Progress Report

Quantifying carbon sequestration as a function of silvicultural treatment in loblolly pine (CAFS 21.89)

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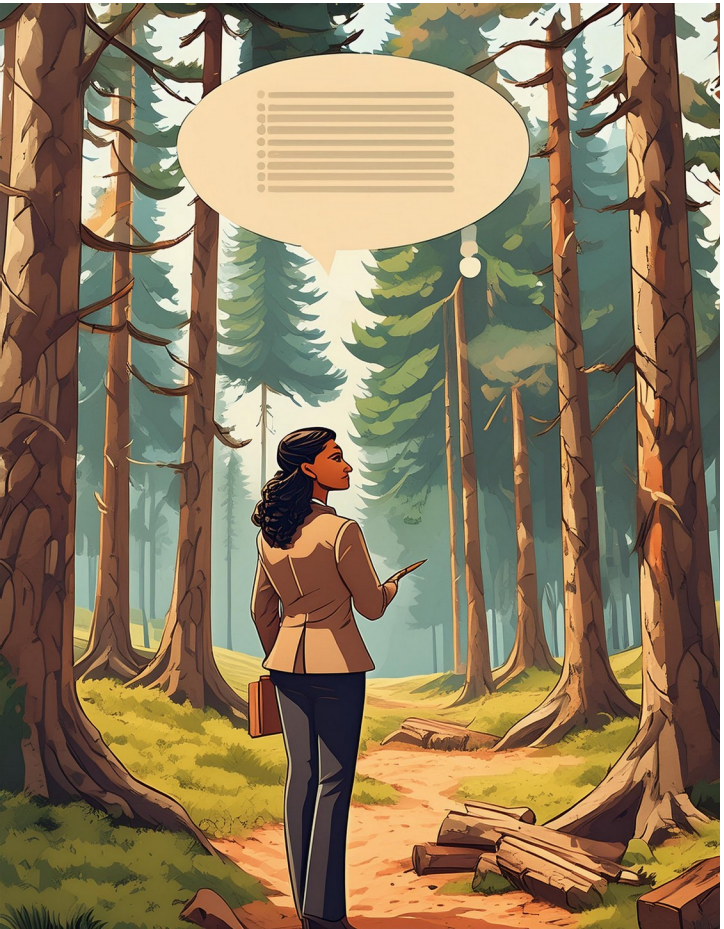
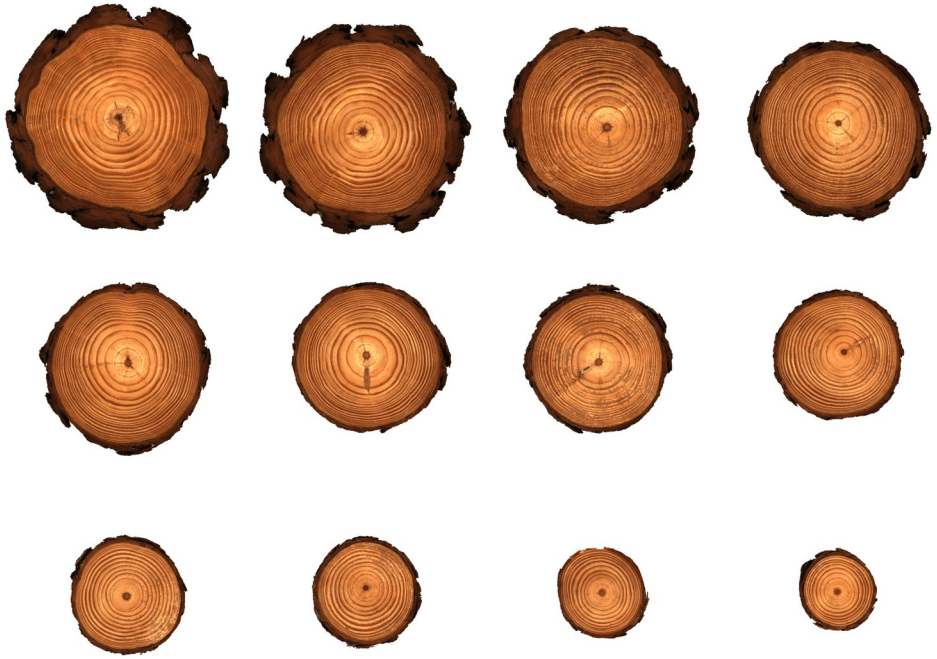
Presenter: Joe Dahlen (UGA)

Project Overview

- Growing interest in quantifying carbon in managed forests
- Weight of carbon for a tissue (e.g. wood) is a function of the volume, specific gravity, and carbon %





