

# Properties of Small-Diameter Loblolly Pine in South Alabama

by

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# Outline

- Background
- Study site
- Field Sampling Methods
- Laboratory Analysis Methods
- Results
- Conclusions

# Background

- DOE High Tonnage Project
- Goal of collecting data on tree properties for project area
  - Whole-tree/Stem weight
    - Percent wood, bark, limbs & foliage
  - Moisture content
  - Density

# Sites

## Physiographic Regions

- Middle Coastal Plain
- Hilly Coastal Plain
- Hilly Coastal Plain/Piedmont

## Age

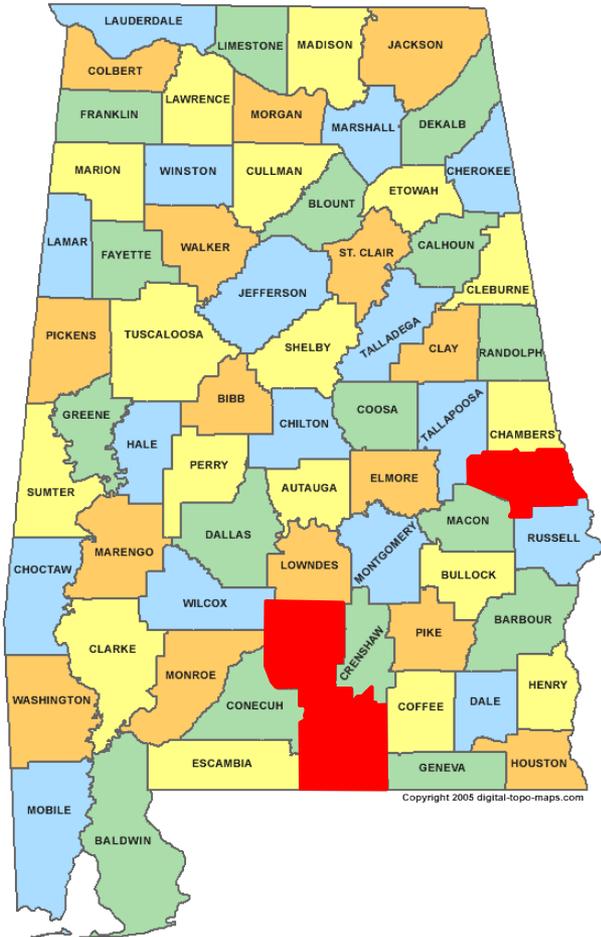
- Plantation sites – 14 to 18 yrs old

## Data Collection

- May/Aug/Dec

Source for Physiographic Regions: J.H. Miller and K.S Robinson, 1994

# Location of Sampled Trees



Lee

• 3 trees (1)

Butler

• 14 trees (4)

Covington

• 5 trees (1)

# Field Measurements

## Diameter

- Dbh
- Disks cut every 5-ft

## Length

- Total
- 1<sup>st</sup> live limb
- 2-inch top

## Weight

- Whole-tree
- Stem (delimbed)
- 2-inch top



# Field Measurements



## Whole-tree weight

# Field Measurements



Stem weight and weight to 2-inch top

# Field Measurements



Disks bagged and labeled

# Laboratory Analysis

## Moisture Content

- Wood
- Bark
- Limbs & foliage

## Disk Diameters

- Outside bark
- Inside bark

## Density

- Wood
- Bark

# Laboratory Analysis

## Moisture Content (wet-basis)

- Wood, bark, limbs & foliage
  - Wet weight
  - Dry weight
    - 105 C until constant weight

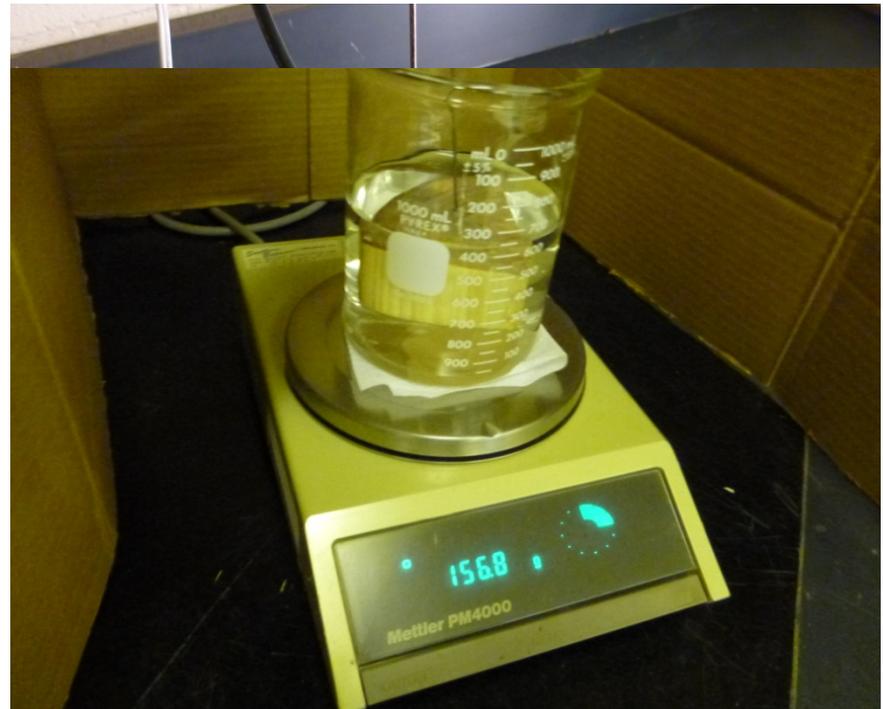
$$\%MC = \frac{\text{wt. water}}{\text{total wt.}} * 100$$



