Continuing Project

Quantifying carbon sequestration as a function of silvicultural treatment in loblolly pine

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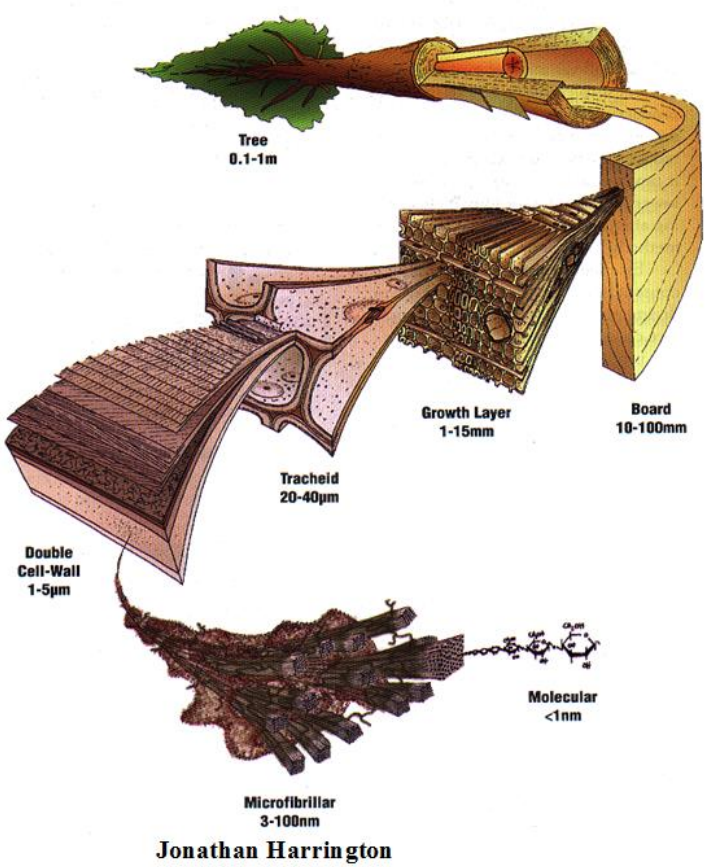
Wood properties measured – which are relevant to carbon?



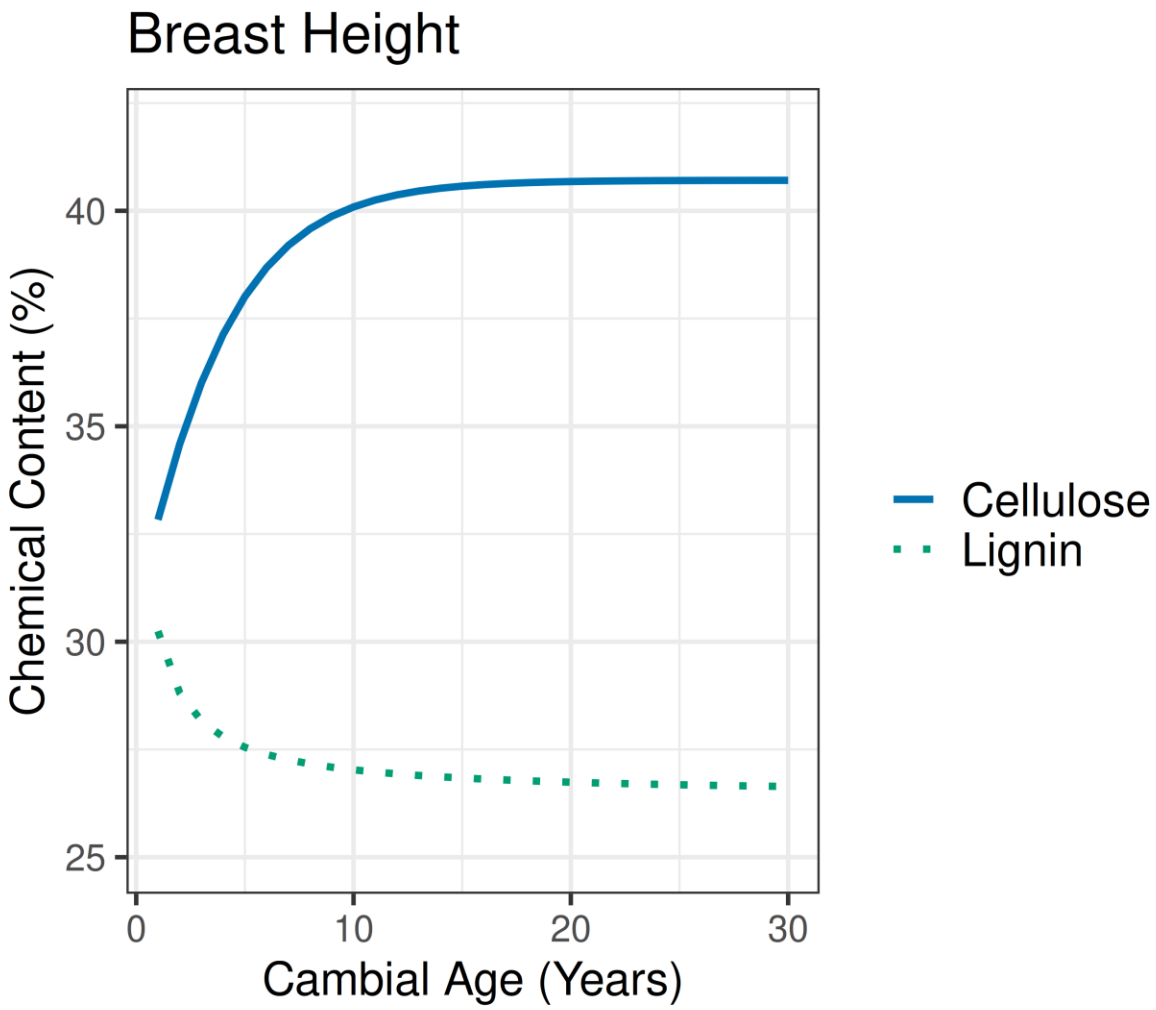
- **Specific gravity**
- Acoustic velocity
- Stiffness (MOE)
- Tracheid length
- Tracheid width
- **Extractives**
- **Cellulose**
- **Lignin**
- **Carbon %**