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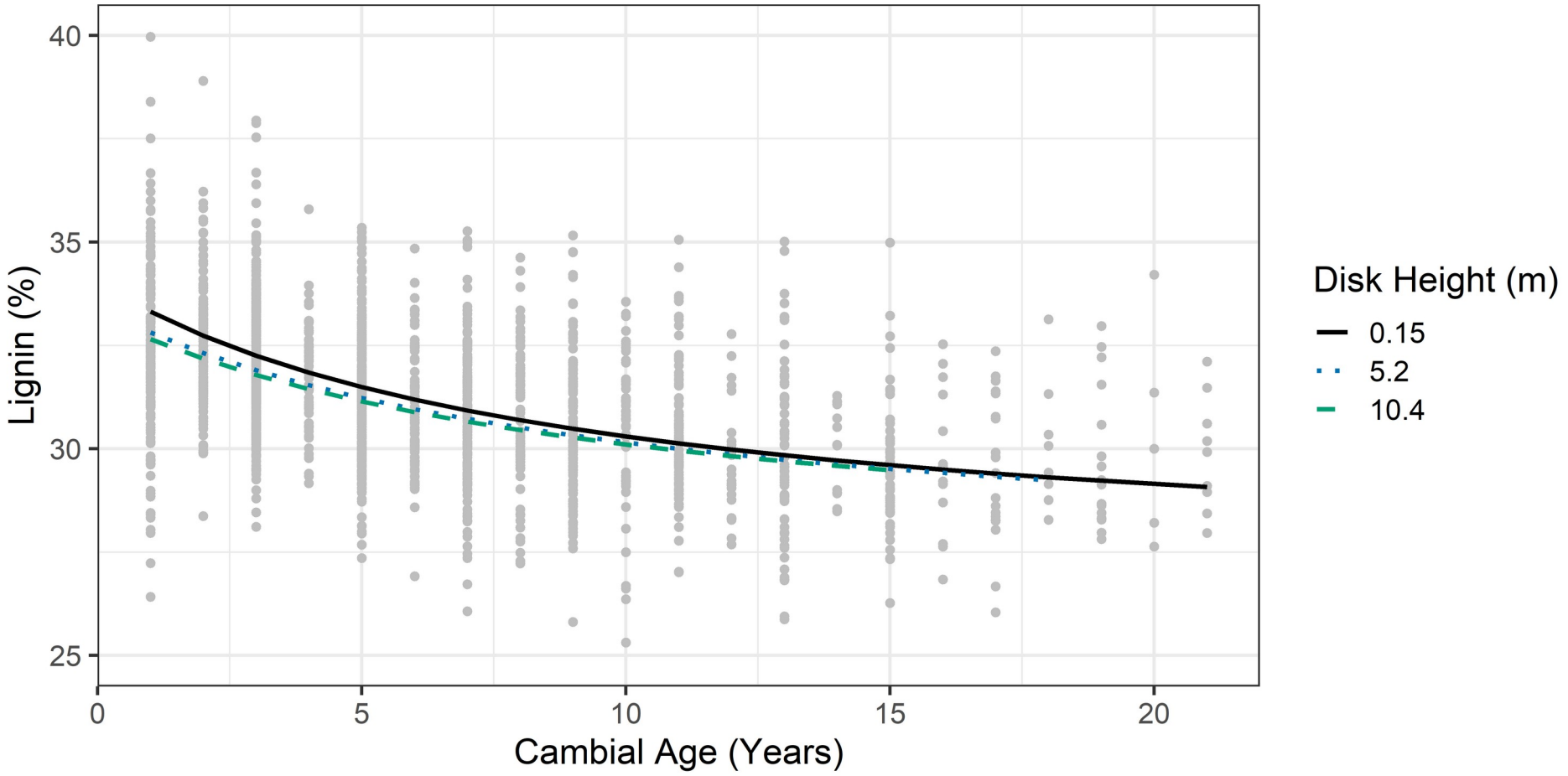
Wood carbon % largely a function of:
1) lignin to cellulose content



Wood carbon % largely a function of:
2) Extractives content

Current Progress

Supplement reference data with NIR

Develop extractives, lignin, and cellulose models for loblolly pine