# Laboratory Analysis

## Density

- Displacement Method
  - Wood
  - Bark



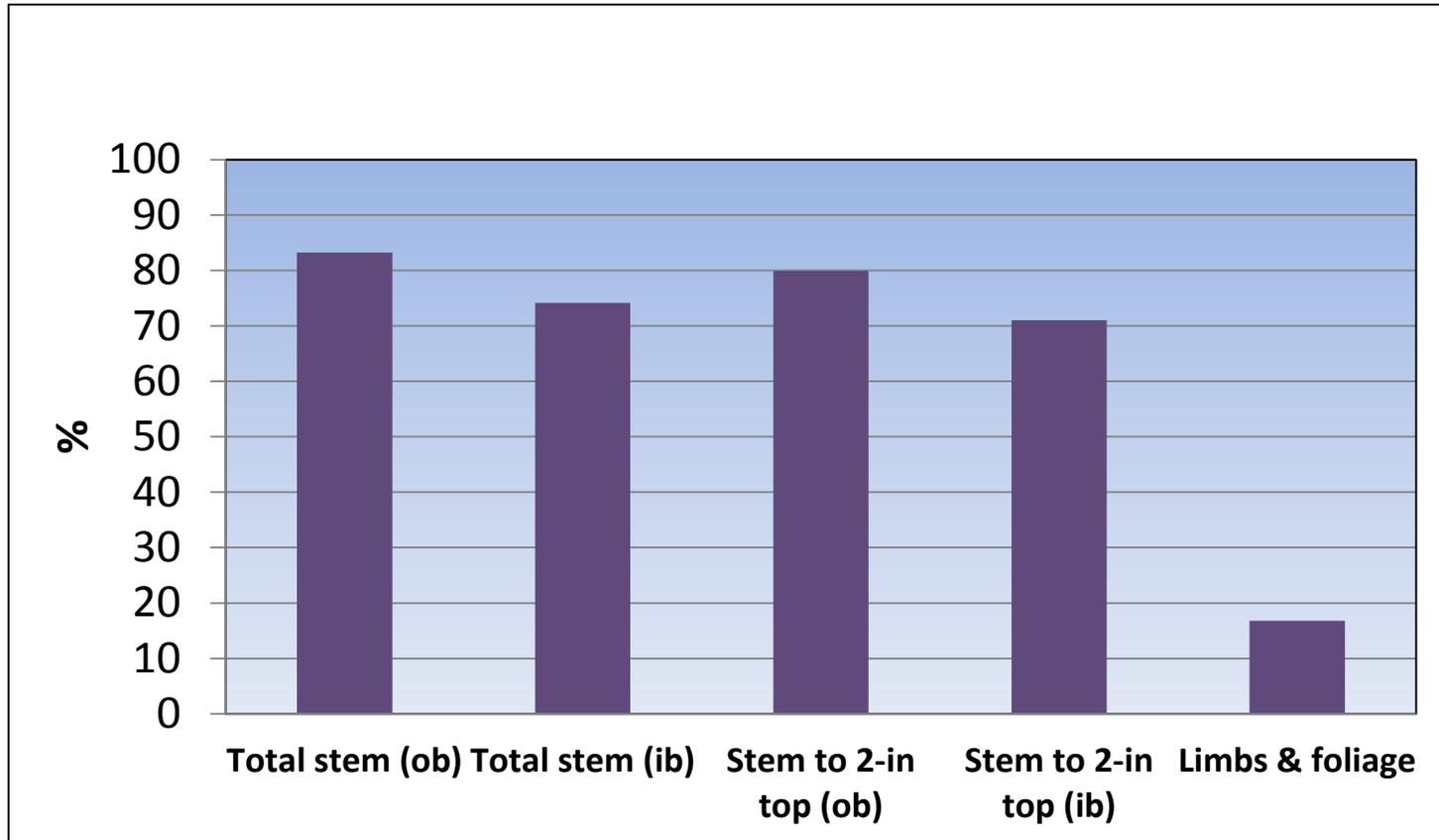
# Planted Loblolly Pine

Variable	N	Mean	SD	Min	Max
<b>Dbh (in)</b>	19	5.9	1.19	4.0	8.3
<b>Length (ft)</b>					
<i>1<sup>st</sup> live limb</i>	19	25.5	10.53	11.6	47.7
<i>2-inch top</i>	19	37.9	10.24	23.8	56.6
<i>Total</i>	19	47.8	9.14	35.0	67.2
<b>Weight (lb)</b>					
<i>Whole-tree</i>	19	346.1	174.0	113	781
<i>Total stem</i>	19	288.7	148.35	95	620
<i>Stem to 2-inch top</i>	19	279.5	149.17	89	615
<i>Limbs &amp; foliage</i>	19	57.4	37.42	18	177

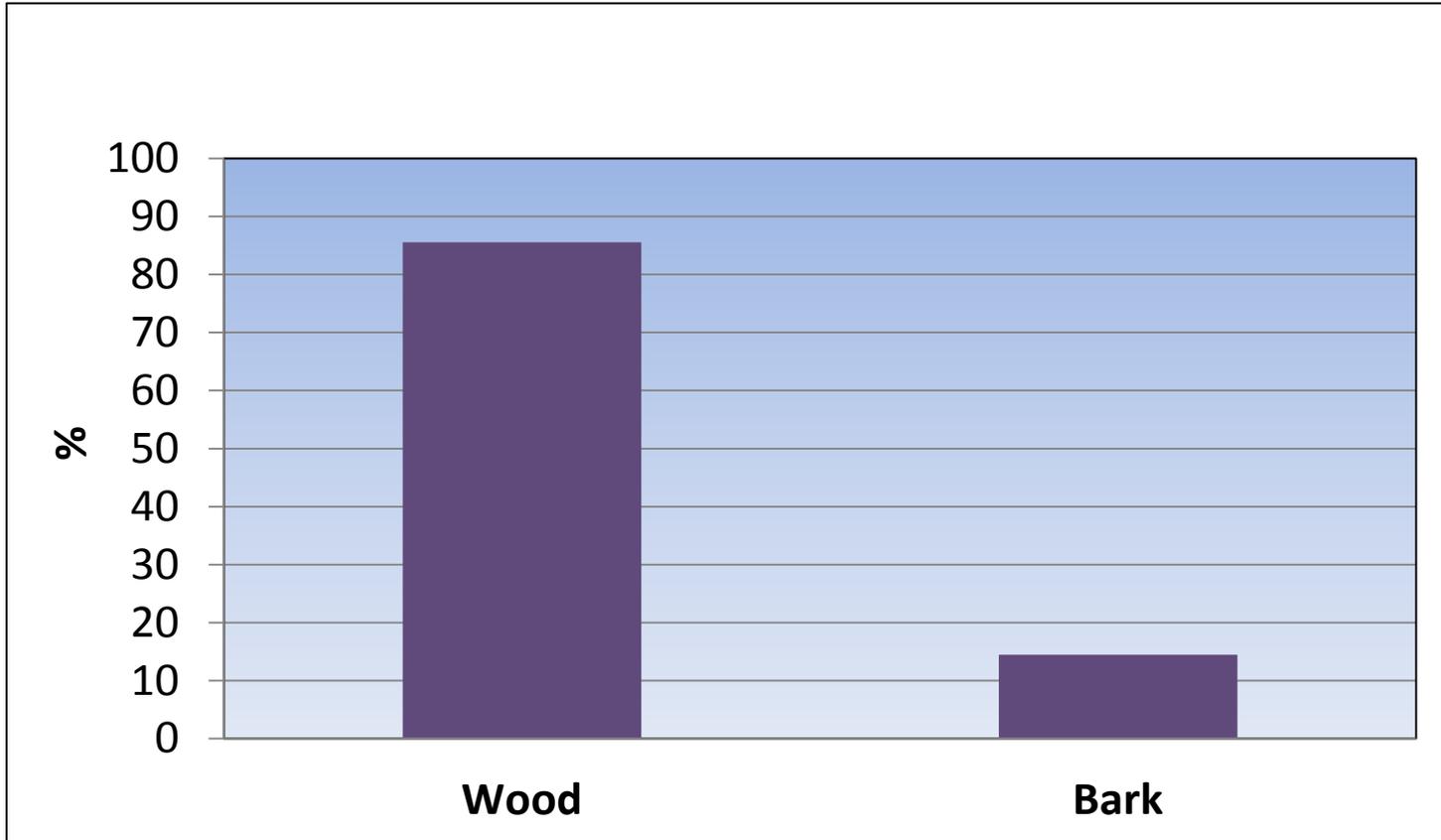
# Percent of Whole-Tree by Weight

Variable	N	Mean	SD	Min	Max
<b>Total stem</b>	19	83.2	6.45	71.7	95.9
<b>Stem to 2-inch top</b>	19	79.9	7.69	62.0	94.4
<b>Limbs &amp; foliage</b>	19	16.8	6.49	4.1	28.3

