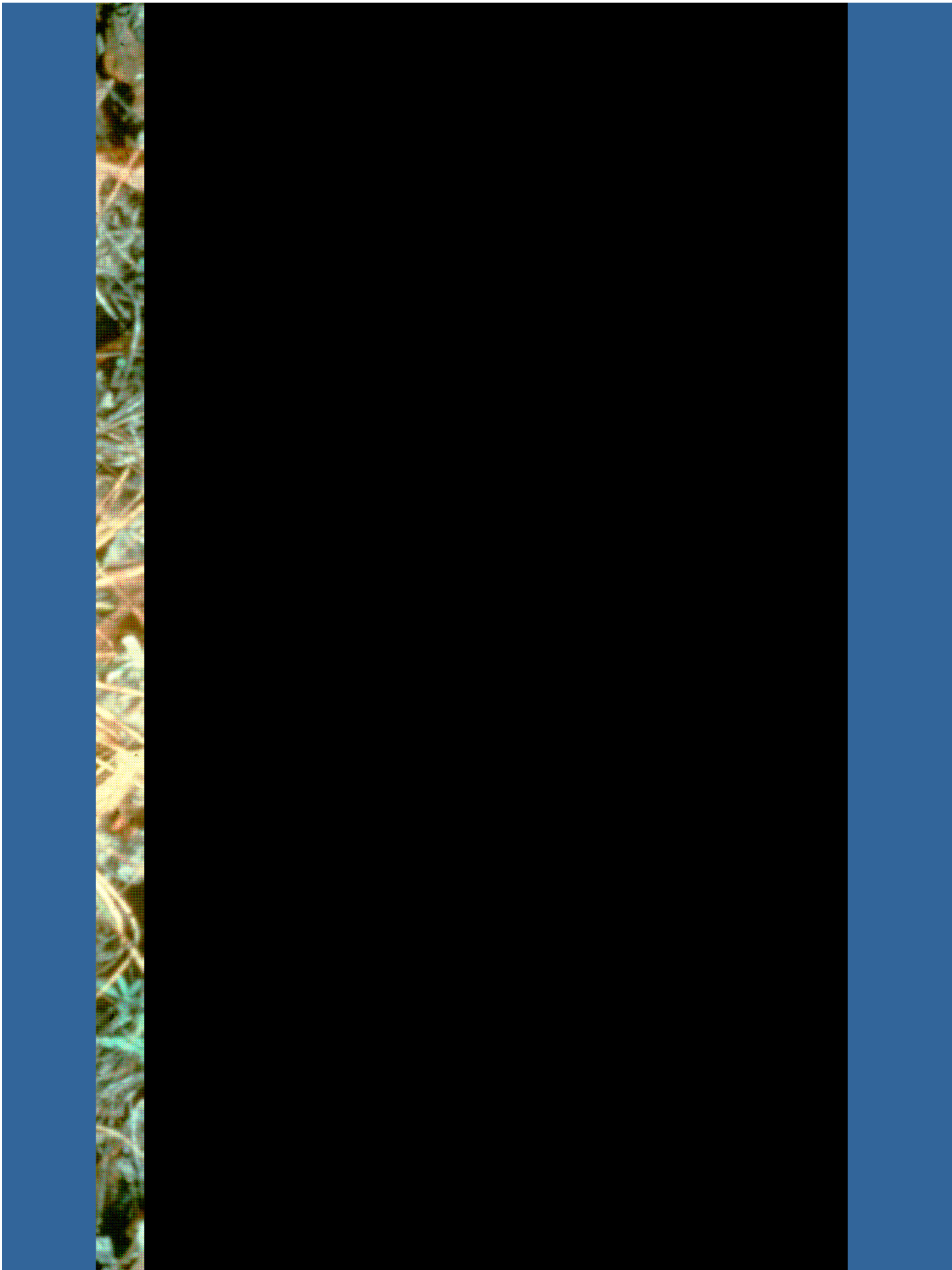
Genetic Influences on Longleaf Pine Wood Properties Assessed Using Near Infrared Spectra

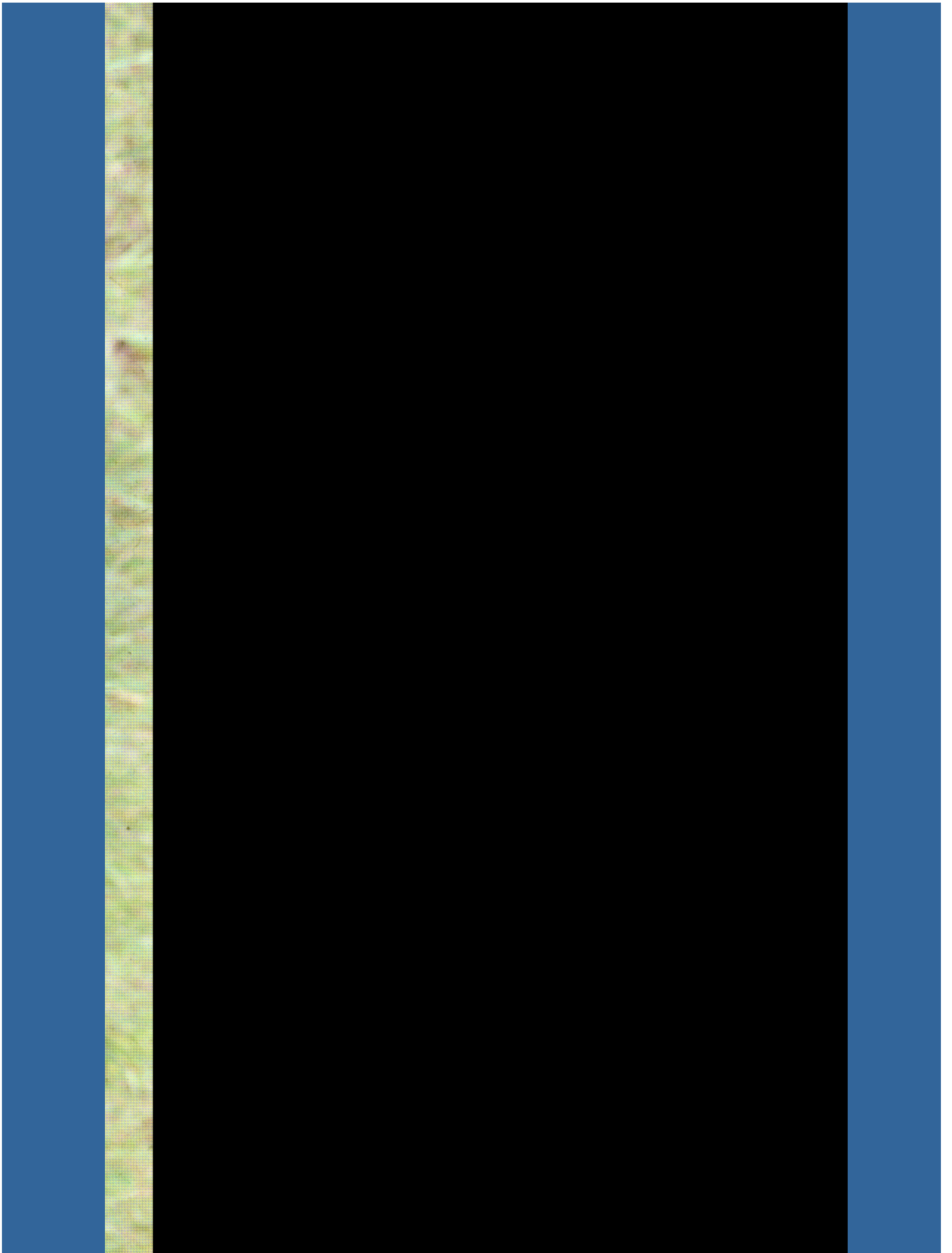
Todd F. Shupe, Leslie H. Groom,
Michael Stine, and Brian K. Via



Objectives

- Develop models to predict wood strength, stiffness, chemistry, and fiber morphology from NIR spectra for longleaf pine.
- Use the models to analyze a diallel including:
 - Quantify genetic variation
 - Determine if genetic variation is additive or non-additive.