Justification

- Growing interest in quantifying carbon in managed forests
- Carbon in wood function of Volume, SG, Carbon %
- Carbon % function of Extractives %, Chemistry

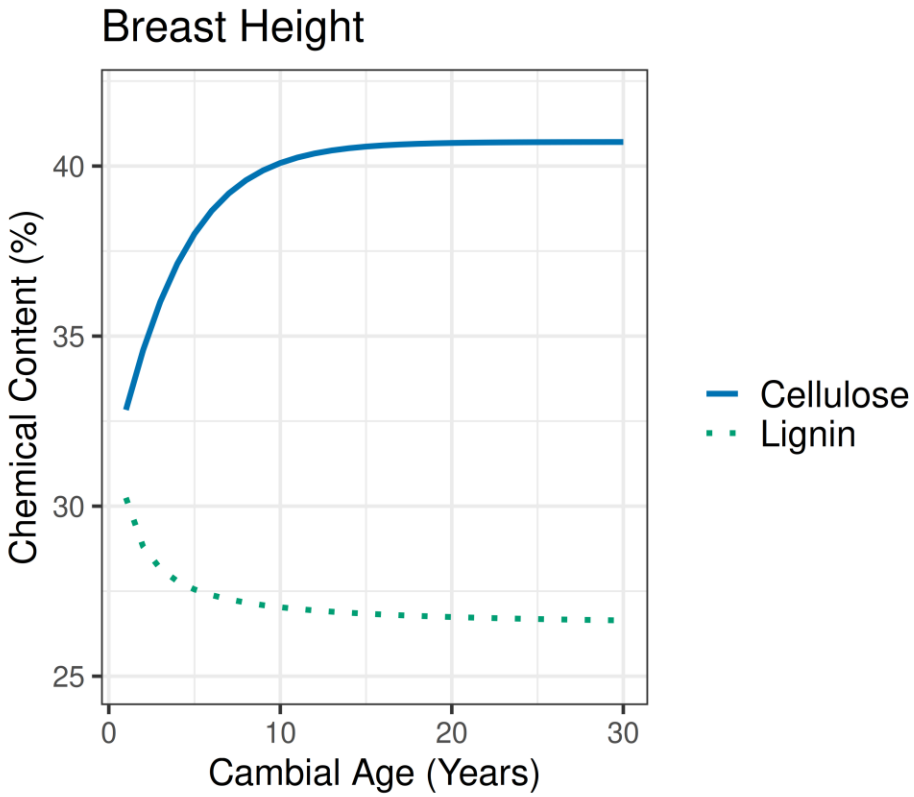
Current Progress

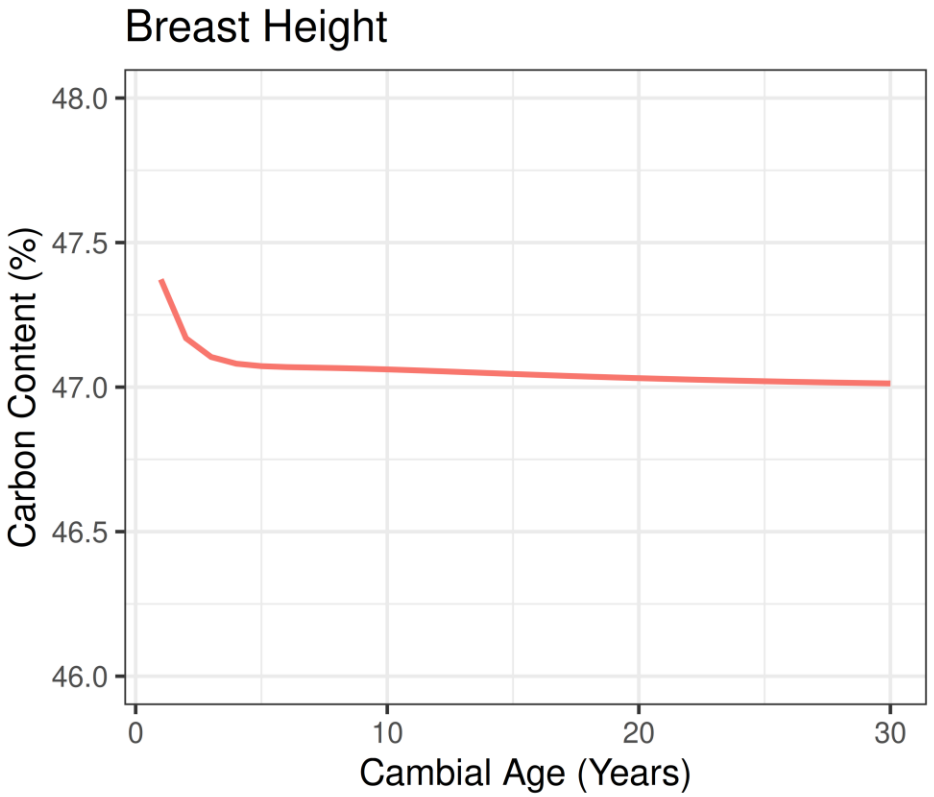
