Hardwood Plantation Development: The Use of Multiple Species to Improve Log Quality

Wayne K. Clatterbuck
Professor
Forestry, Wildlife & Fisheries
UT Knoxville

Presentation Outline

- Extension at UT-FWF ----> Clatterbuck
  ========
- Why Mixed Species Plantings?
- Crowns and Branching Patterns
- Spacing
- Present Research

A Quick Introduction

- Global demand for hardwood sawlogs and veneer logs continues to grow
- Grade is more important than volume
- Social demands for increased diversity in plantations
- Afforestation efforts continue to increase

Why Mixed Species Plantings?

????????

Objectives

- Produce a forest more natural in appearance
- Produce a forest with more diverse flora & fauna
- Produce multi-products
- Develop high grade boles

Advantages

- More resistant to biotic agents
- More resistant to mechanical damage (fire, wind, freezing)
- Training effect of upper and lower canopies
- Better utilization of the site
- Diversity
- Log Grade ??? --- crown stratification

Disadvantages

- Controlling interactions between species is complicated --- species differences
- More difficult woods operations
- Planning and perhaps costs to achieve results

Factors

- Spacing within and between species
- Site suitability for each species, even within a genus
- Growth rate of each species
- Crown form of each species

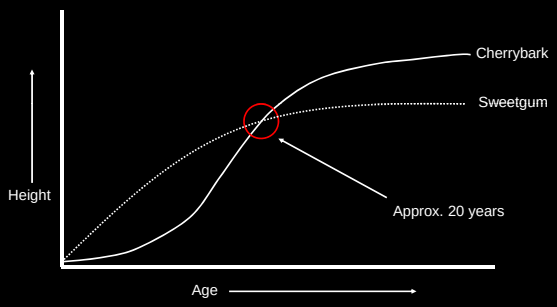
Plantation Establishment

Monospecific
vs.
Multispecific

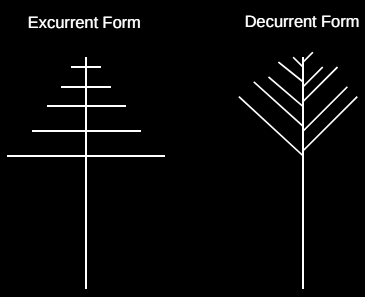
Pine Mentality ???

- Conventional plantation management
  - Tight Spacing
  - Monospecific
  - Thinning(s)
- Probably will not work with most hardwoods – specifically oaks, crown stratification does not occur

Example: Cherrybark Oak and Sweetgum (Natural Stands)

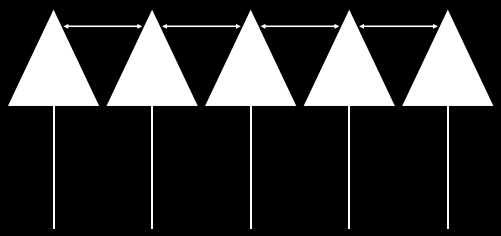


Importance of Crown Form



Monospecific

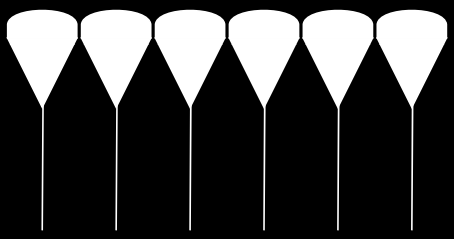
Free space between crowns with an excurrent growth pattern



Example species - Sweetgum

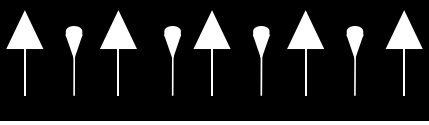
Monospecific

No crown stratification in pure oak plantation – decurrent growth pattern

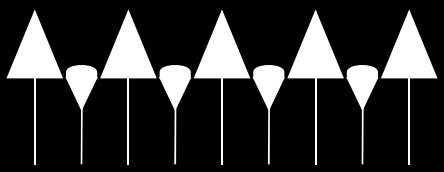


Example species – Cherrybark oak

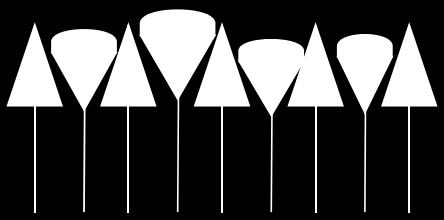
Multispecific



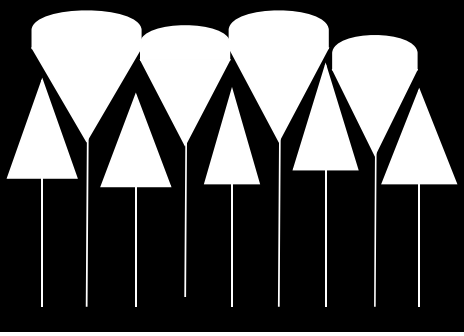
Multispecific



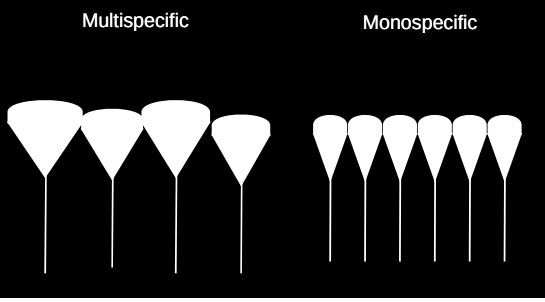
Multispecific



Multispecific



Comparison



Dynamics in Planted Stands

- Can we emulate natural stand dynamics in planted stands?
- Differences in crown development may result in stem quality differences
  - Monospecific = narrow crown widths
  - Multispecific = wider crown widths