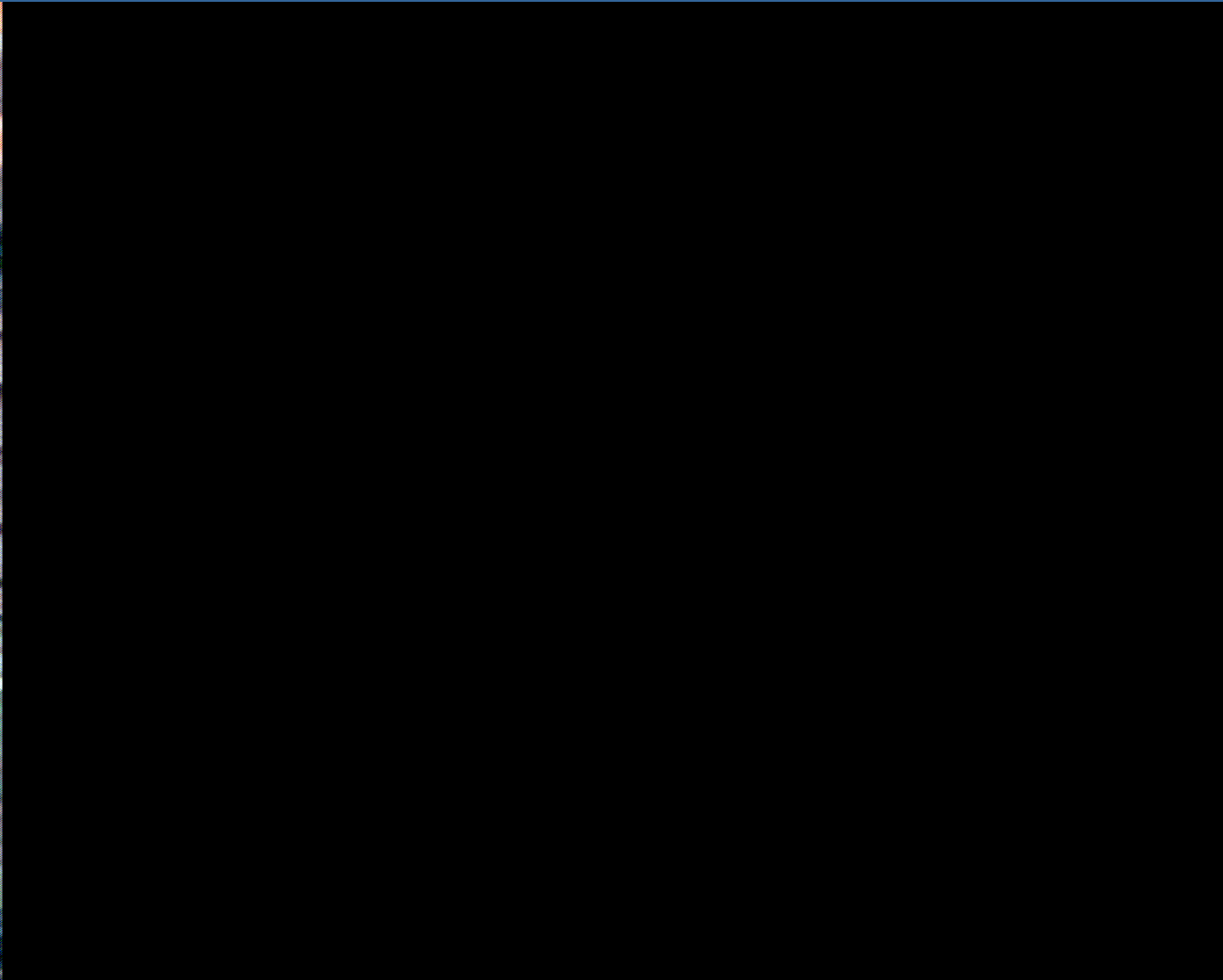
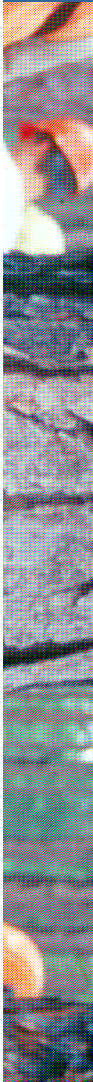