Cellulose (44.4% C) and lignin (~59% C) vary radially from pith to bark and longitudinally from stump to tip (not shown)



Current Progress

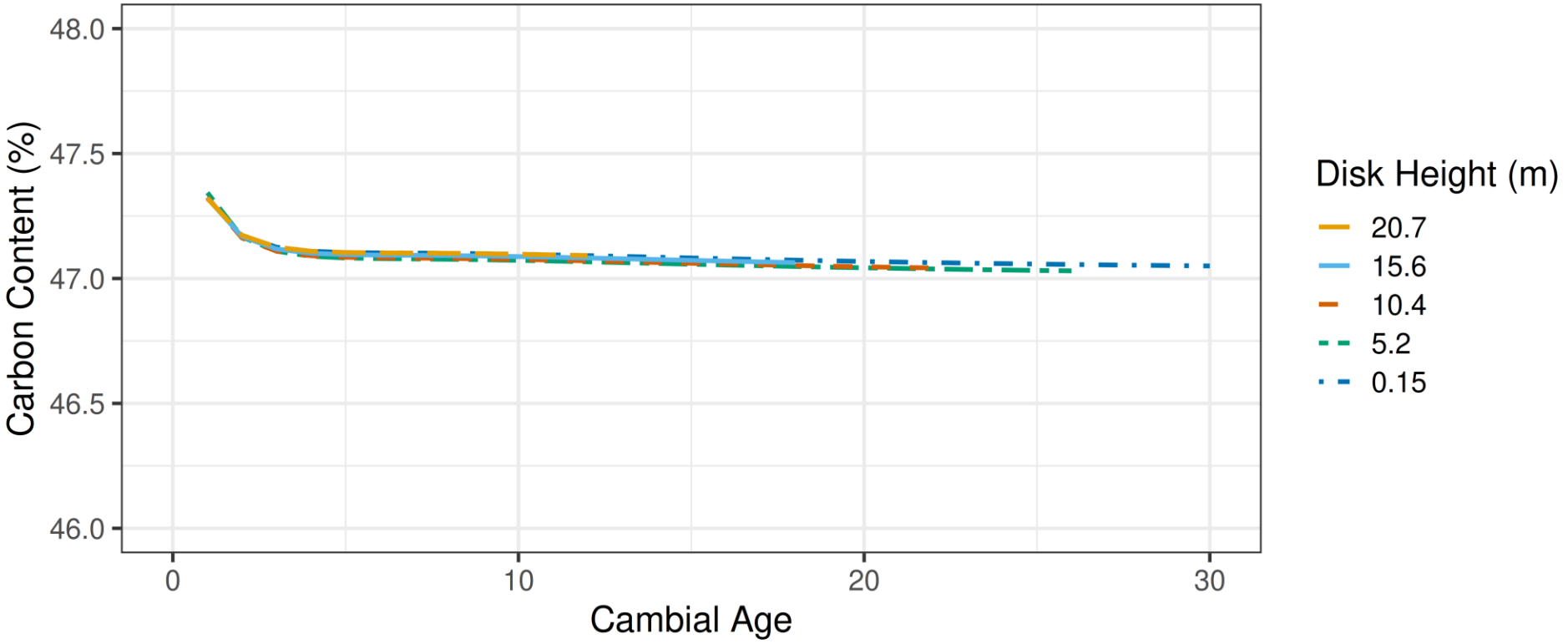
But calculated carbon content is relatively stable from pith to bark (extractive free wood)
Calculated carbon content = 47.1%