(Data from natural stands)

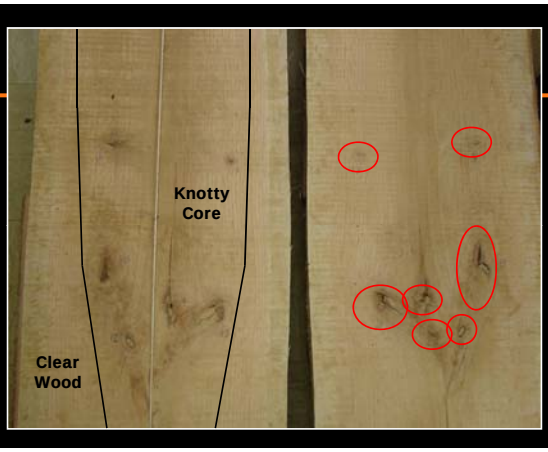
Pressing Question

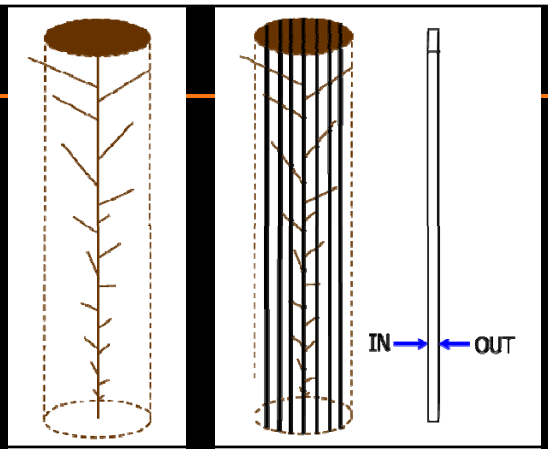
- What is the impact of various silvicultural decisions on the production of quality hardwood logs ?
- Understanding is Critical

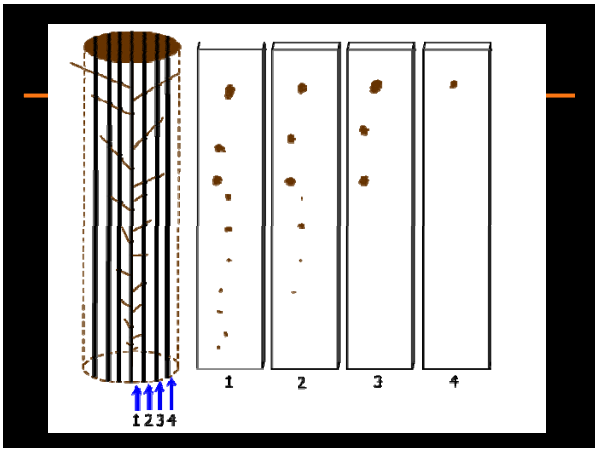
-Hardwood plantation spacing
-Hardwood plantation species mixtures
-Hardwood thinning schedules