Specim FX17

- 931 to 1718 nm wavelength range
- 2 lights 45° from camera
- Dark & white reference
- Tray contains 1 trees worth of samples
- Scanned 1000s of samples

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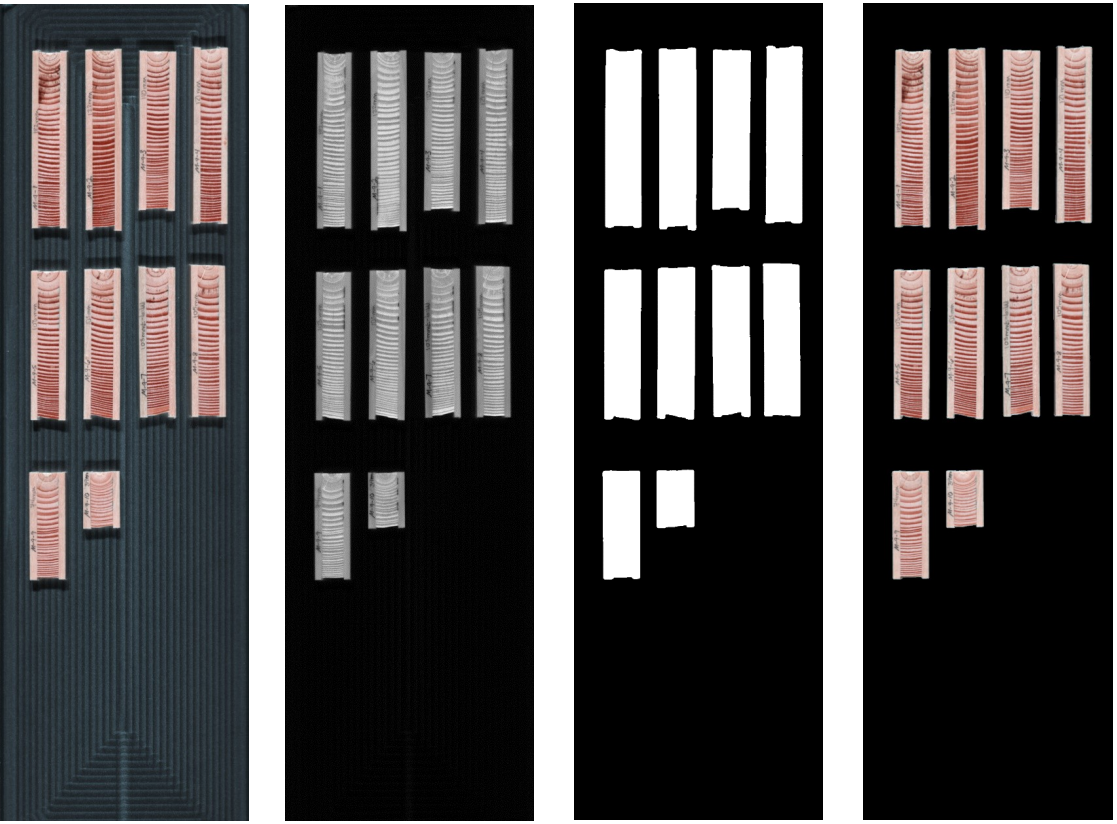
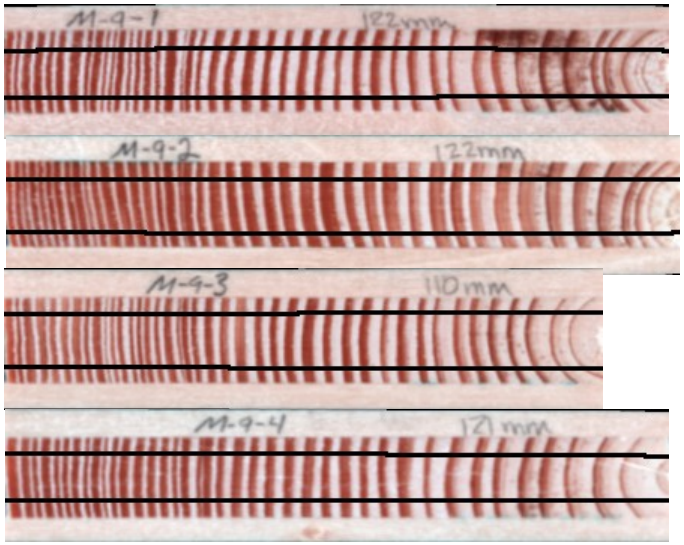
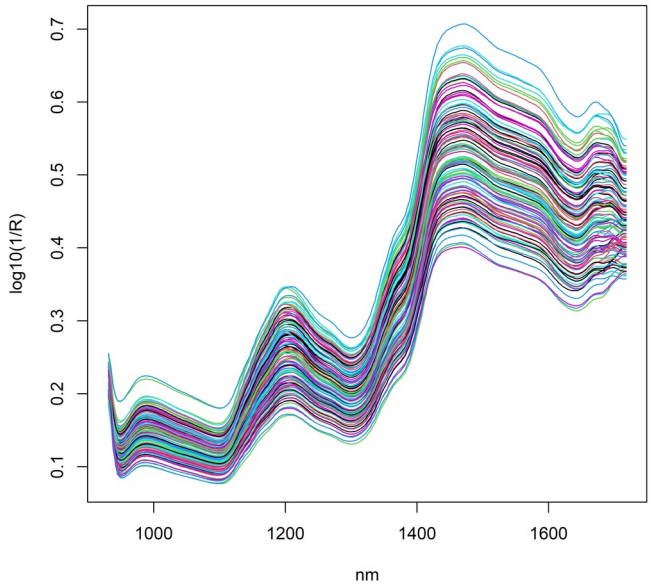
Image processing