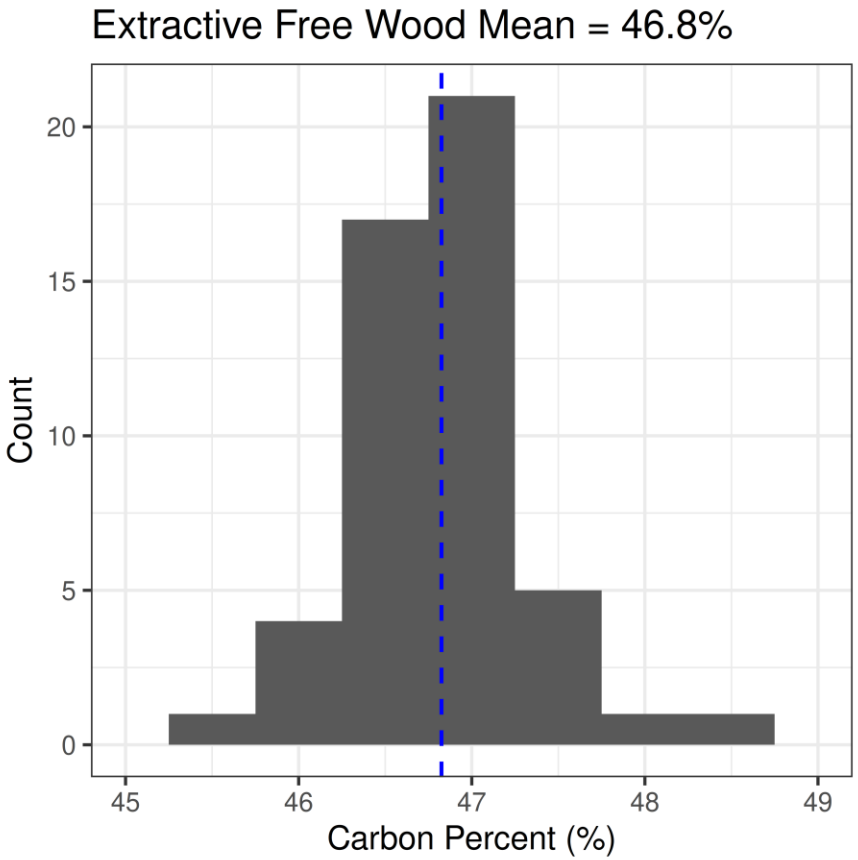
Current Progress

And calculated carbon content shows very little variation with height (extractive free wood)
Calculated carbon content = 47.1%



Current Progress

Measured carbon content is also relatively consistent (extractive-free wood)



47.1% vs 46.8% differences due to moisture, ash, assumptions, or data/models

FIA carbon content for loblolly pine = 47.7%

Extractives (~71.6% C) will increase carbon %!

Justification

- Carbon in wood function of Volume, SG, Carbon %
- SG - radial, longitudinal, and regional variation
- Carbon % – models of extractives %

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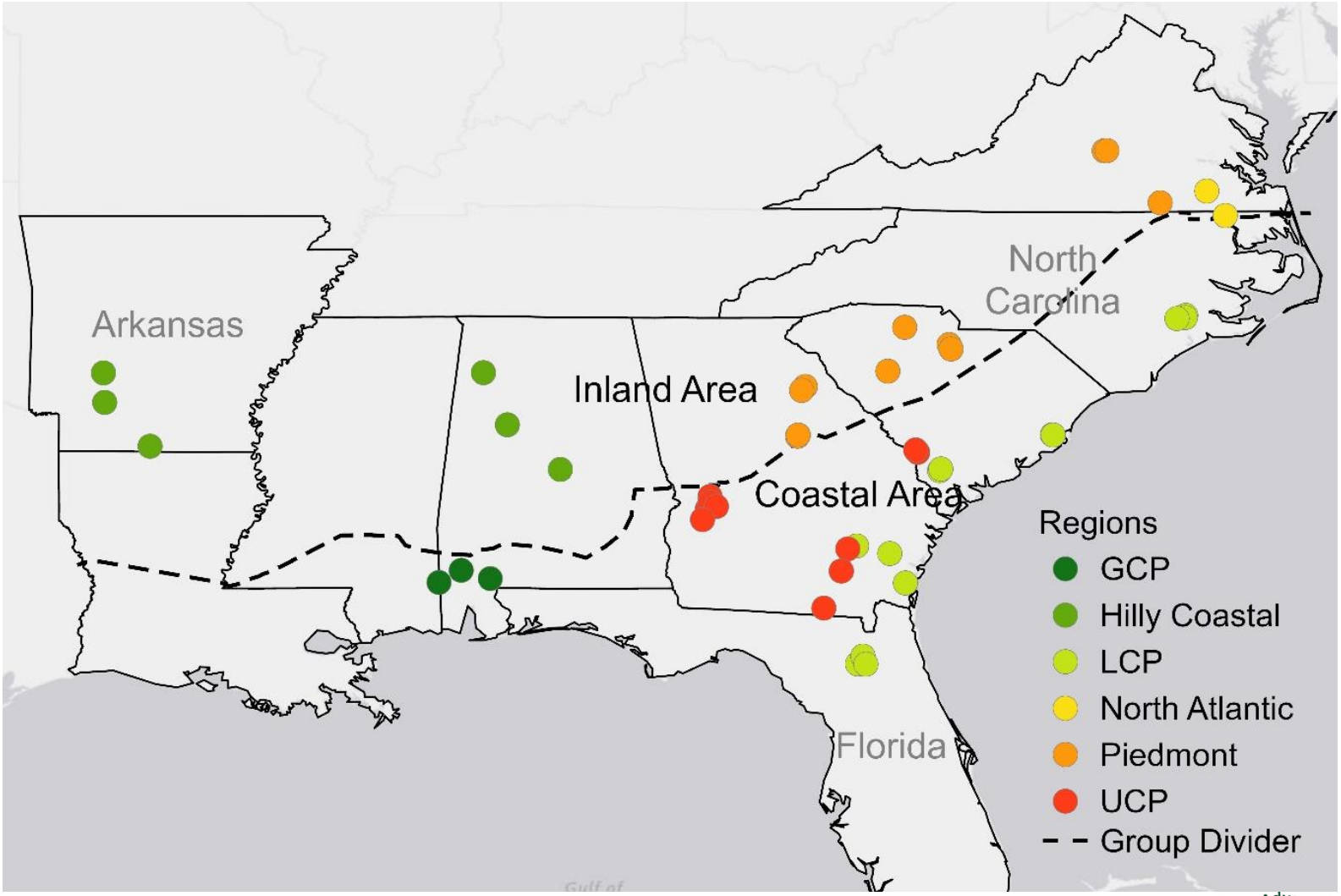
Methods