# Percent of Whole-tree by Weight



# Percent of Total Stem by Weight

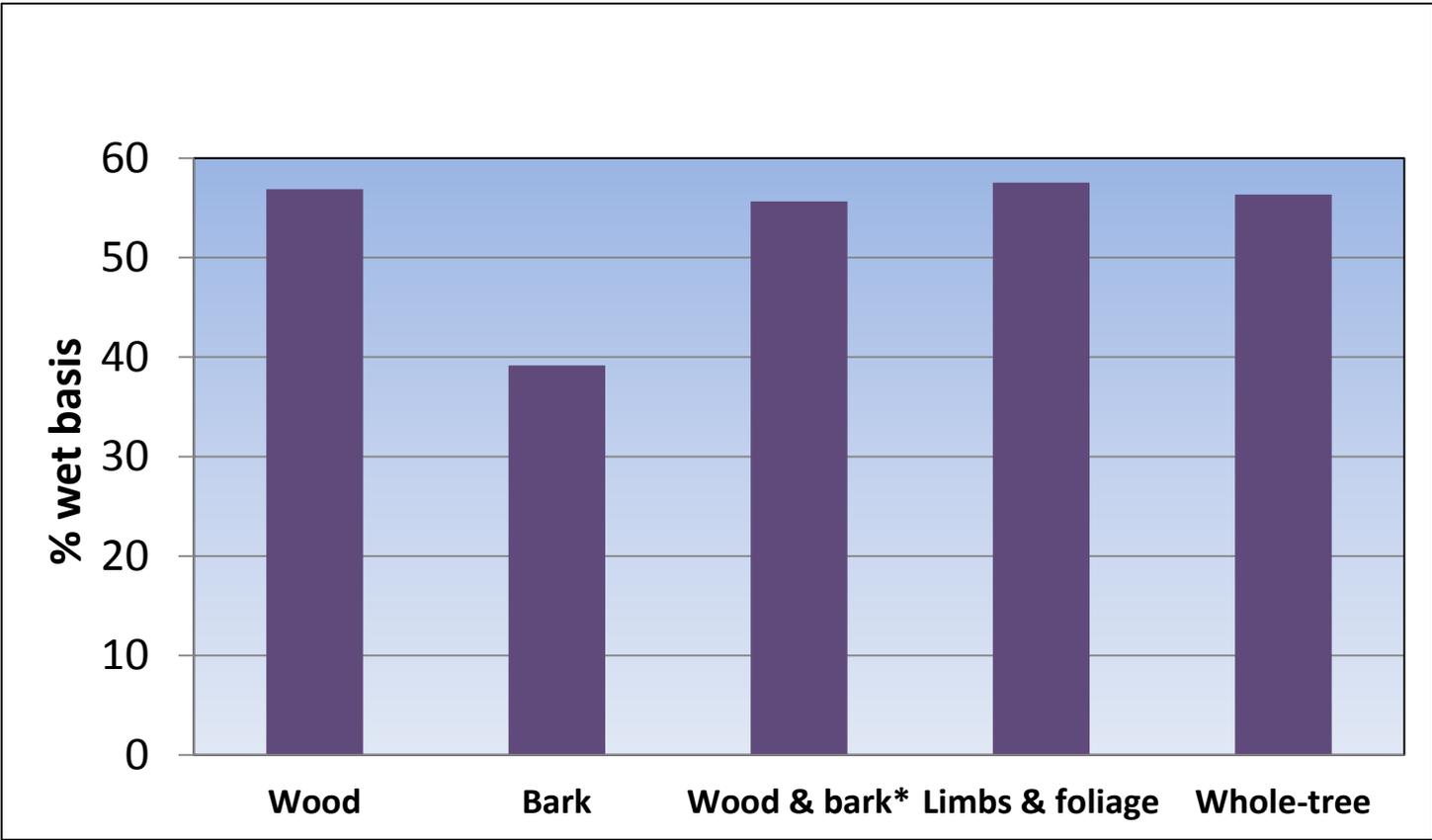


**% Total stem by weight**

Wood: 
$$\frac{\text{Stem wt.} - (\text{stem vol. ob} - \text{stem vol. ib}) * \text{bark density}}{\text{Stem wt.}} * (100)$$

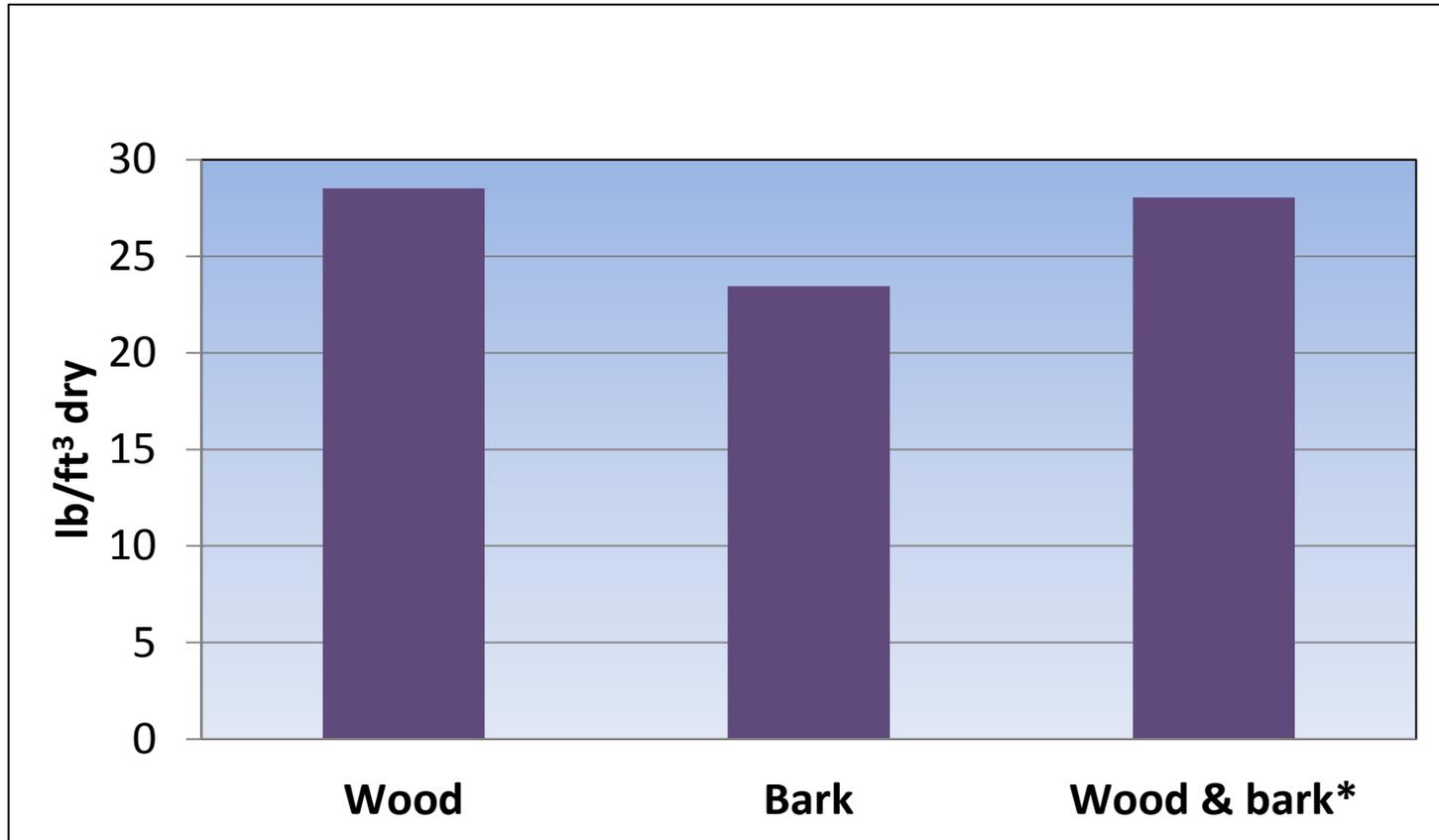
Bark: 100 - %wood wt.