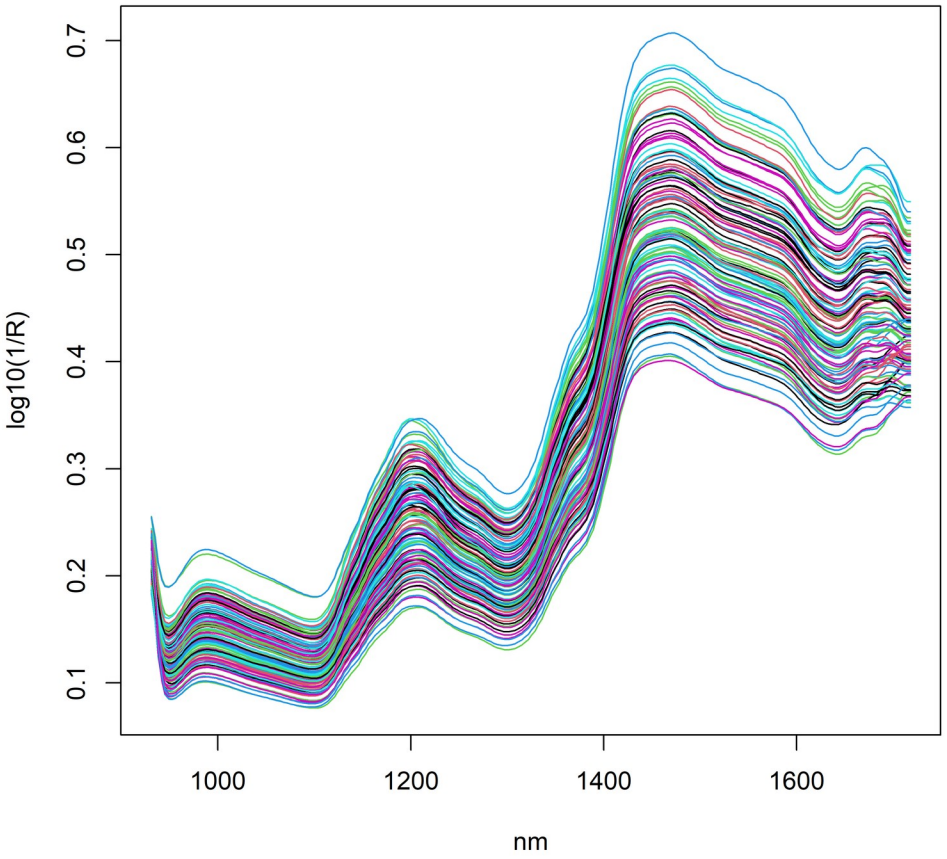
Current Progress





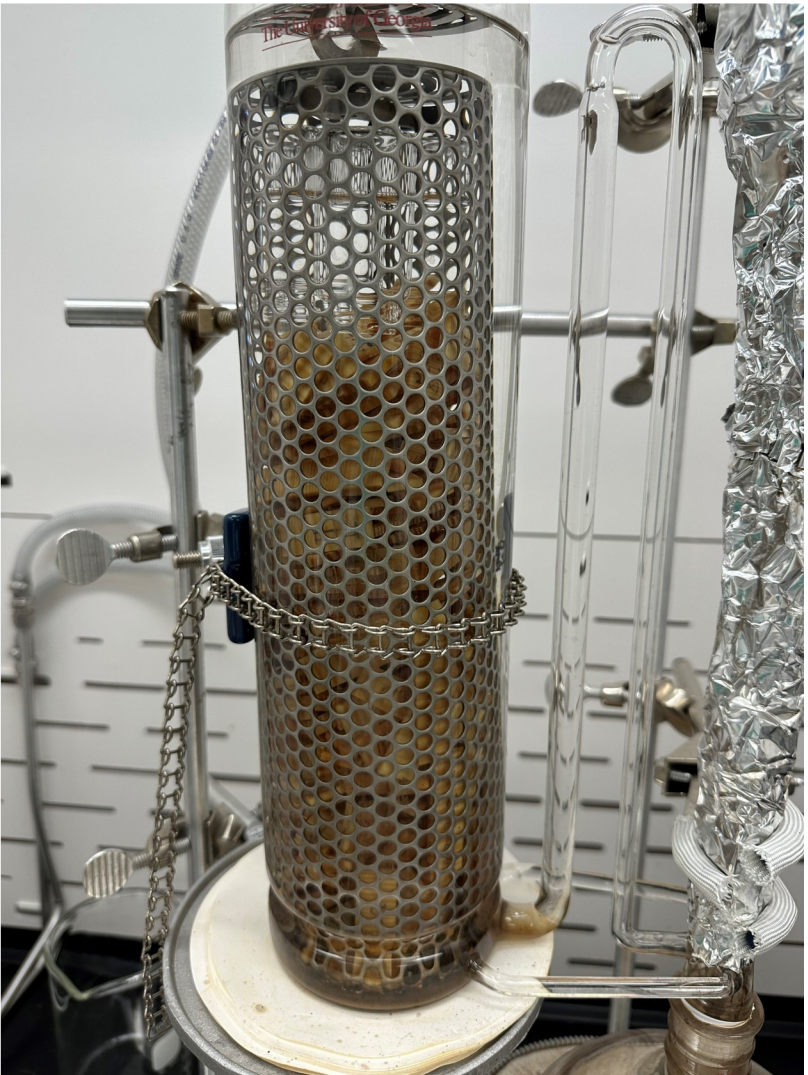


Select most unique samples

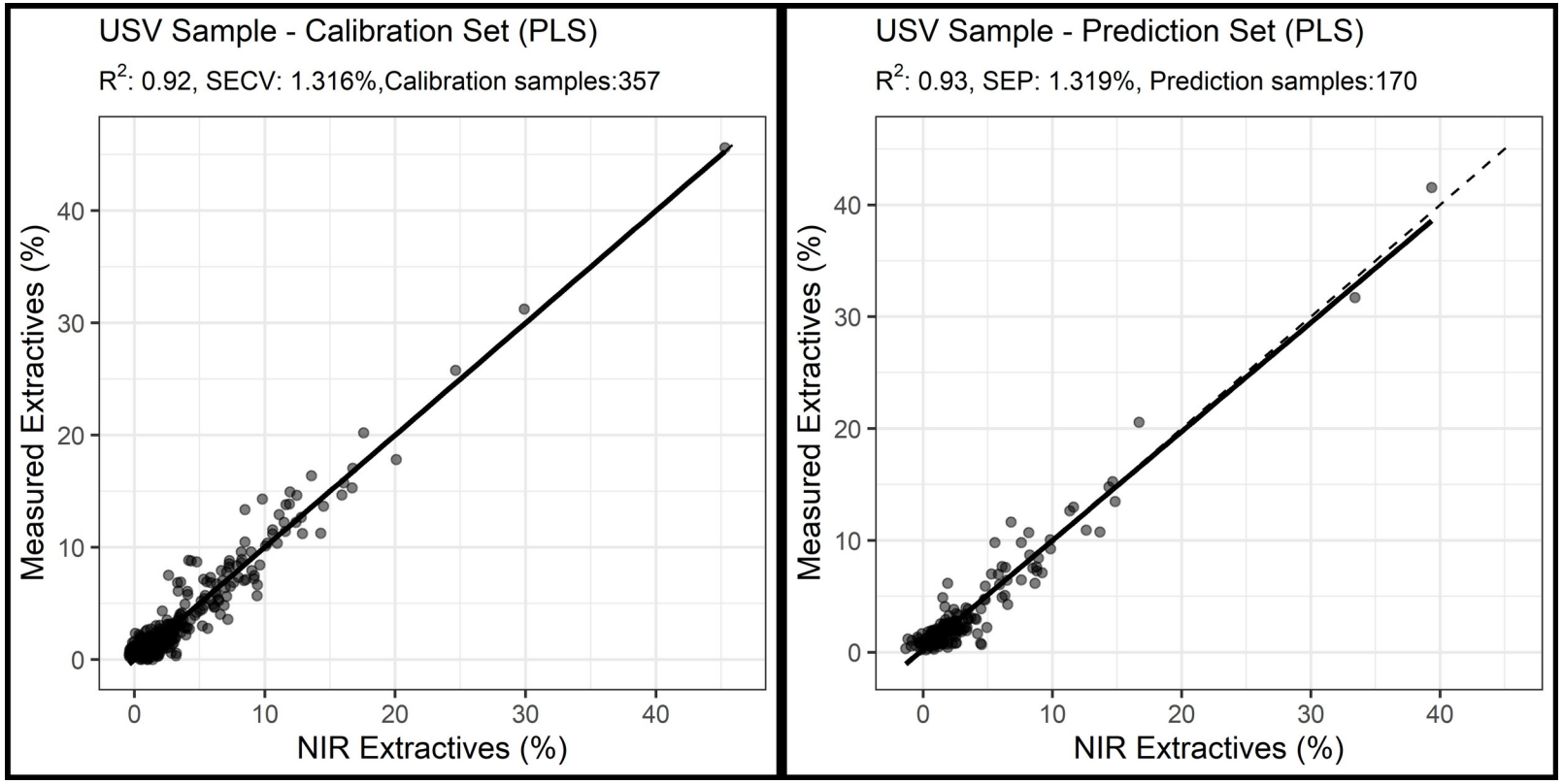


Current Progress

Extractives % = dry weight of samples before and after Soxhlet extraction