Sampling sites - ~23.5 years of age



Major Findings

Whole Tree Wood and Bark MC% & SG

Region	Wood		Bark	
	Wood SG	Wood MC%	Bark SG	Bark MC%
Coastal	0.499a	99a	0.290	95
Inland	0.447b	116b	0.285	93
Overall	0.474	107	0.288	94

Major Findings

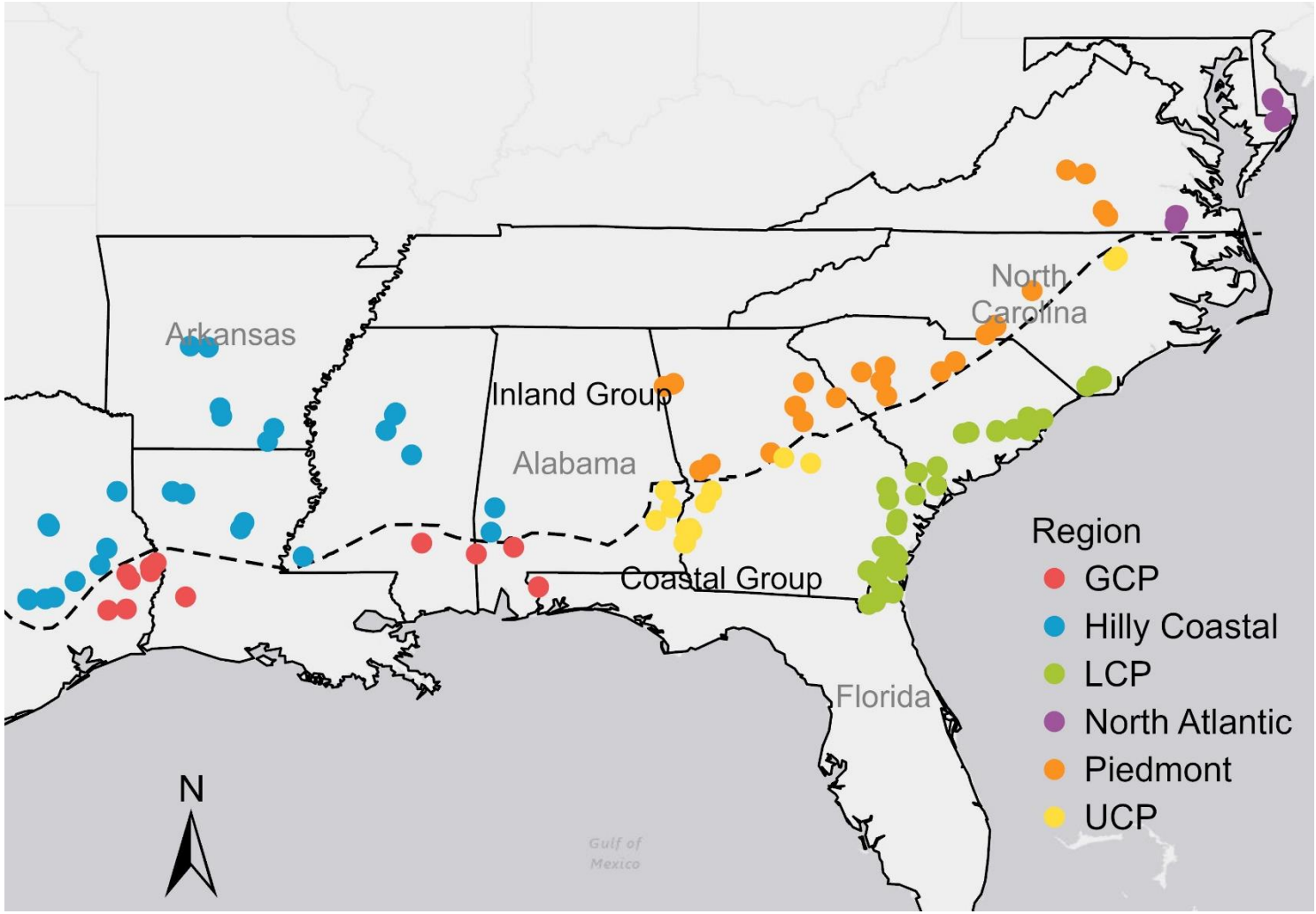
Dry Tons of Carbon Per Green Ton
(Assume Wood = 47.7% and Bark = 48.5%)