# Mean Moisture Content



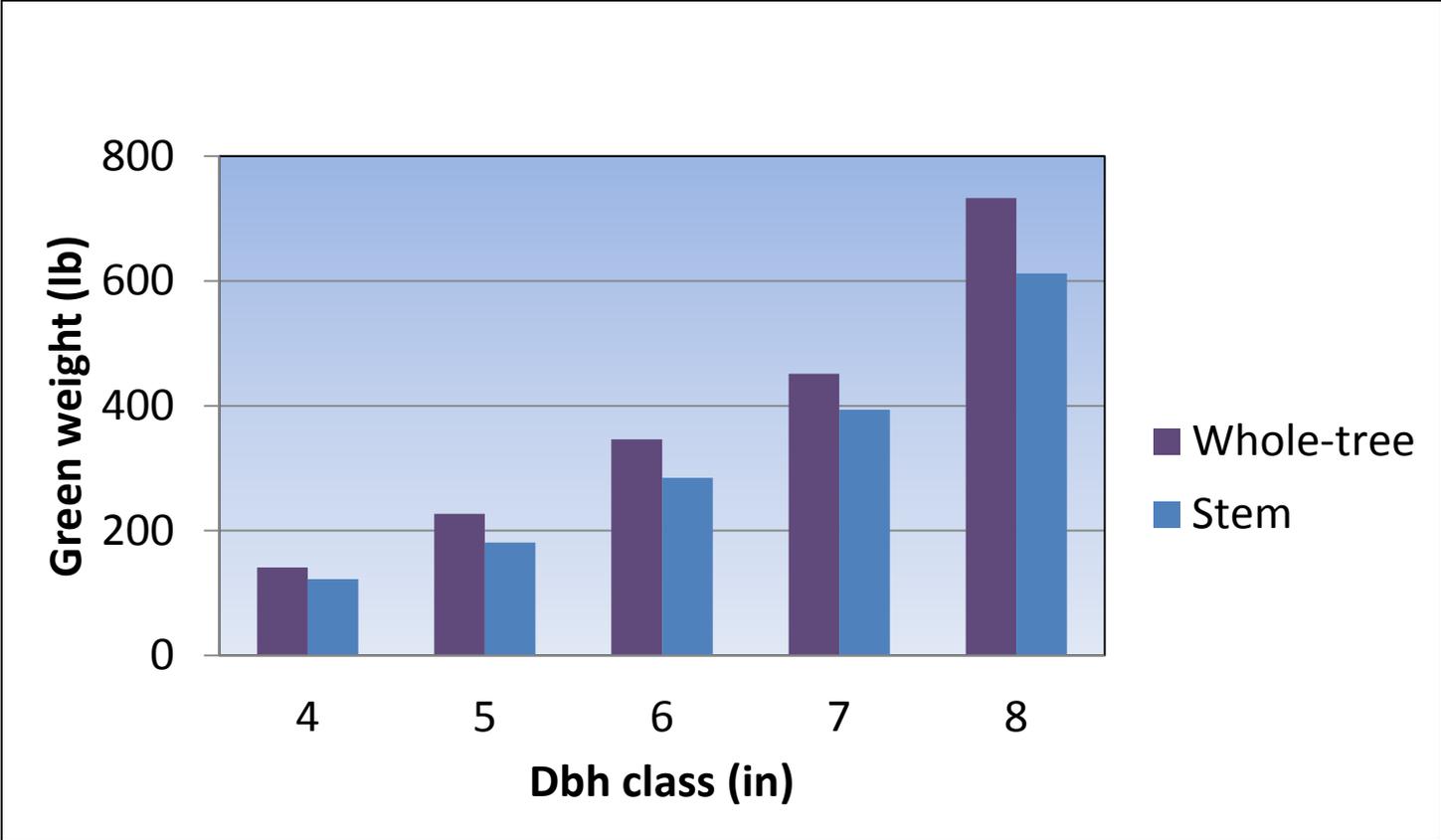
\*Weighted average

# Mean Density

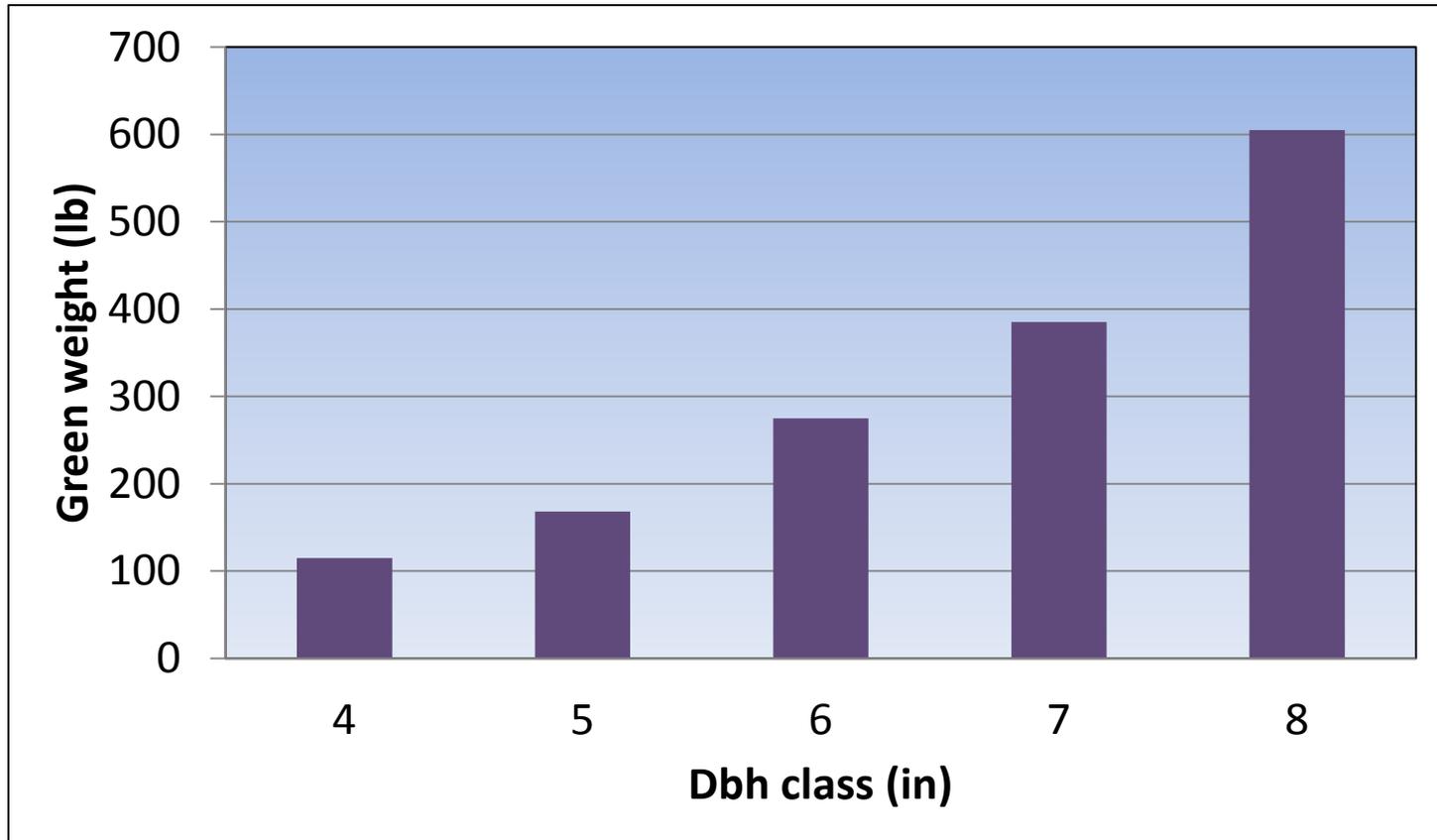


\*Weighted average

# Mean Weight



# Mean Stem Weight to 2-inch Top



# Percent Moisture Content (wet-basis)

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>
<b>Wood</b>	22	56.9	2.73	52.3	62.5
<b>Bark</b>	22	39.1	4.47	28.2	45.2
<b>Wood &amp; bark*</b>	22	55.7	2.57	51.3	61.1
<b>Limbs &amp; foliage</b>	18	57.5	7.34	39.3	72.8
<b>Whole-tree</b>	18	56.36	3.99	47.6	63.5