Juvenile & Mature Wood Samples age 30

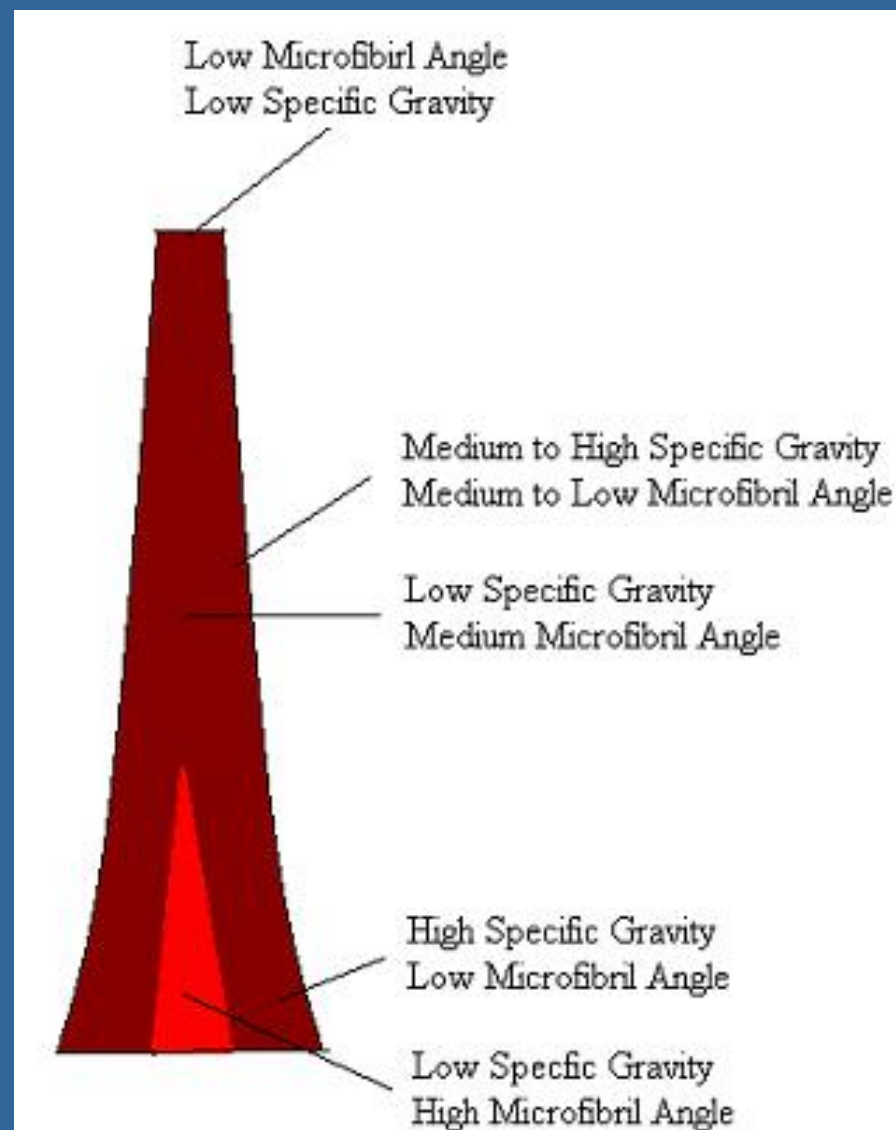




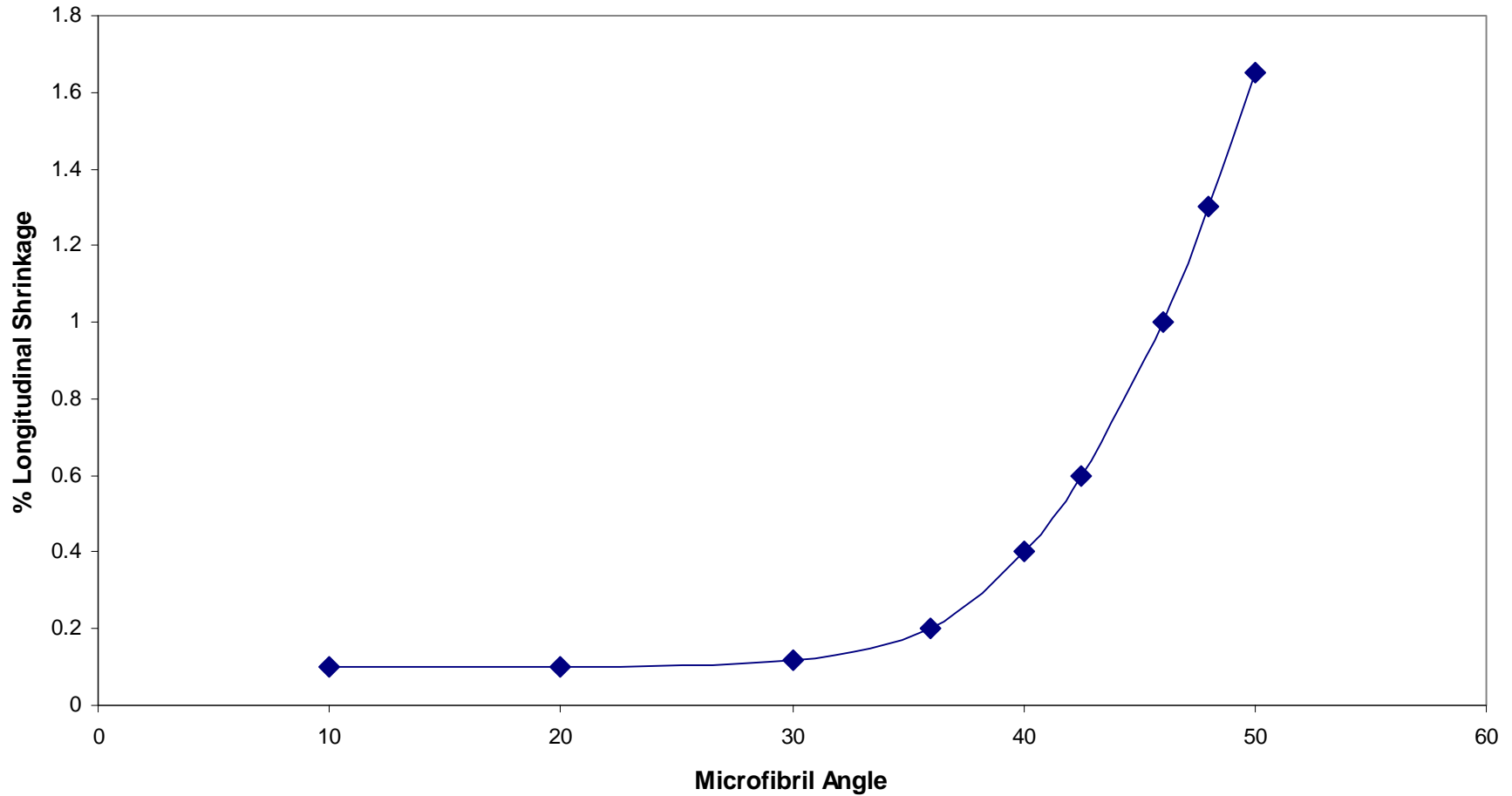
Strength and stiffness response

What happens if you:	Burst	Tensile	Tear	Compression	MOE	Pulp Yield	Longitudinal Shrinkage
Decrease fibril angle from 40 to 30 degrees	?	↑ 2.5%	↑	↑ 3%	↑ 100%	?	↓ 66%
Increase cell length by 10%	↓ 10%	↓ 6%	↑ 15%	↓ 3%	↑	No effect	No effect
Increase cell wall thickness by 10%	↓ 6%	↓	↑ 15%	↓ 19%	↑	↑ 1%	No effect
Increase % latewood by 10%	↓ 3%	↓	↑ 7%	↓	↑	↑ 1%	No effect

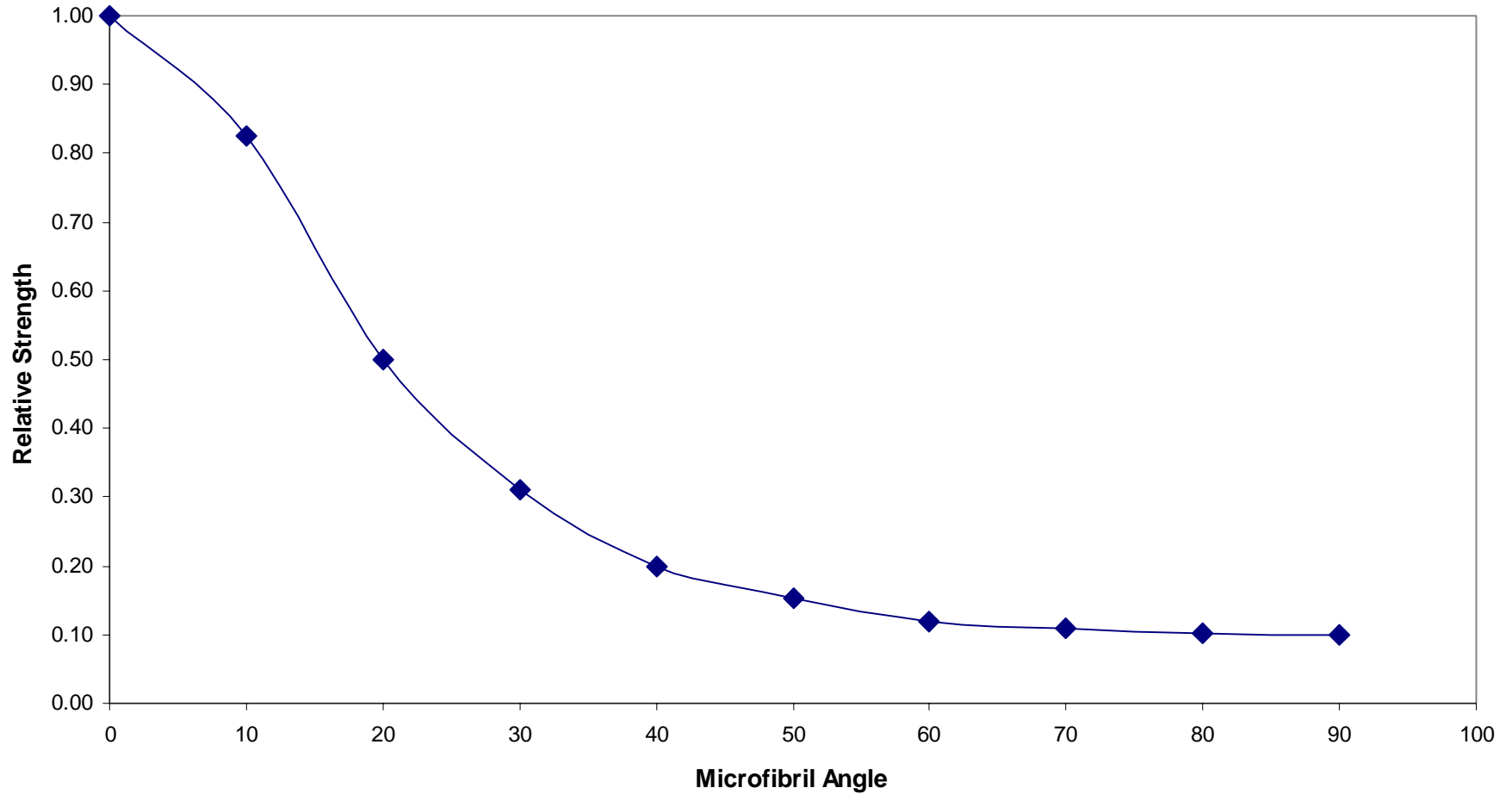
Microfibril angle and specific gravity tree patterns