Region	Wood		Bark		Wood+Bark	
	Dry Mass	Carbon	Dry mass	Carbon	Dry mass	Carbon
Coastal	0.504a	0.241a	0.519	0.252	0.505a	0.241a
Inland	0.466b	0.222b	0.526	0.255	0.472b	0.225b
Overall	0.486	0.232	0.522	0.253	0.489	0.234

Major Findings

Hilly Coastal vs Lower Coastal Plain

Conventional Stands



Major Findings

Coastal Group (Conventional vs Intensive)

Tissue	Property	Conventional	Intensive
		Mean	Mean
Tree	Age (years)	22.9	23.0
	DBH (cm)	22.9a	26.8b
	Height (m)	19.8a	21.0b
Wood	Specific gravity	0.464a	0.499b

Major Findings

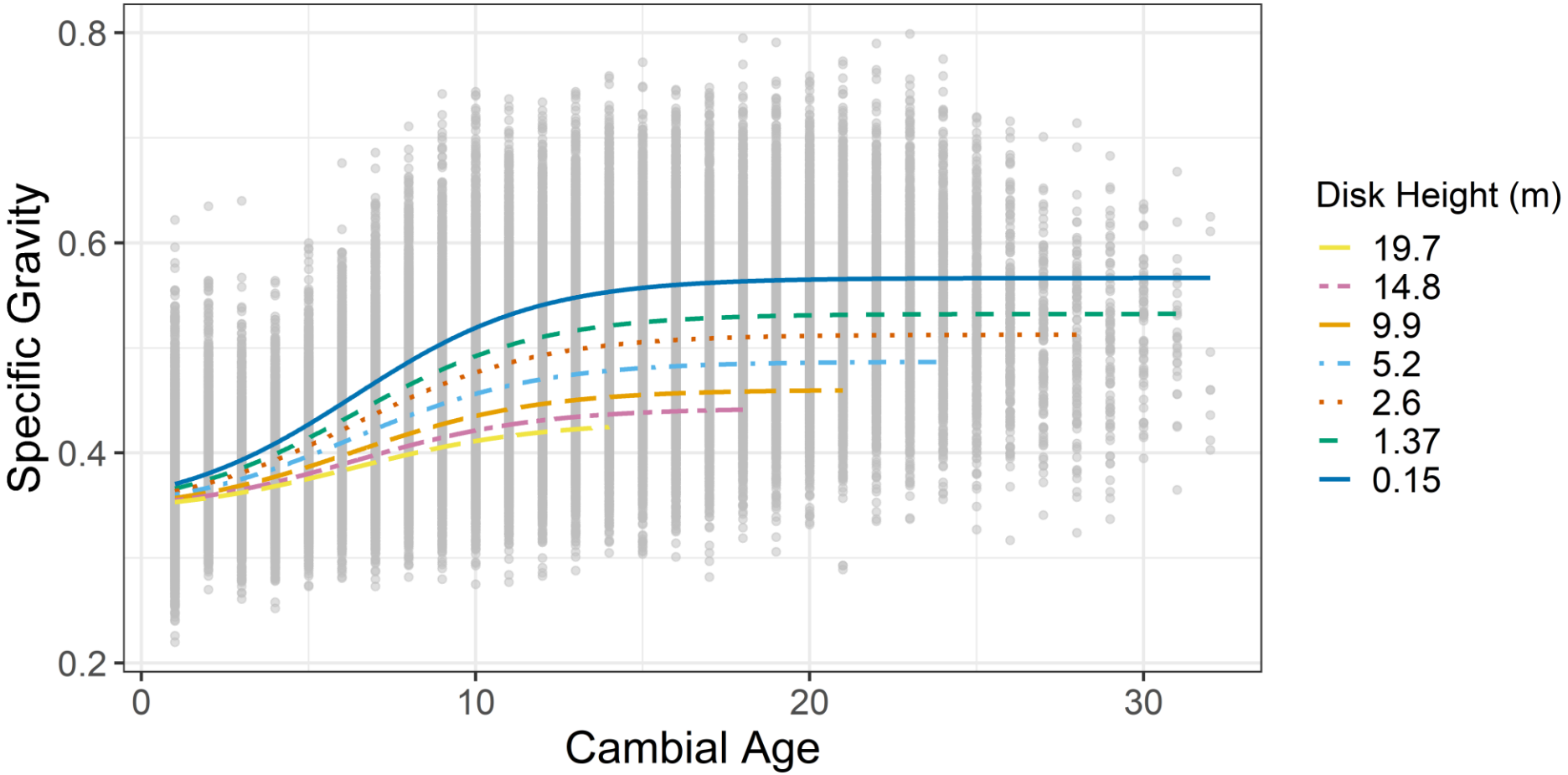
Inland Group (Conventional vs Intensive)