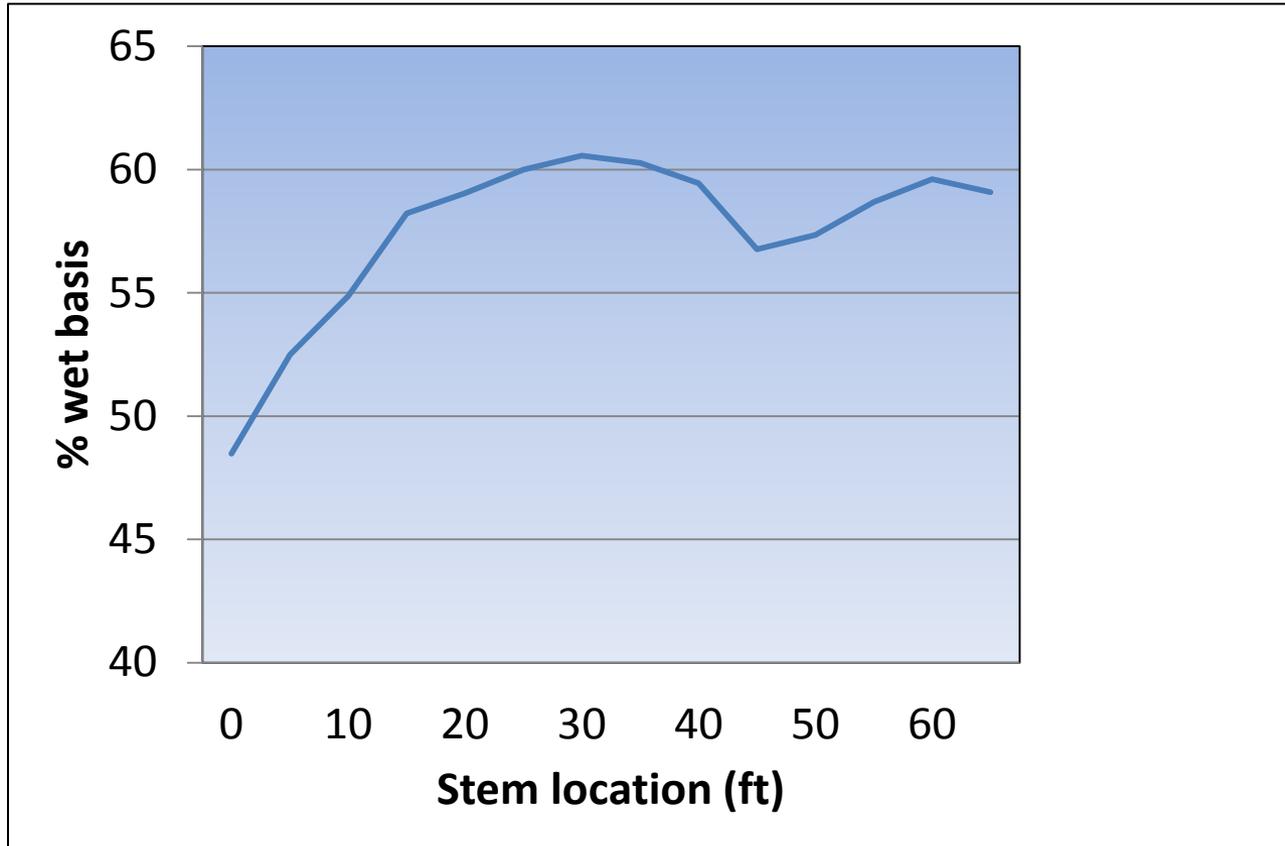
\*Weighted average

# Density (lb/ft<sup>3</sup>)

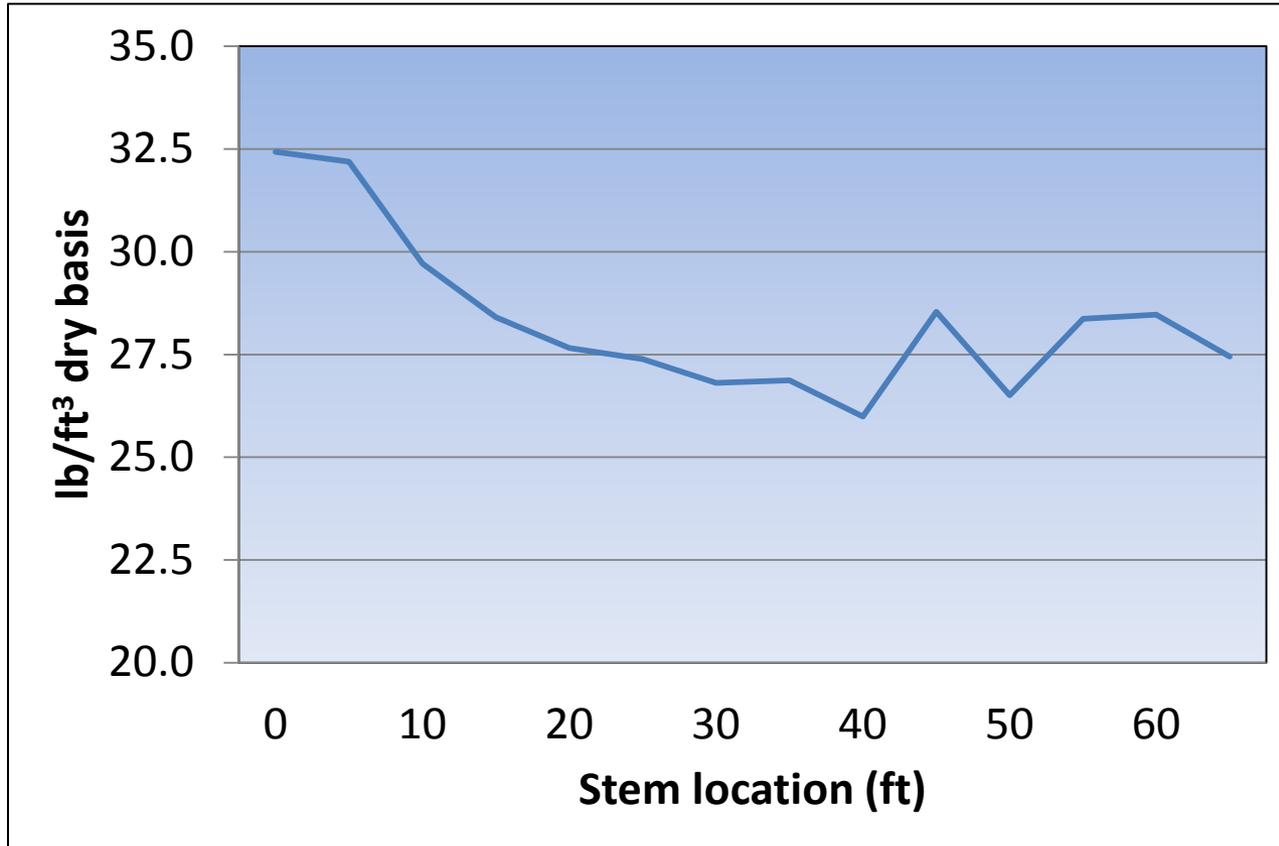
Variable	N	Mean	SD	Min	Max
Wood	22	28.5	1.34	26.1	31.6
Bark	22	23.4	2.29	20.0	29.3
Wood & bark*	19	28.0	1.38	25.9	31.3