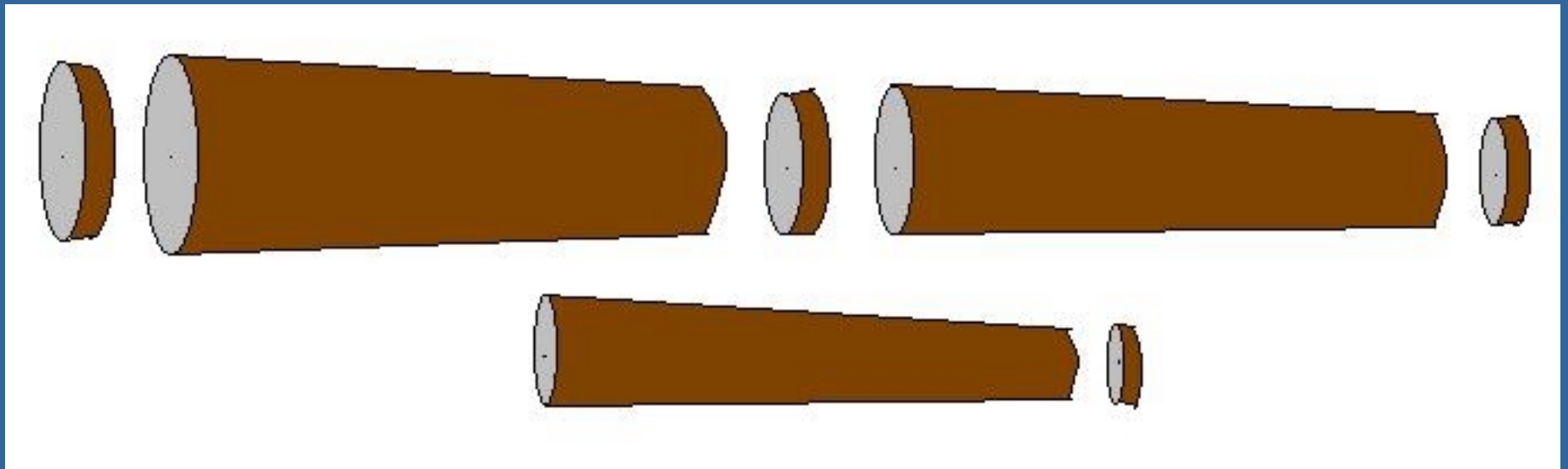
Longitudinal Shrinkage



Relative Strength



Harvesting strategy



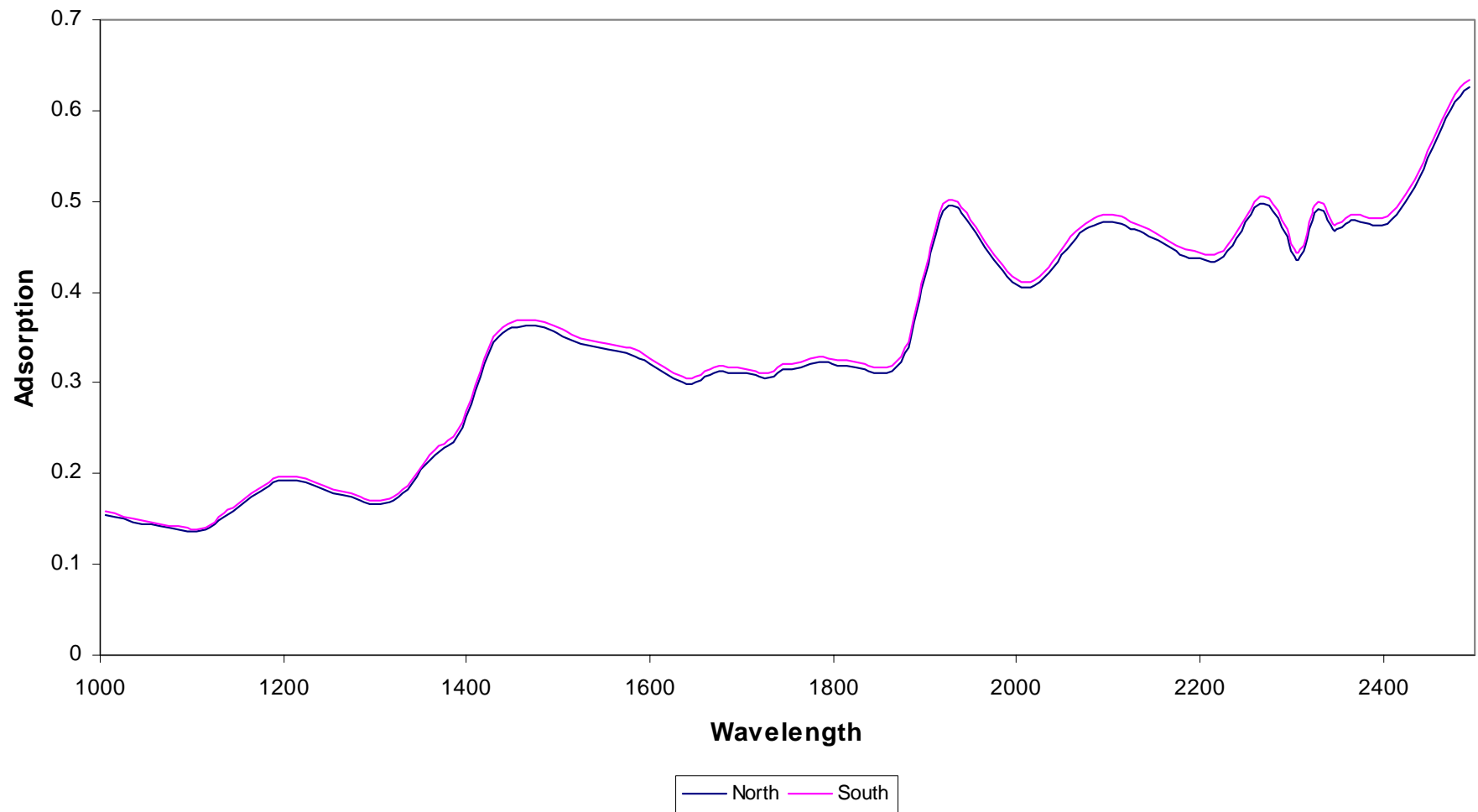
Increment core collection



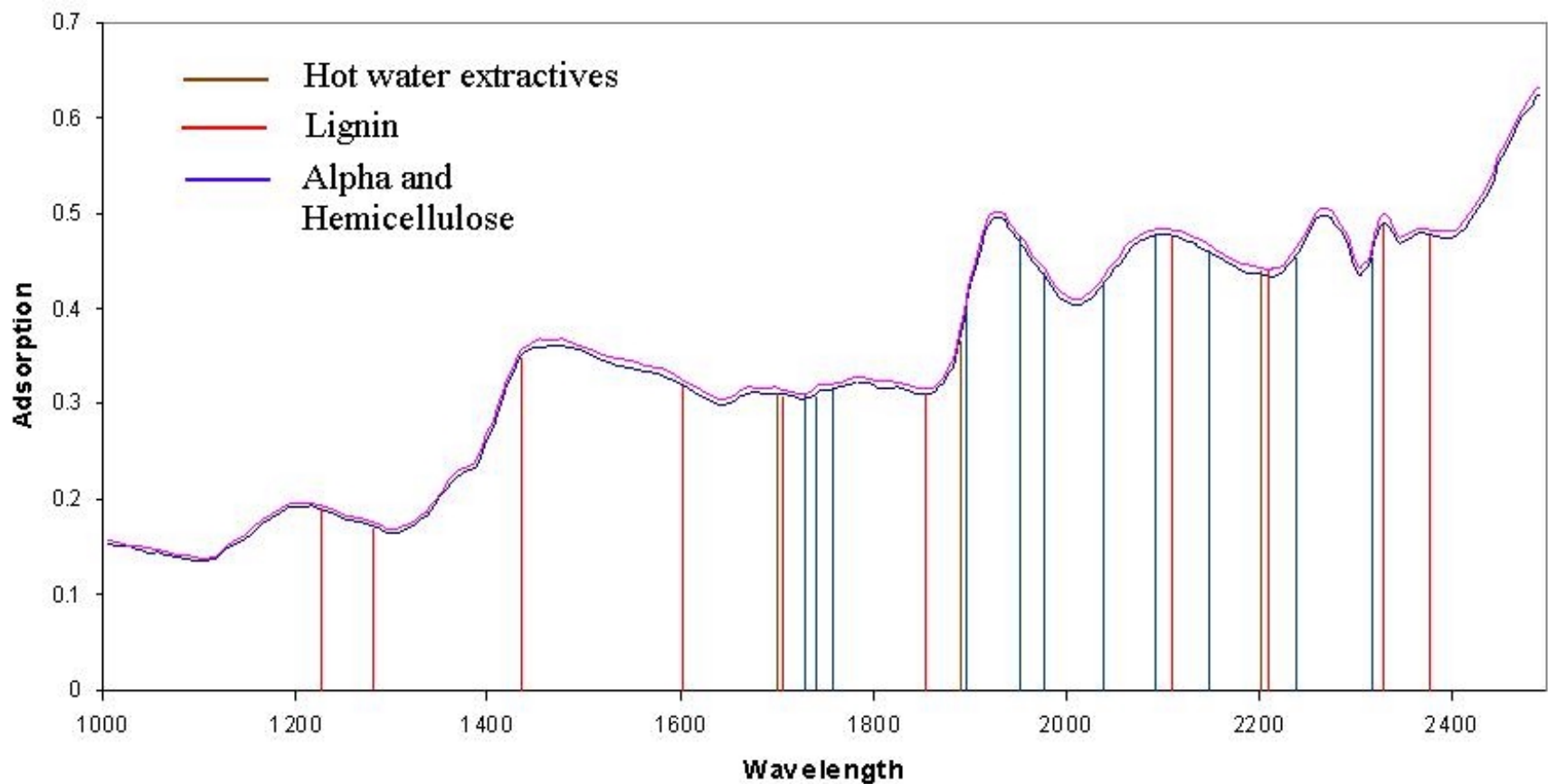
Increment core test strips – preliminary lay-up