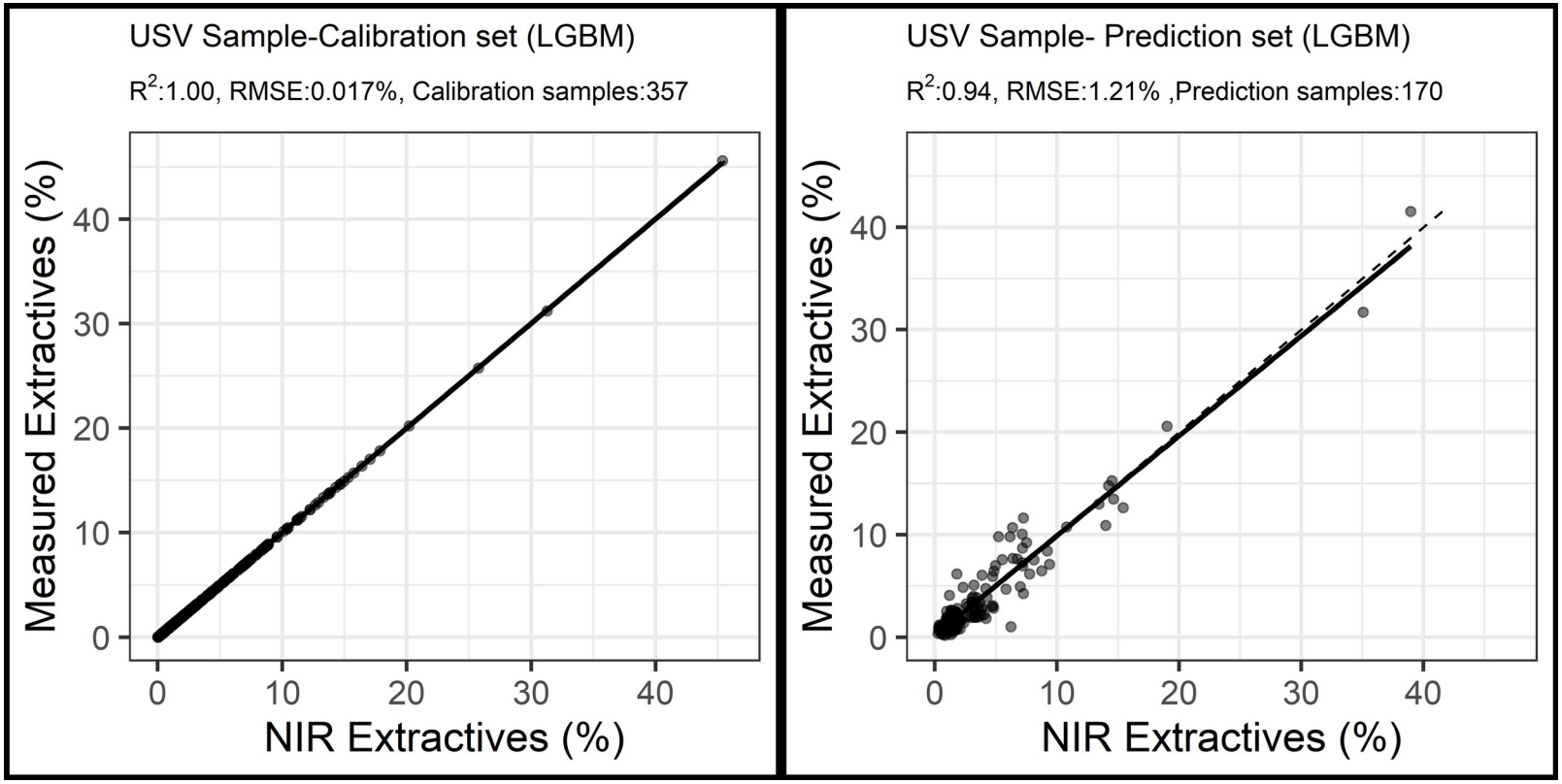


Extractives model for loblolly pine
Partial least squares (PLS) regression



Negative Extractives (%) predicted!!

Extractives model with Light Gradient Boosting Machine (LGBM)