Tissue	Property	Conventional	Intensive
		Mean	Mean
Tree	Age (years)	23.1	24.2
	DBH (cm)	23.4a	27.9b
	Height (m)	18.1a	21.4b
Wood	Specific gravity	0.437a	0.447b

For Wood SG, p-value = 0.0497

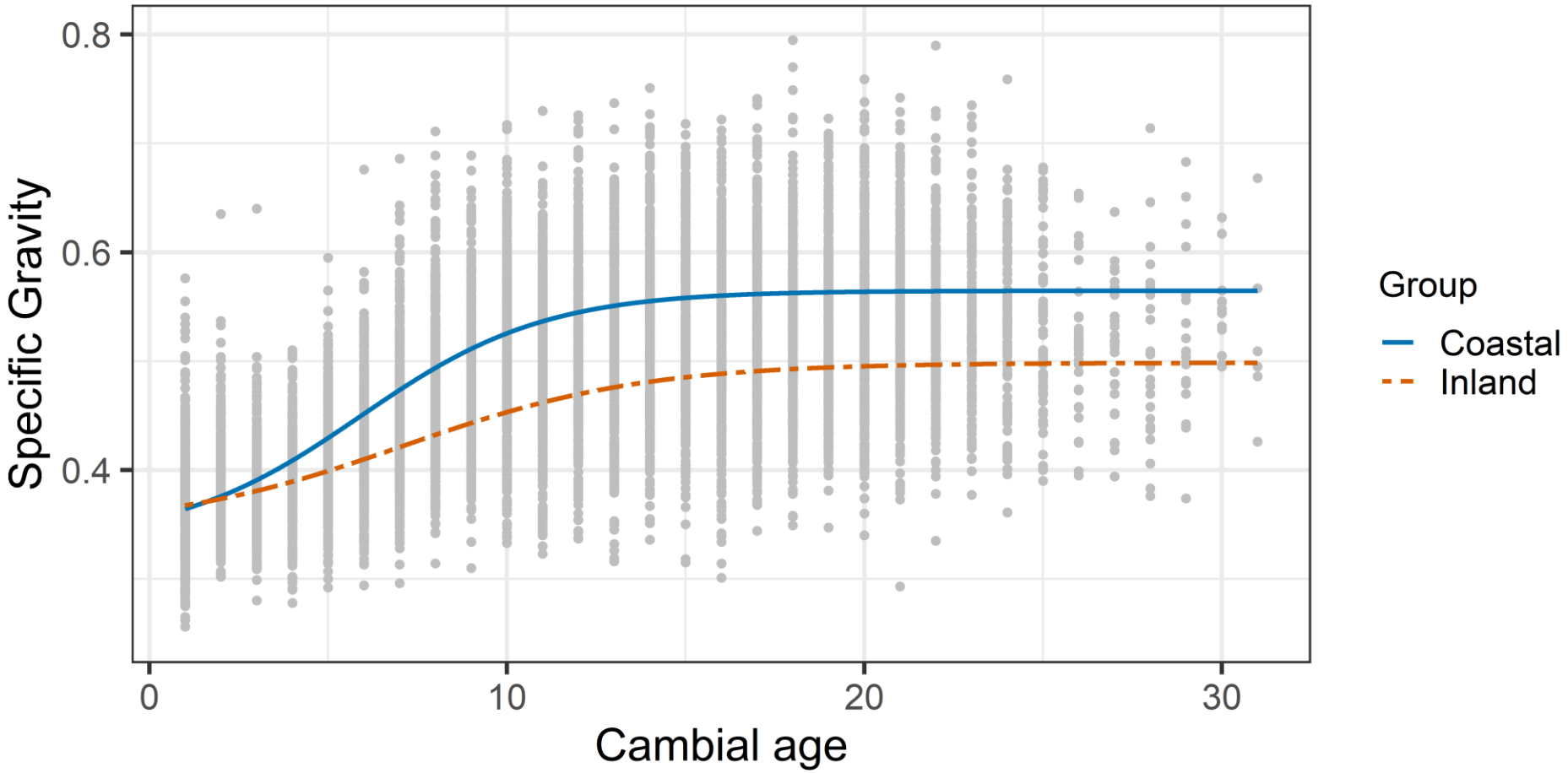
Major Findings

SG variation from pith to bark and along the height



Major Findings

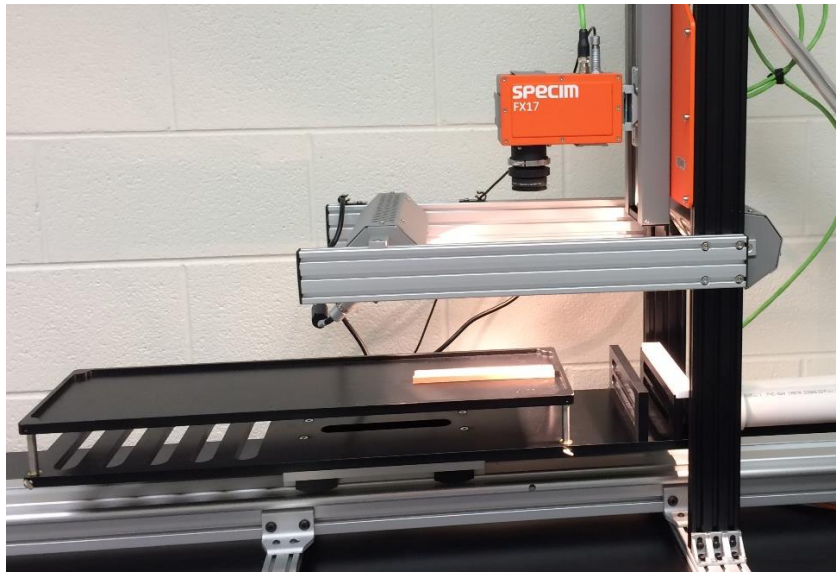
SG variation by region at DBH height

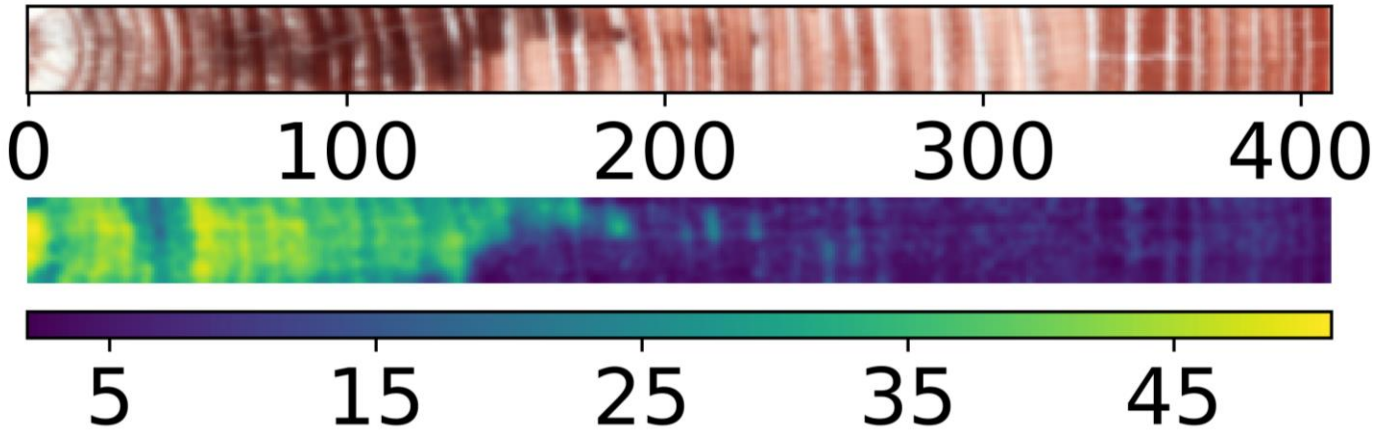


Current Progress

The other part of carbon in a volume of wood…