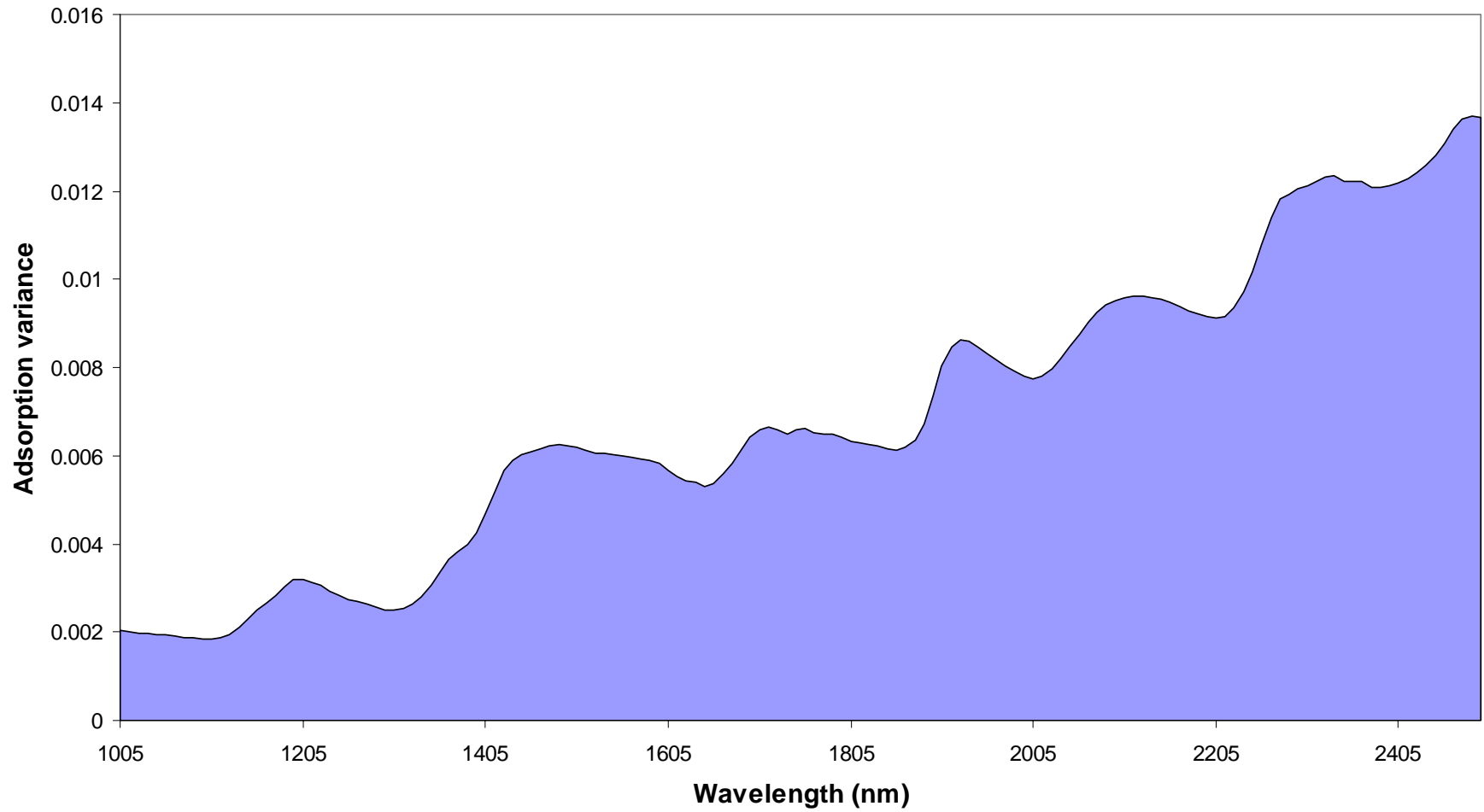
Results



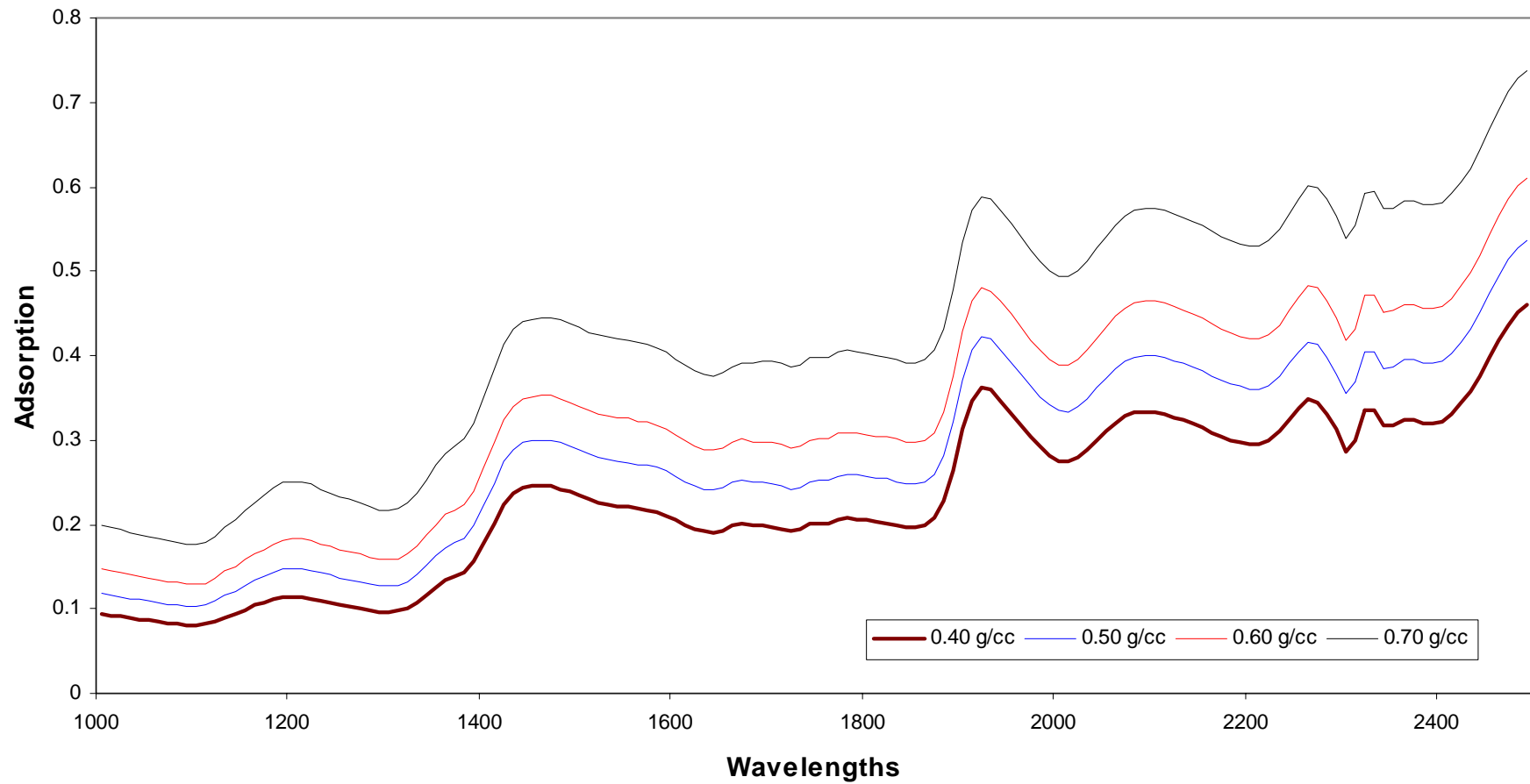
Spectra response to wood chemistry



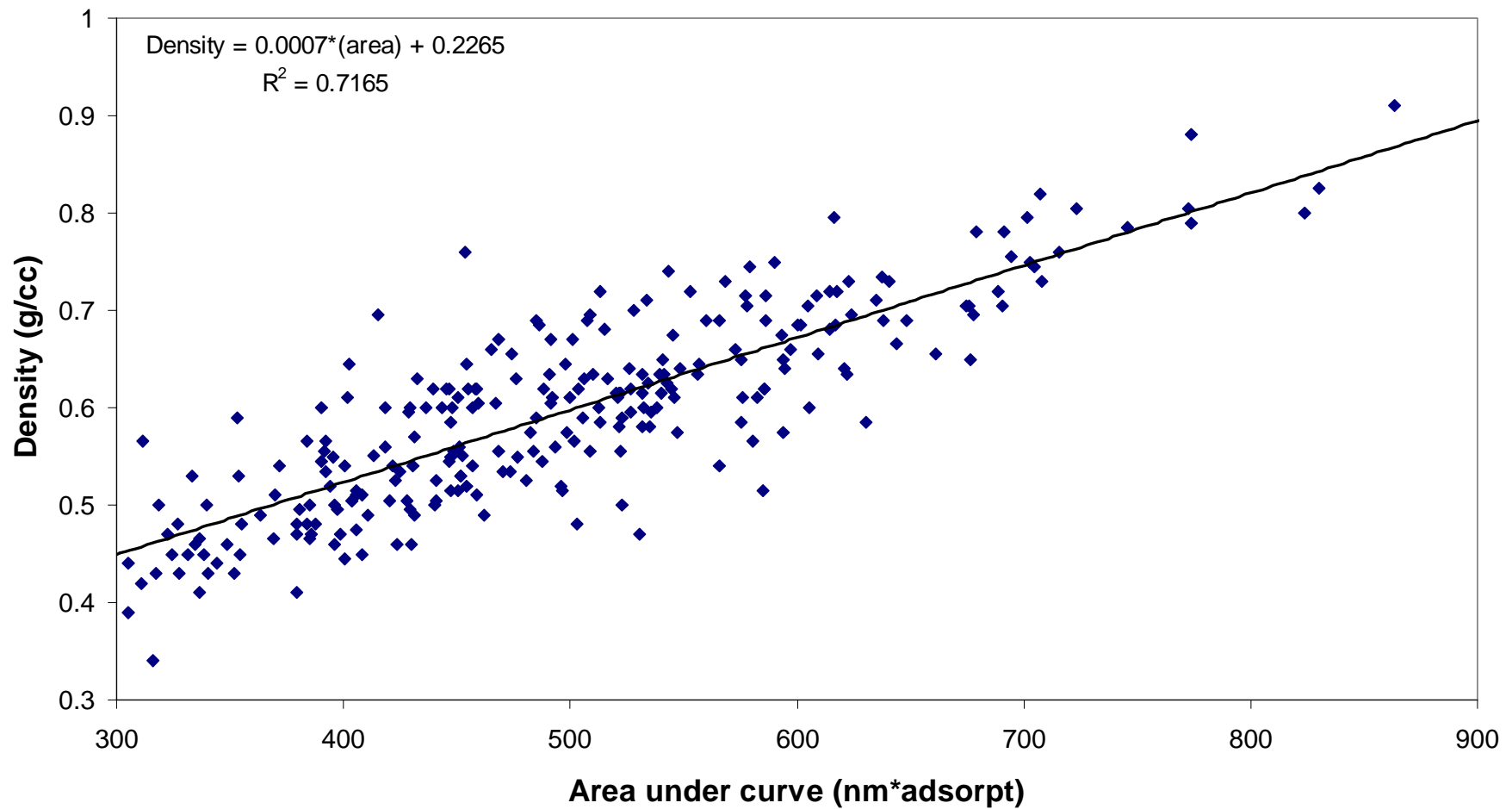
Variance