No negative predictions

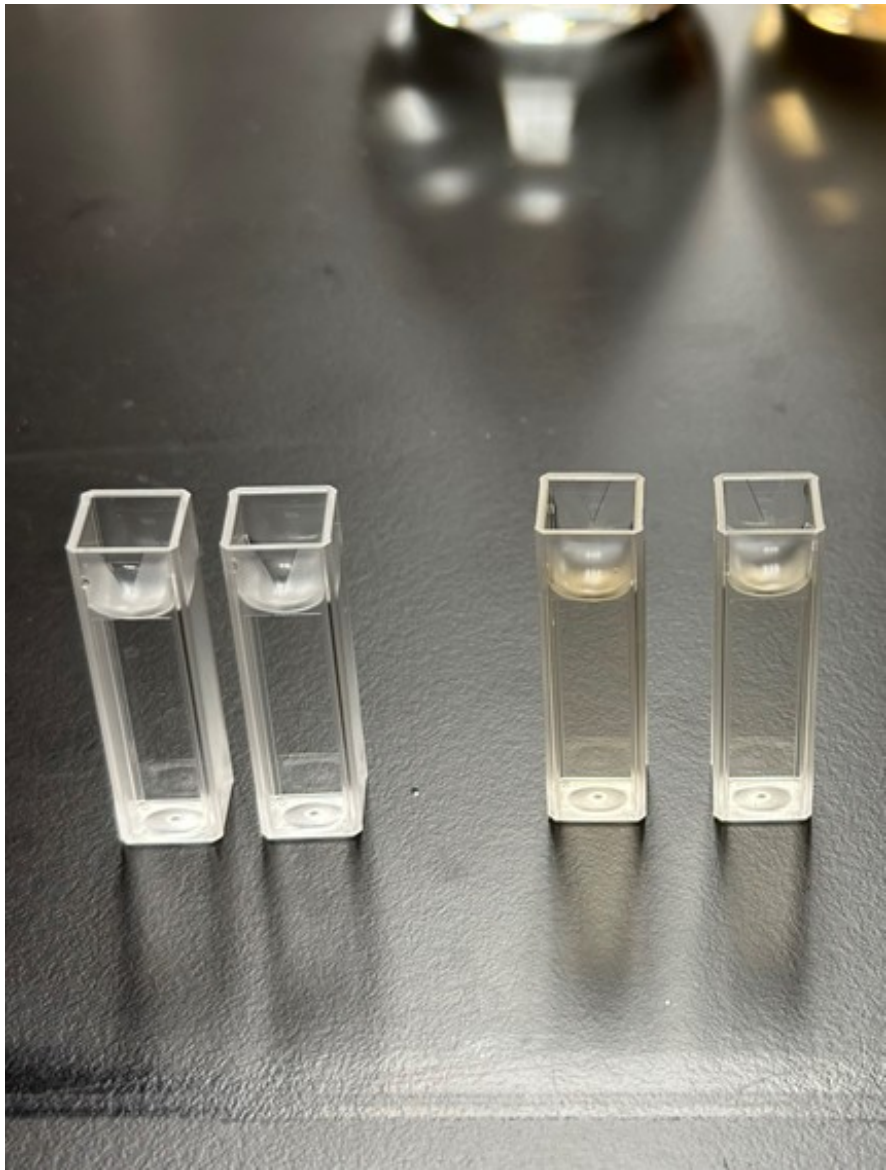
Average extractives content = 3.5%

Lignin, cellulose, and carbon content

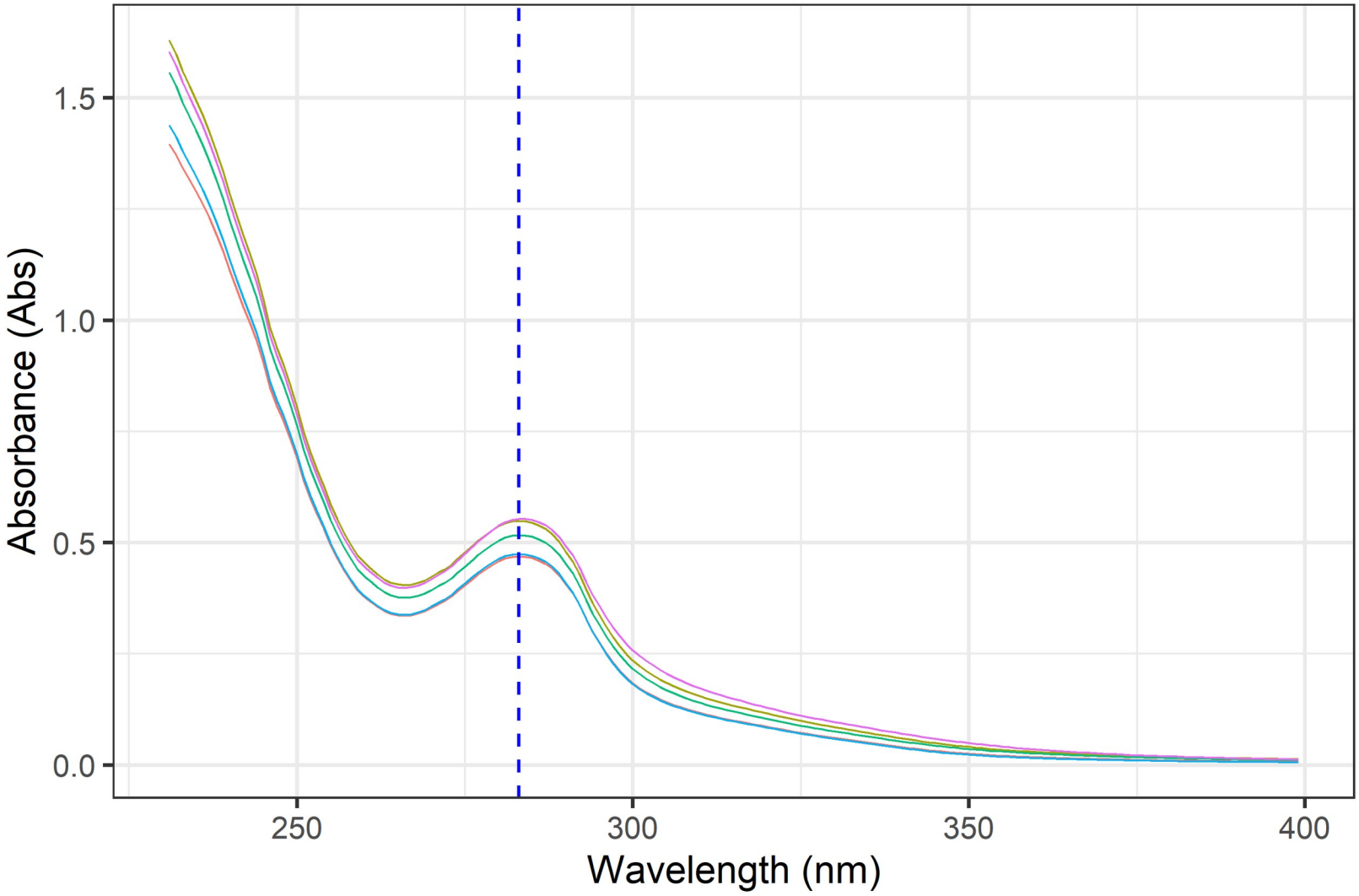
- Samples ground
- Lignin via CASA method
  - Finish in June
- Cellulose via Diglyme method + bleaching
  - Finish in June
- Carbon via CHNS analyzer
  - 50 samples