\*Weighted average

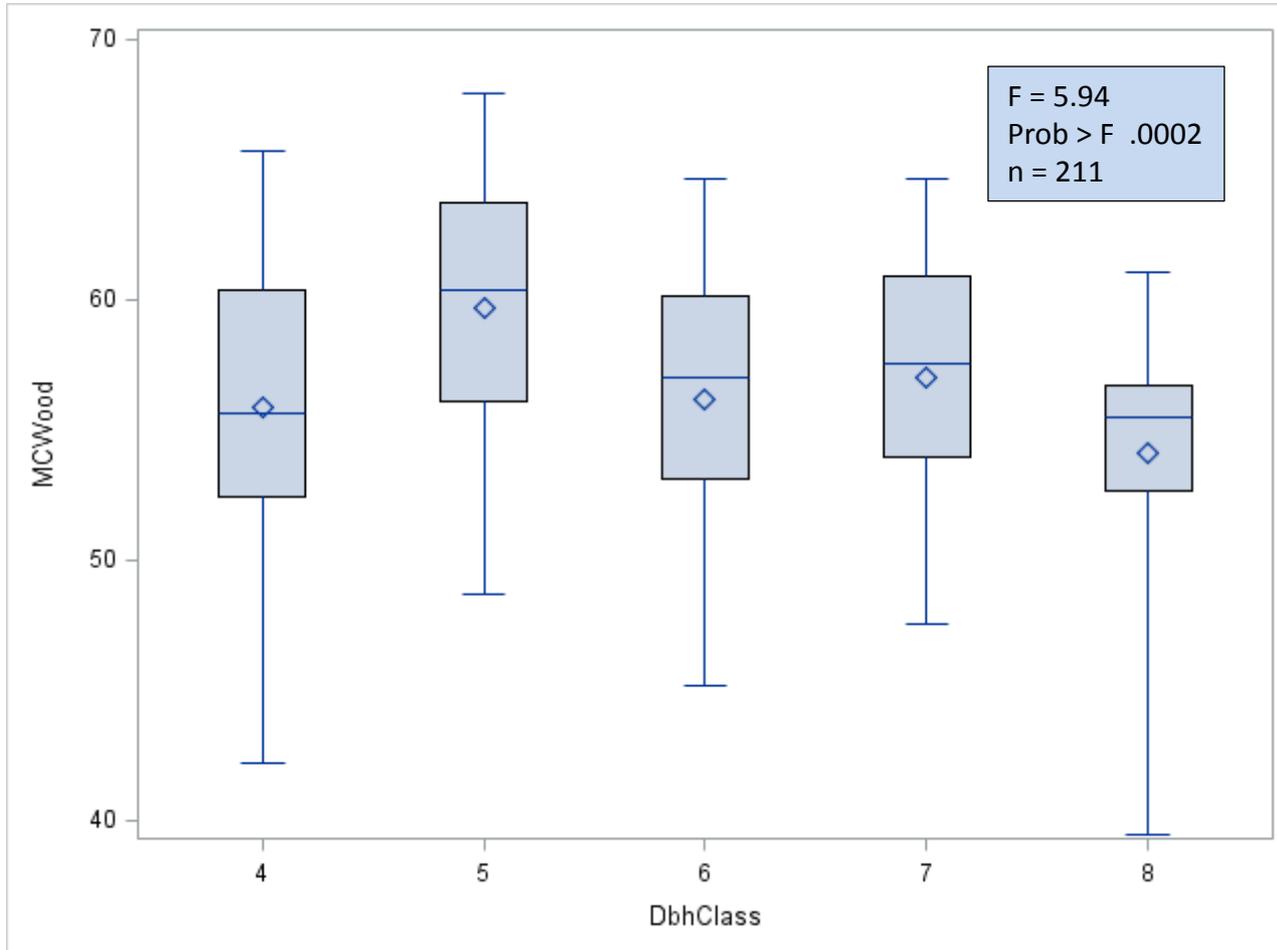
# Mean Moisture Content of Wood



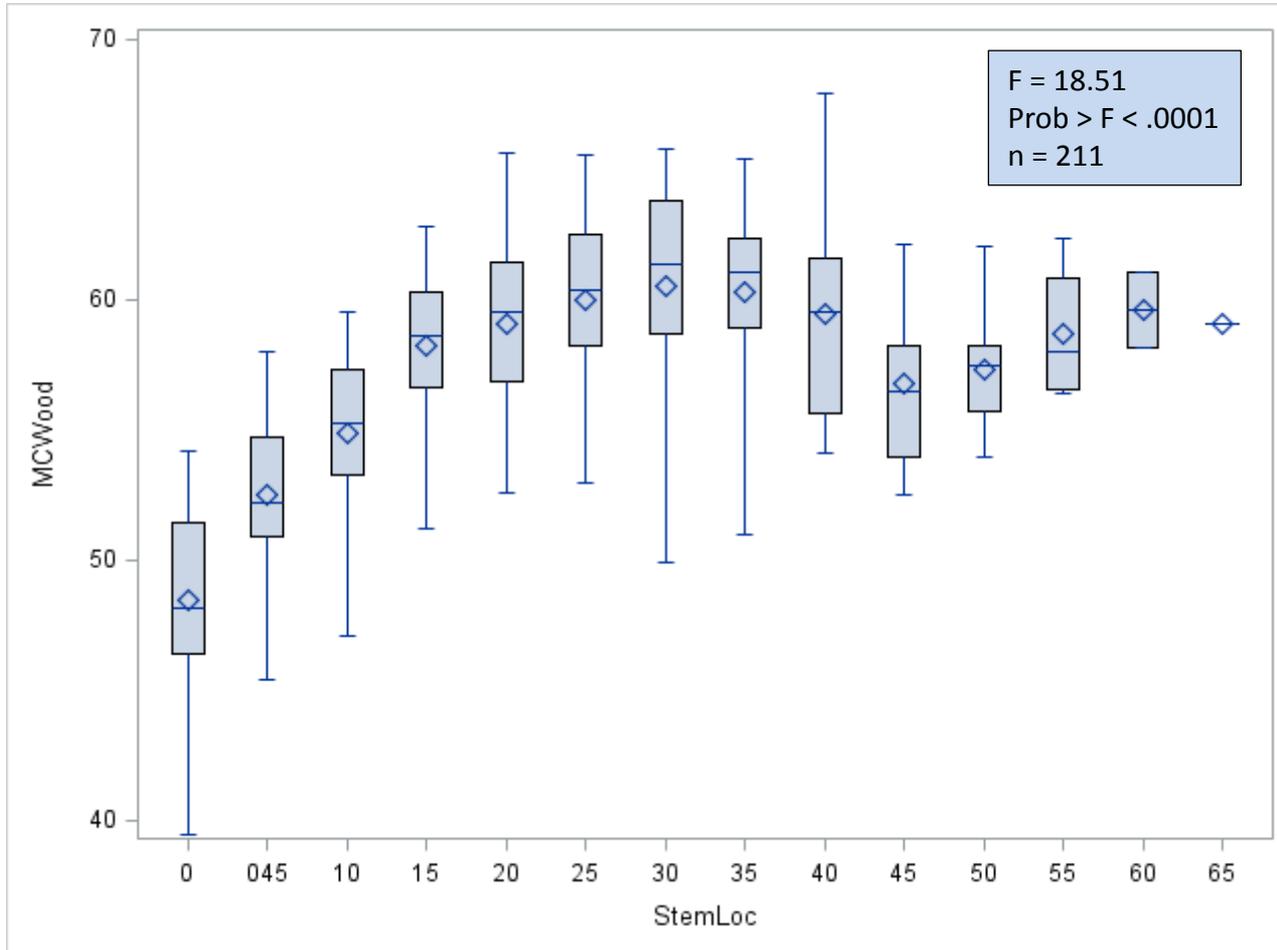