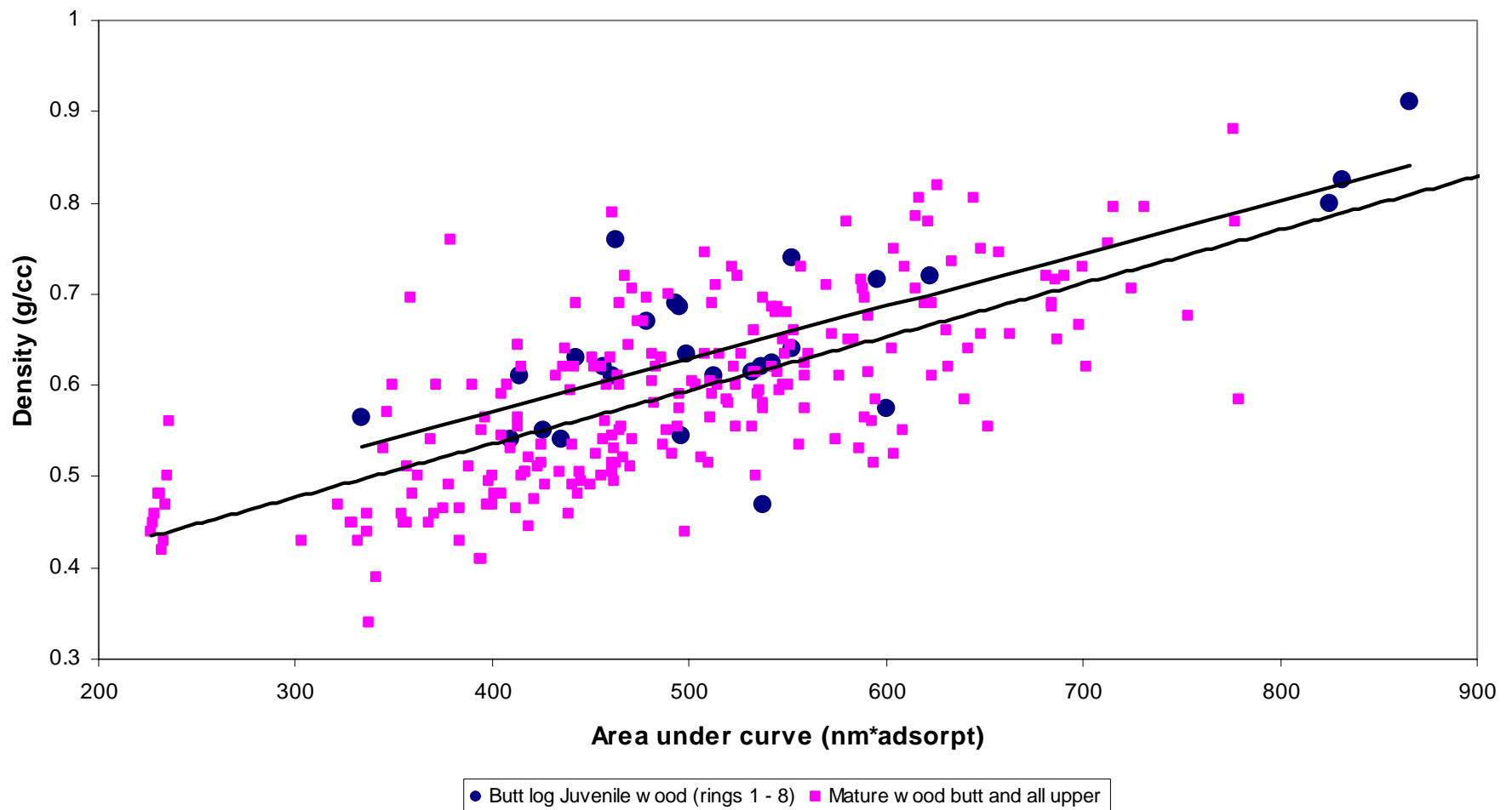
Results



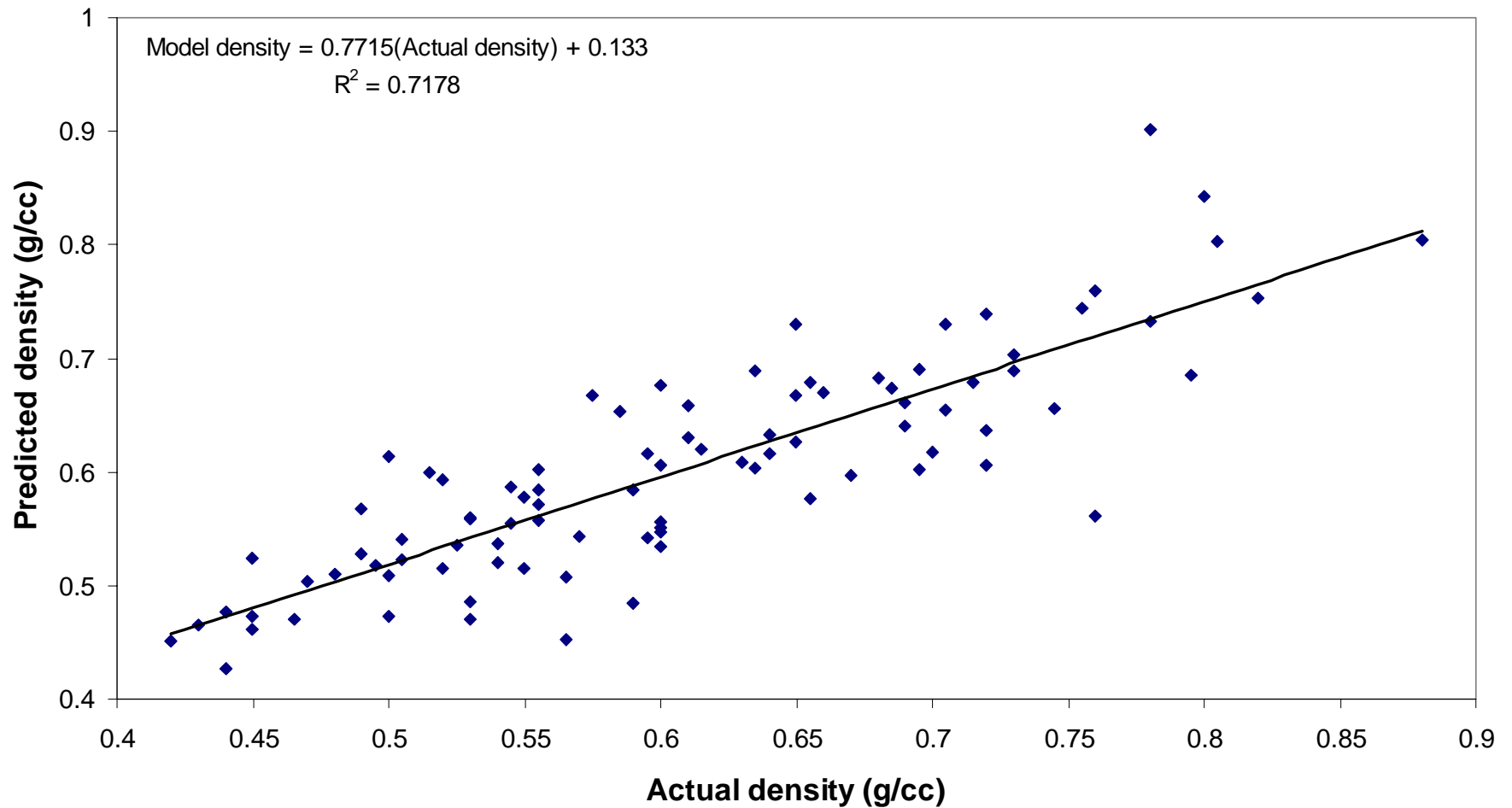
Prediction of Density



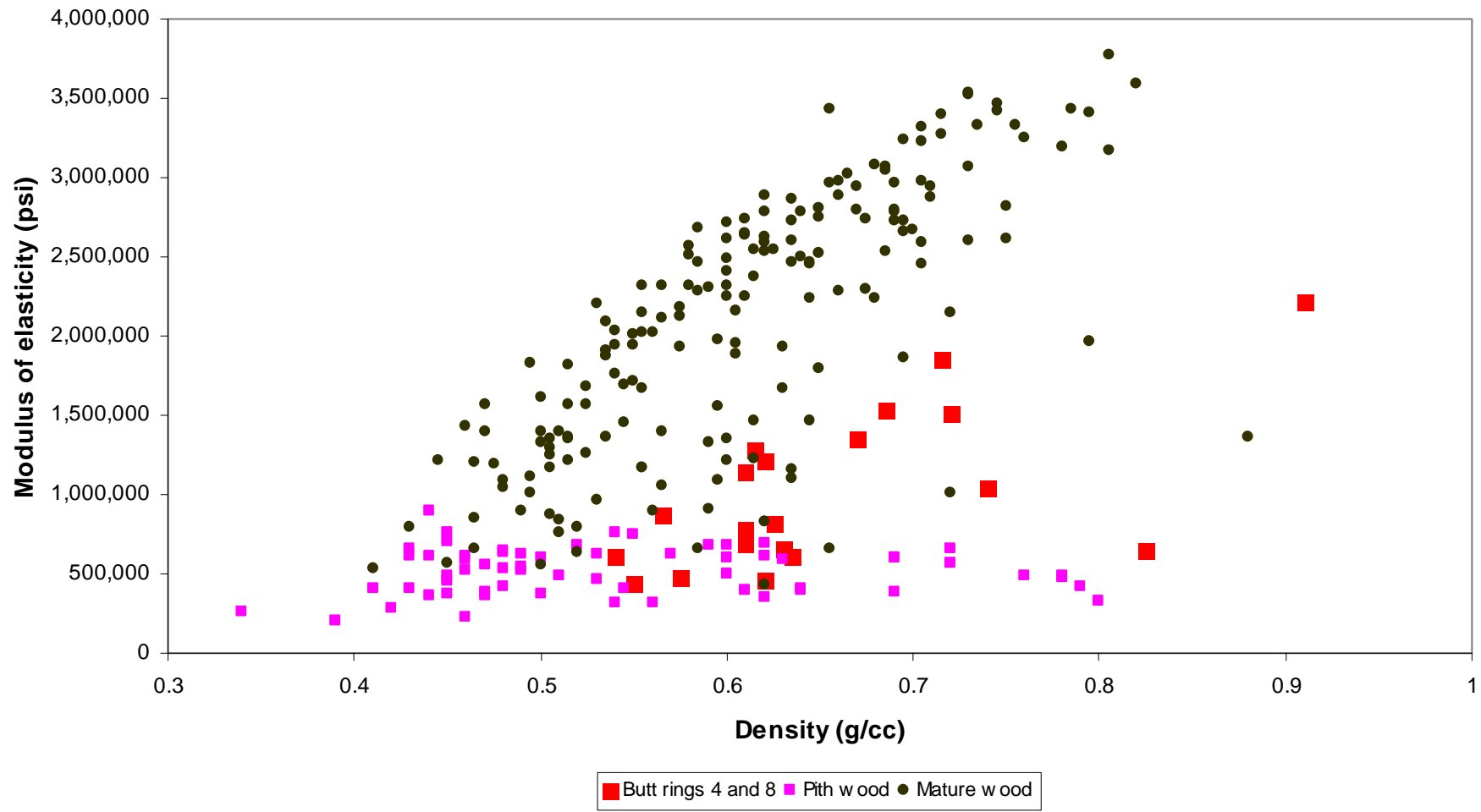
Prediction of density for mature and juvenile wood