Lignin % - dissolve samples in sulfuric acid + cysteine

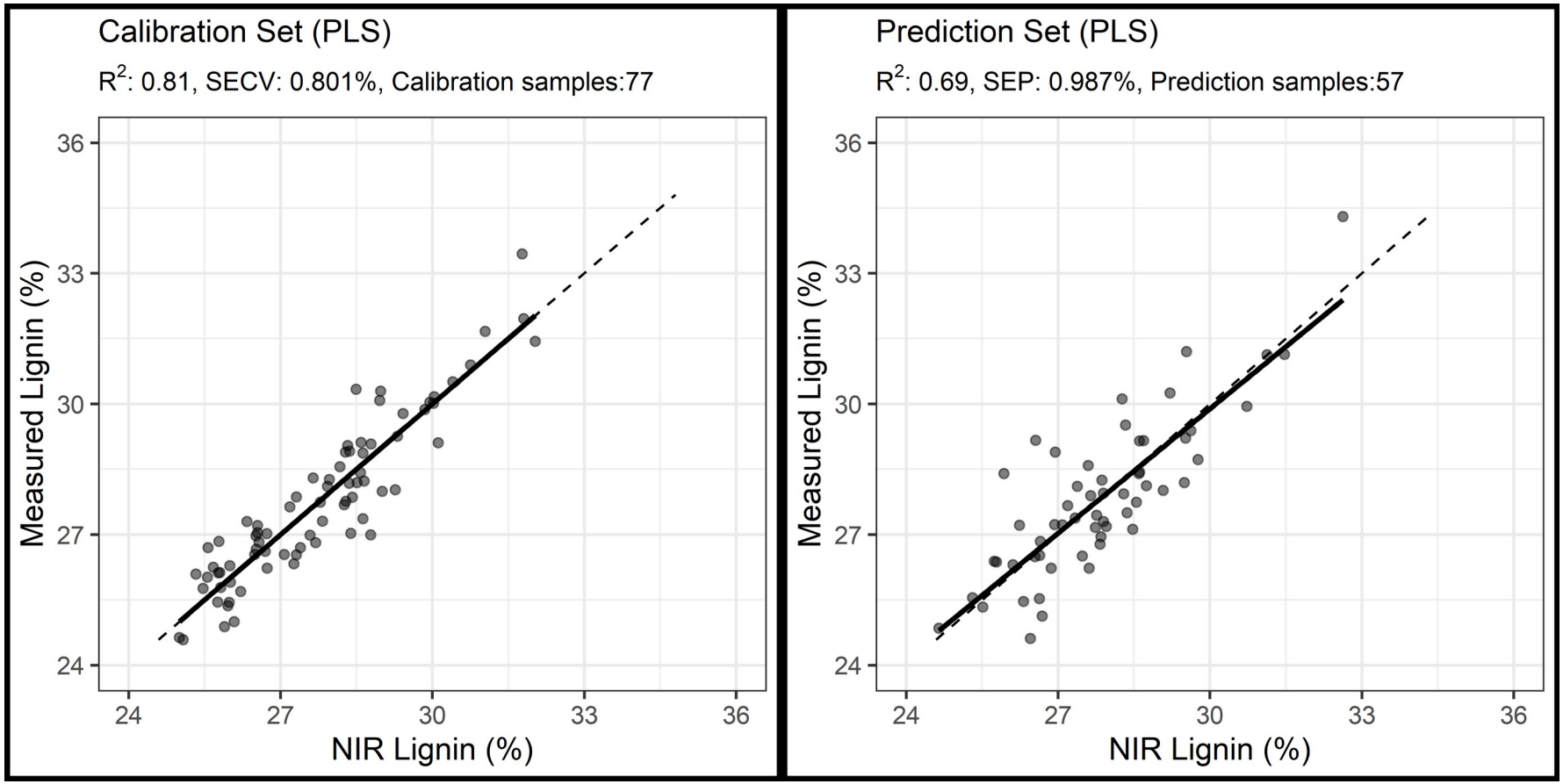
Lignin % - dilute solution



Lignin % - quantify lignin % using spectrophotometer at 283 nm



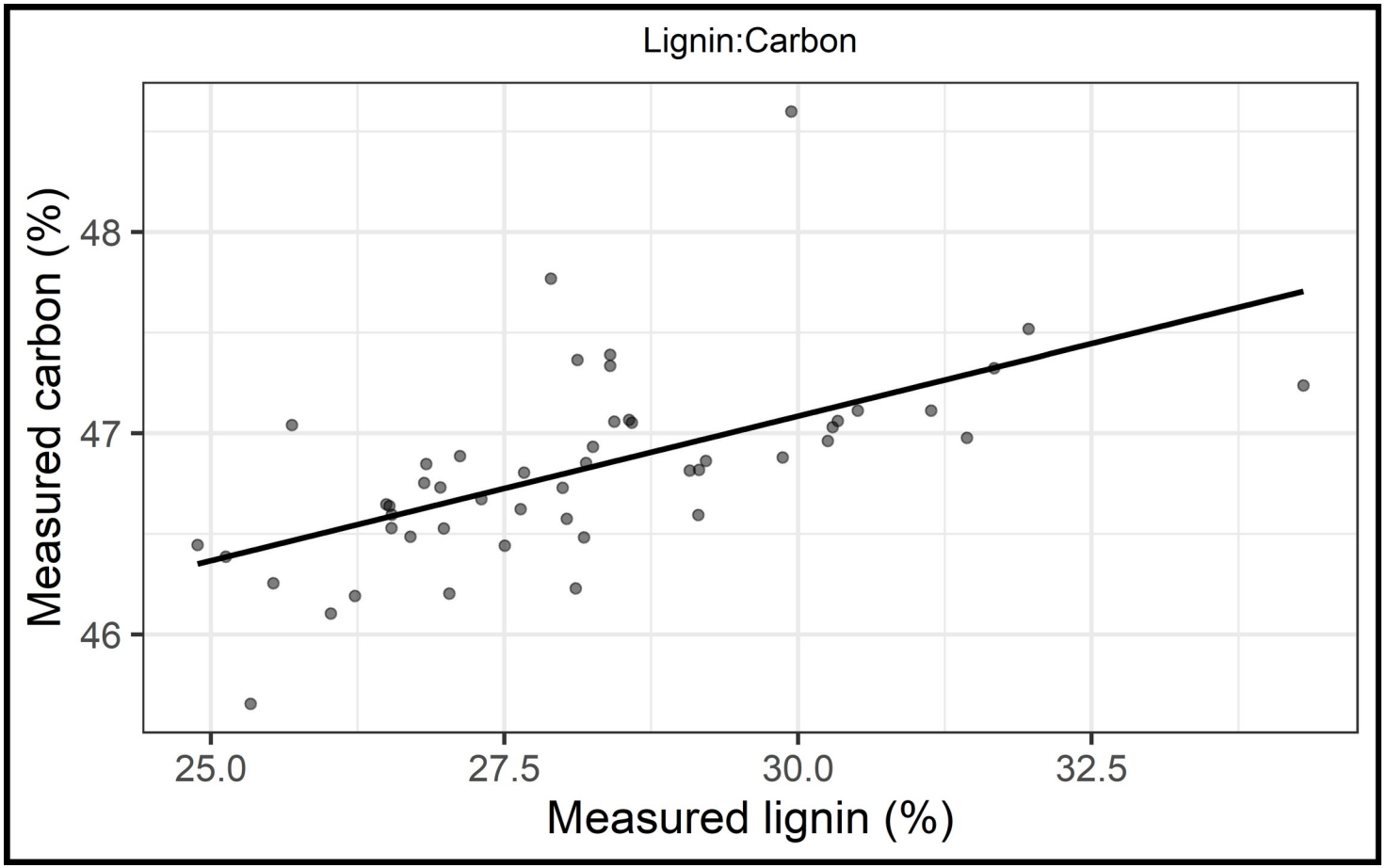
Preliminary lignin model with PLS regression



Will fit LGBM model when measurements are completed

Average lignin content = 27.8%

Carbon relationship with lignin

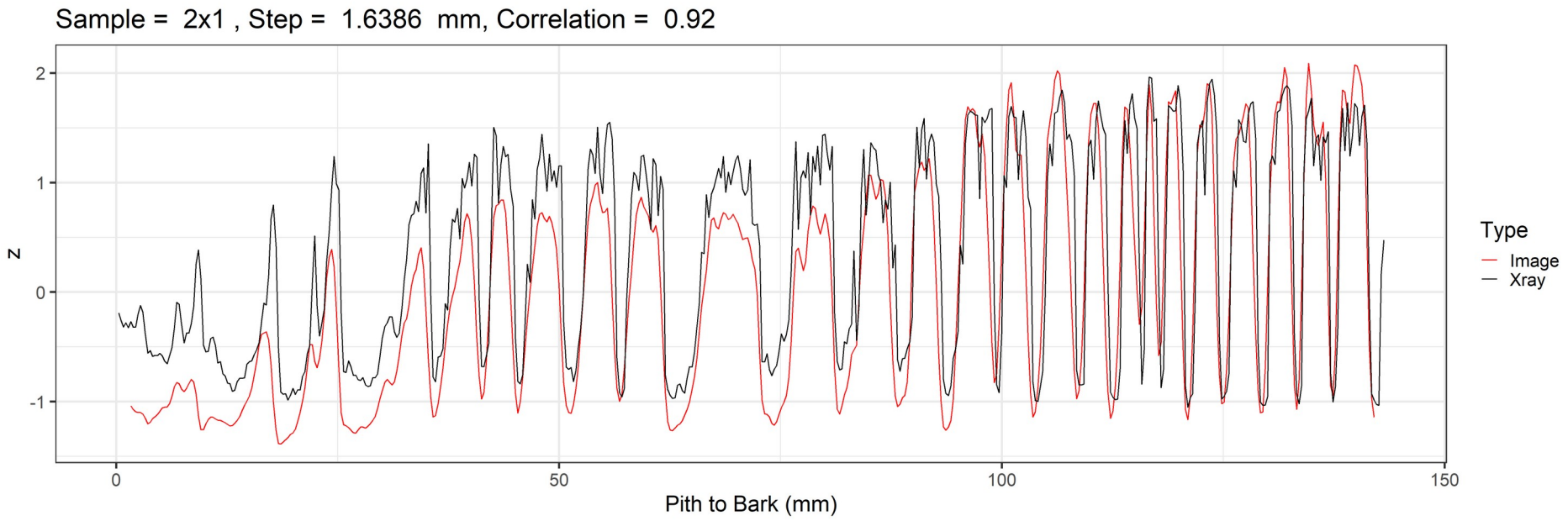


NIR model for carbon is terrible
Average carbon content = 46.8%

Wood carbon % largely a function of:
2) Extractives content
Carbon content of extractives = 71.6%

Future Plans

- Complete lignin measurements (June)
- Complete cellulose measurements (June)
- Finalize NIR models (June-July)
- Predict ring level values and build models (post July)



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
- AI images via Adobe

- jdahlen@uga.edu

- Comic: xkcd