# Mean Density of Wood



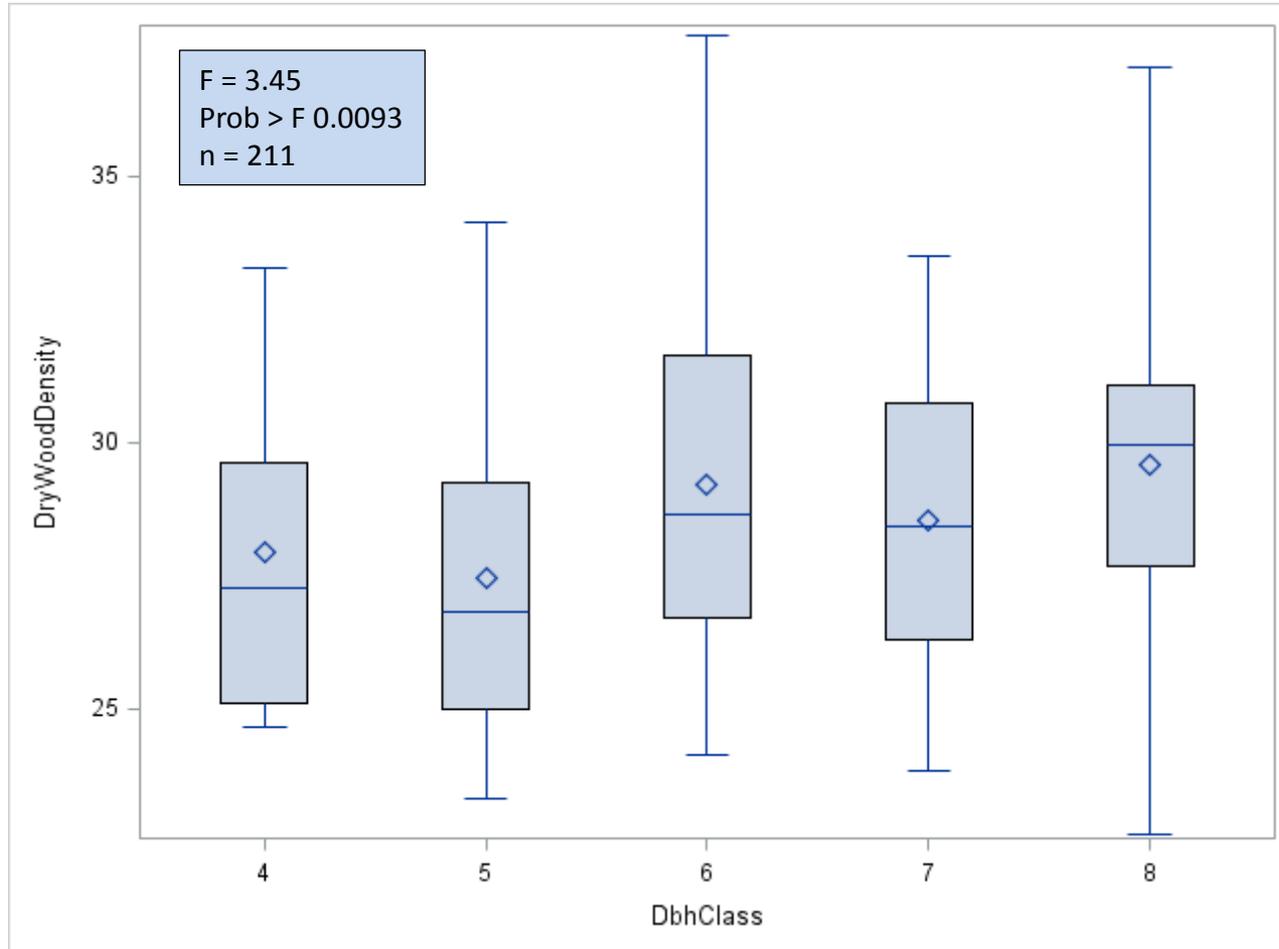
# Planted Pine Moisture Content (%)