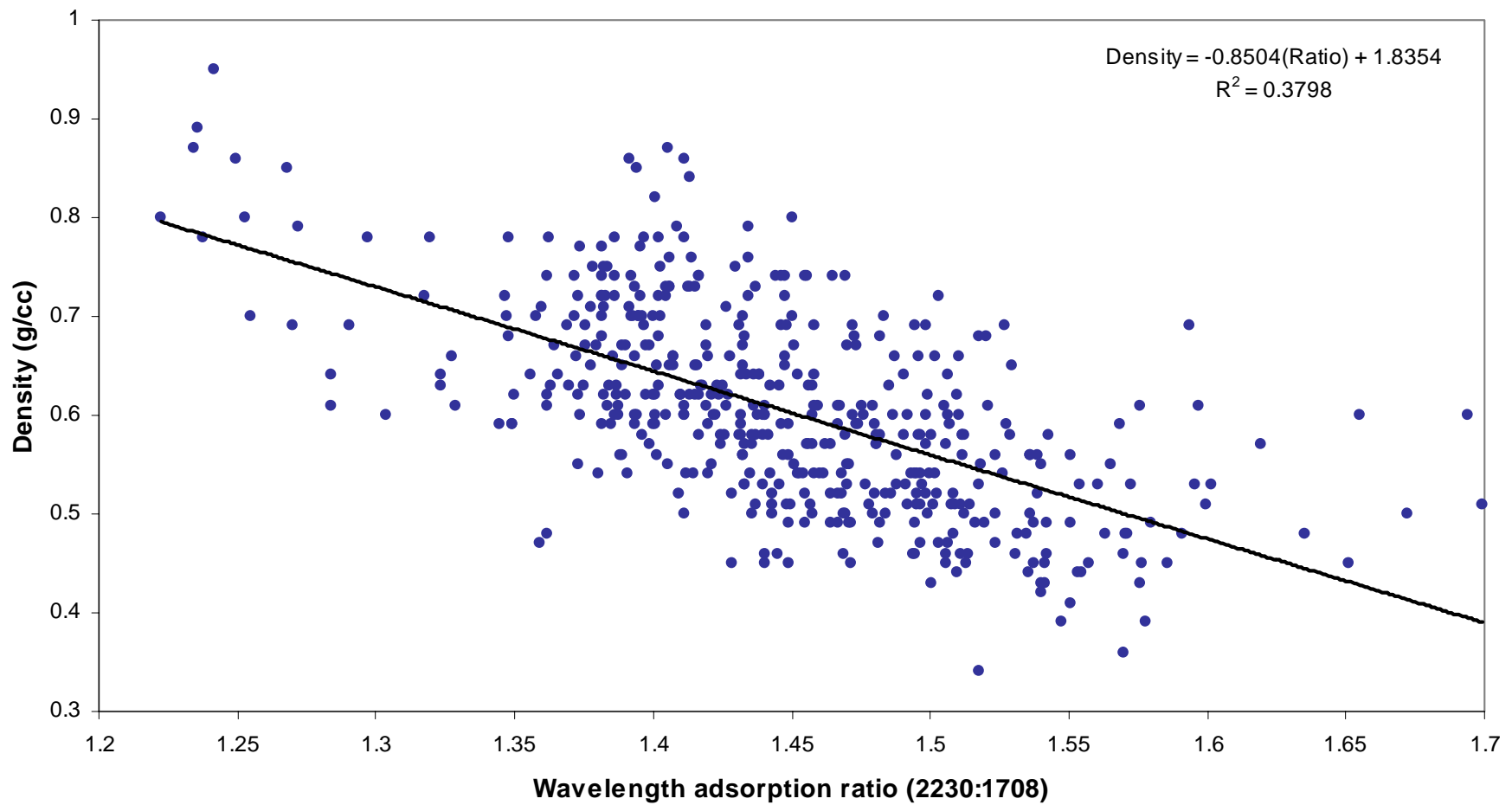
Validation of density model



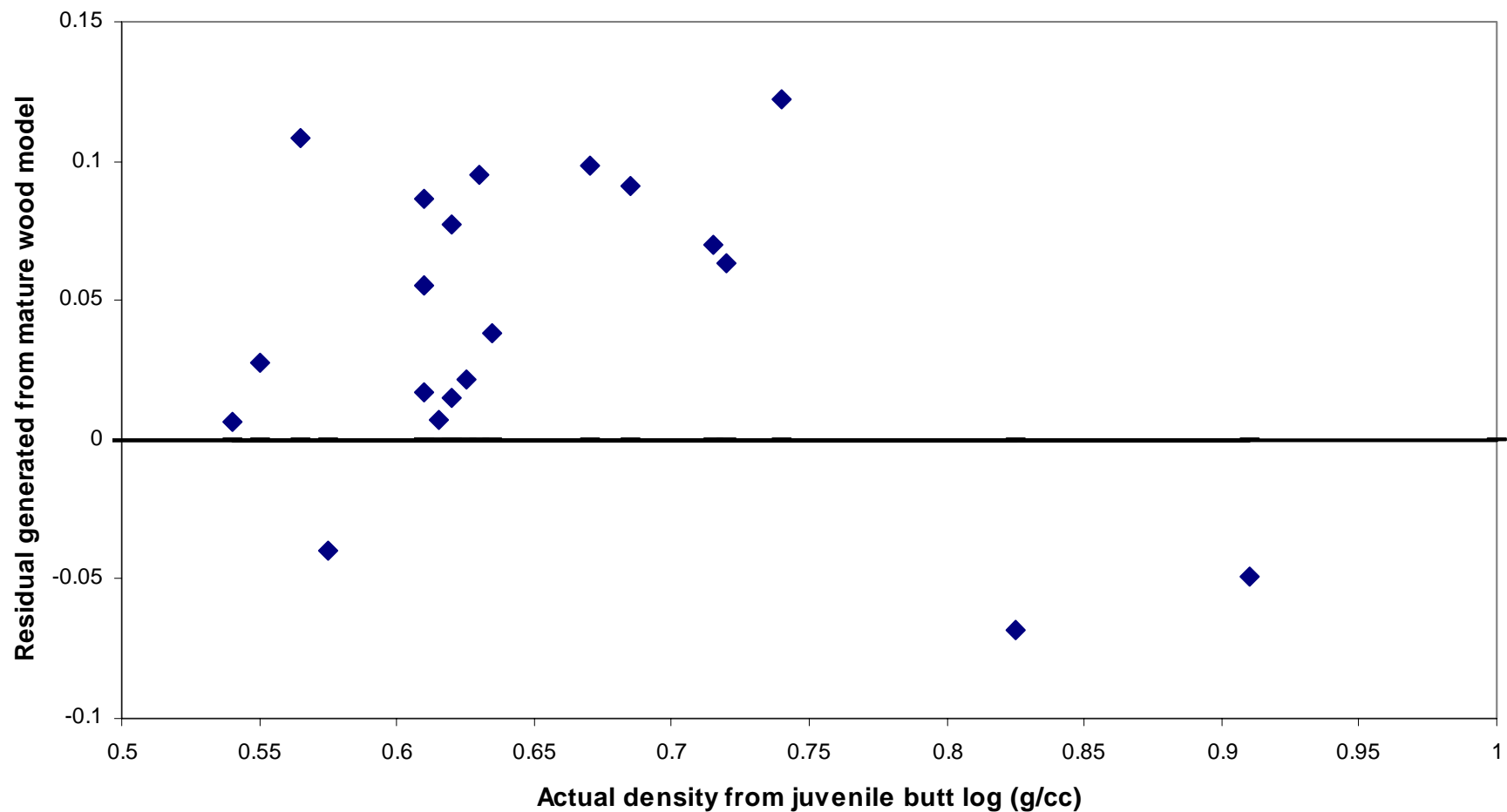
Density versus MOE for pith, juvenile, and mature wood