Optimize for Grade

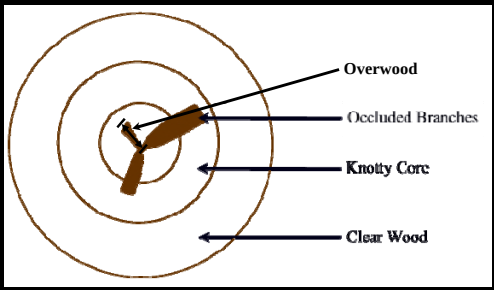
Branch Size and Occlusion



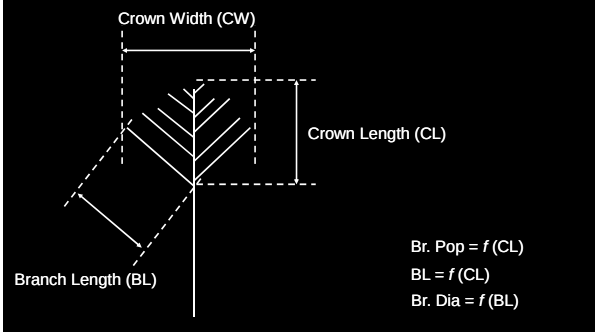




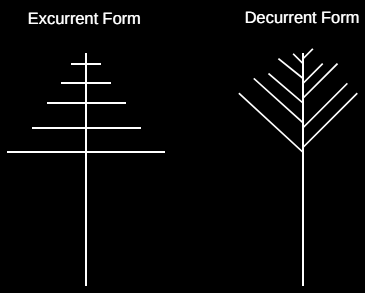
Data - illustrated



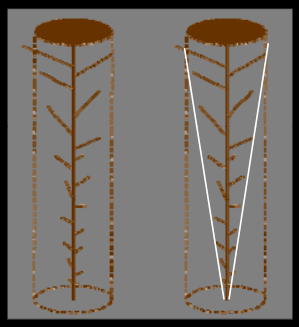
Crown Metrics



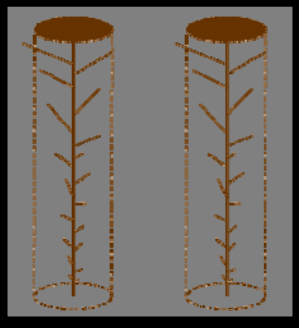
Importance of Crown Form



Identifying the “Knotty Core”



Identifying the “Knotty Core”



Importance of Crown Stratification

- Without stratification crown development may be hindered
- Without stratification heavy intraspecific competition may result in stagnation
- Without stratification stem quality may be negatively influenced

Spacing

- **Wide Spacing Disadvantages**
  - Increased weed competition & maintenance
  - Reduced stem quality due to greater taper and longer branch retention
  - Increased fire hazard
  - Reduced erosion control

Spacing

- **Wide Spacing Advantages**
  - Planting costs are less
  - Trees attain larger diameters and become merchantable sooner
  - Trees may produce greater quantities of seed/mast at an earlier age
  - Increased understory growth will provide wildlife food and habitat.

Spacing

- **Close Spacing Disadvantages**
  - Increased site preparation, planting and seedling costs
  - Early timber stand improvement may be needed to reduce crown competition
  - Access during initial thinning operations may be difficult.

Spacing

- **Close Spacing Advantages**
  - Faster crown closure resulting is less weed competition and maintenance
  - Improved stem quality (straighter boles and small, self-pruning branches)
  - Large wood volumes accumulate in early years
  - Greater number of trees to select from during thinning operations

Spacing & Planting

	4'	5'	6'	7'	8'	9'	10'	12'	15'
4'	2722	2178	1815	1556	1361	1210	1089	907	726
5'		1742	1452	1244	1089	968	871	726	581
6'			1210	1037	908	807	726	605	484
7'				889	778	691	622	518	415
8'					681	605	545	454	363
9'						538	484	403	323
10'							436	363	290

Planting Schematics

Alternate Rows

X O X O X O X
X O X O X O X
X O X O X O X
X O X O X O X
X O X O X O X

Planting Schematics

Double & Single Species Rows

X O O X O O X
X O O X O O X
X O O X O O X
X O O X O O X
X O O X O O X

Planting Schematics

Alternate Species Within Rows

X O X O X O X
O X O X O X O
X O X O X O X
O X O X O X O
X O X O X O X

Planting Schematics

Surround One Species Within & Between Rows

O O O O O O O

O X O X O X O

O O O O O O O

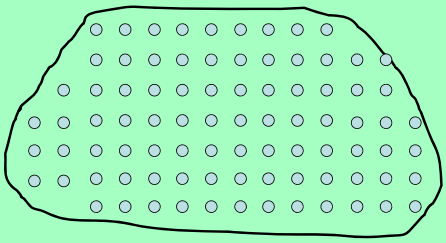
O X O X O X O

O O O O O O O

Conservation Planting Design

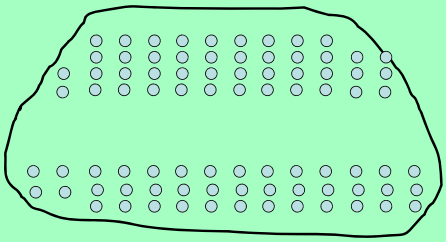
- Systematic

12 x 12



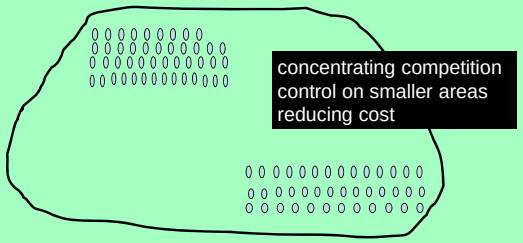
Conservation Planting Design

- Closer Spacing



Conservation Planting Design

- Even Closer Spacing - Recommended



Future Research

Planting at UT Cumberland Forest this Spring

3 species x 3 spacings x 3 reps

Future Research

Spacings: 6’ x 6’
8’ x 8’
10’ x 10’

Future Research

Species Combinations:

Cherrybark Oak Mixed with

a. Yellow-Poplar
b. Black Cherry
c. Sweetgum

Planting Arrangement

Surround One Species Within & Between Rows

O O O O O O O
O X O X O X O
O O O O O O O
O X O X O X O
O O O O O O O

Summary

For Mixed Species Plantings

- Objectives ???
- Know your Site, Know your Species
- Spacing, Growth, Branches, Stem Quality
- Timing is critical
- Don't be afraid to be innovative!

Questions
and/or
Comments
if Time Permits