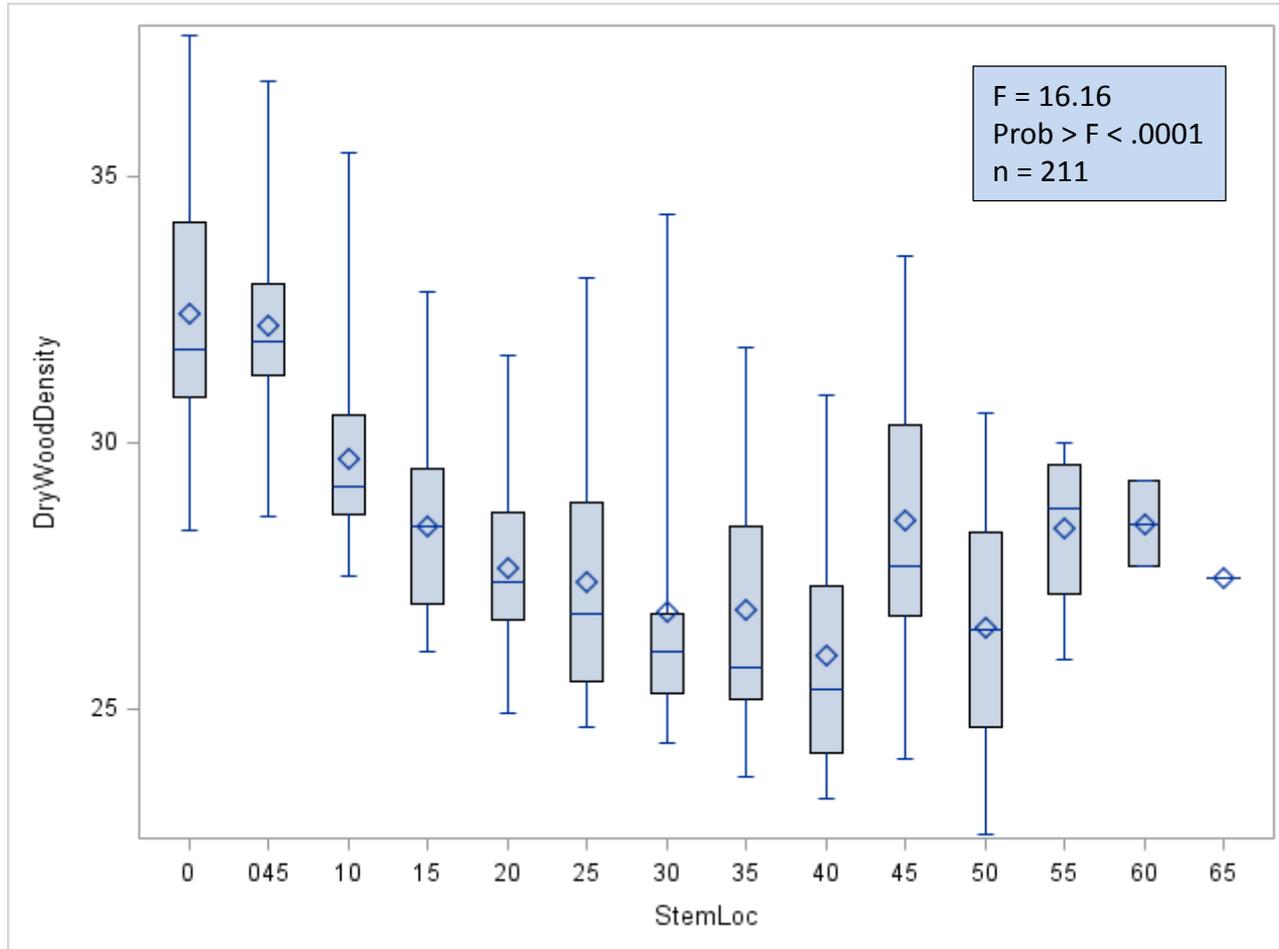
# Planted Pine Moisture Content (%)



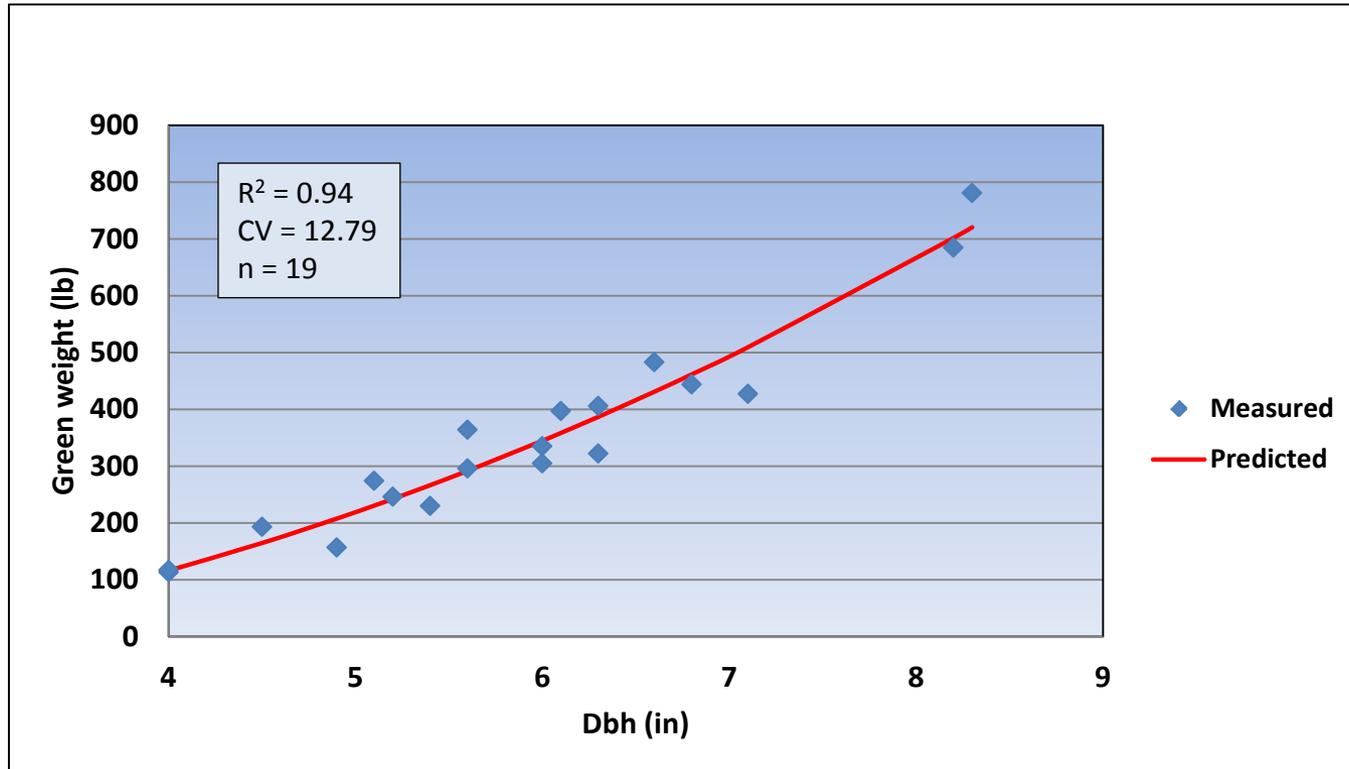
# Planted Pine Wood Density (lb/ft<sup>3</sup>)



# Planted Pine Wood Density (lb/ft<sup>3</sup>)



# Whole-tree Weight of Planted Loblolly Pine



$$Weight (lb) = (11.428410 * Dbh^2) - 66.6453084$$

# Conclusions

- Direct relationship between MC and stem location
- Inverse relationship between density and stem location
- Significant trends between MC and density by Dbh class
- Ash content and chemical analysis of samples are in the works
- Larger sample size of trees at different times of the year

# Acknowledgements

- Auburn University BioSystems Engineering Dept.
- Corley Land Services
- Dept. of Energy

# Thank You!

Forest Operations Research Unit Website

<http://www.srs.fs.fed.us/forestops>