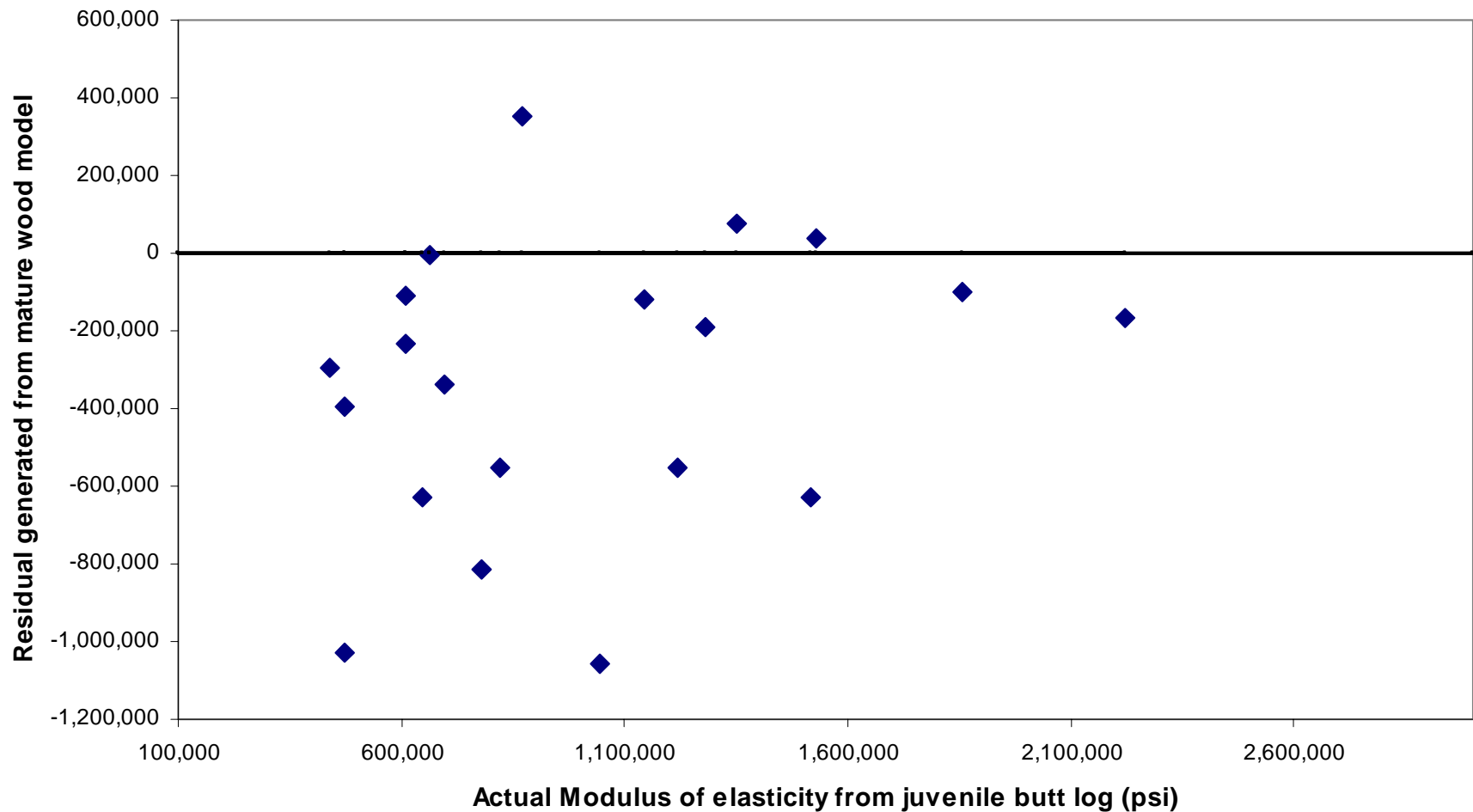
Prediction of density via ratio



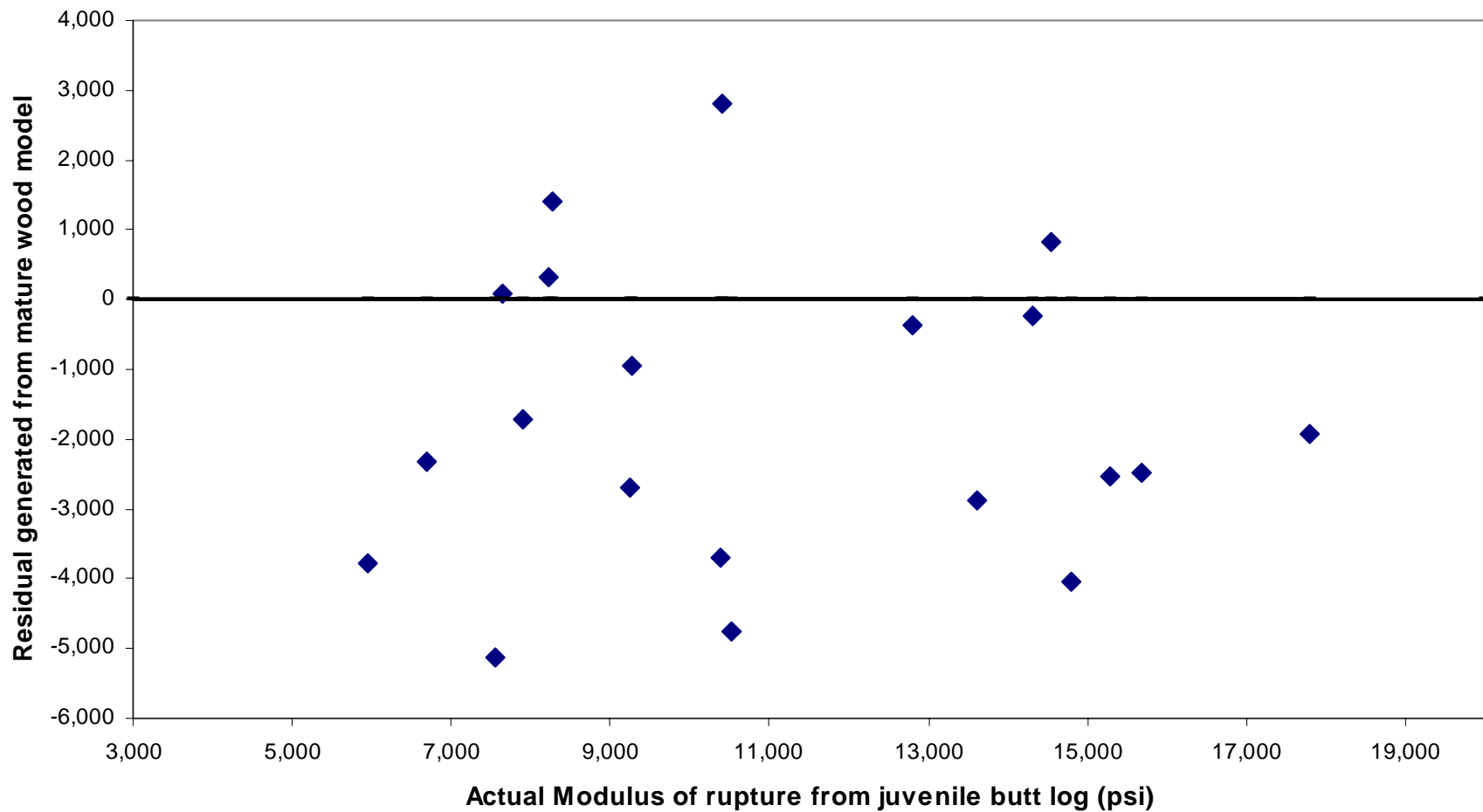
Density residual plot for juvenile wood density versus mature wood model



MOE residual plot for juvenile wood density versus mature wood model



MOR residual plot for juvenile wood density versus mature wood model



Preliminary Results

- Different models may be needed for juvenile wood at breast height versus mature wood taken from the whole tree.
- MOE and MOR is:
 - Strongly modeled by spectra for mature wood ($r^2 > 0.85$).
 - Moderately modeled by spectra from juvenile wood at butt log ($r^2 > 0.75$).
 - Weakly modeled by spectra for pith wood ($r^2 < 0.15$).
- Density can moderately be modeled for all three tree regions (0.65 to 0.75 r^2).
 - The baseline shift in spectra was probably attributable to macro density variation while the wavelength ratio was attributable to micro density variation attributable to lignin and cellulose.