Building Near-Infrared Spectroscopy Hyperspectral Imaging Models for Extractives

- Combines NIR spectroscopy with imaging
- Each pixel has spectral data
- 931 to 1718 nm wavelength range
- Build models using NIR HSI data + extractives data



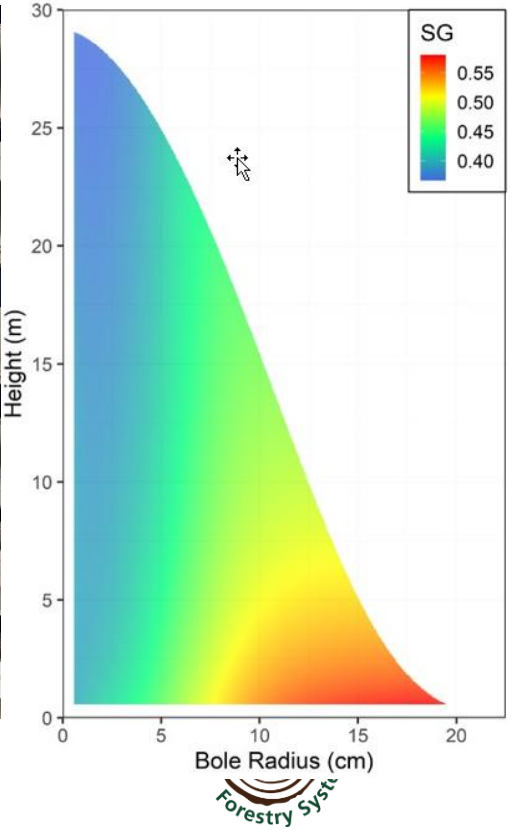


Center for Advanced Forestry Systems

Summary

- Carbon% in loblolly pine practically only varies by the extractives content

- Volume, SG, Extractives%



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