Restoring Bottomland Hardwood Forests

John A. Stanturf

Center for Forest Disturbance Science

US Forest Service

Southern Research Station

Athens, GA 30602

jstanturf@fs.fed.us

Emile S. Gardiner

Center for Bottomland Hardwoods Research

US Forest Service

Southern Research Station

Stoneville, MS

egardiner@fs.fed.us

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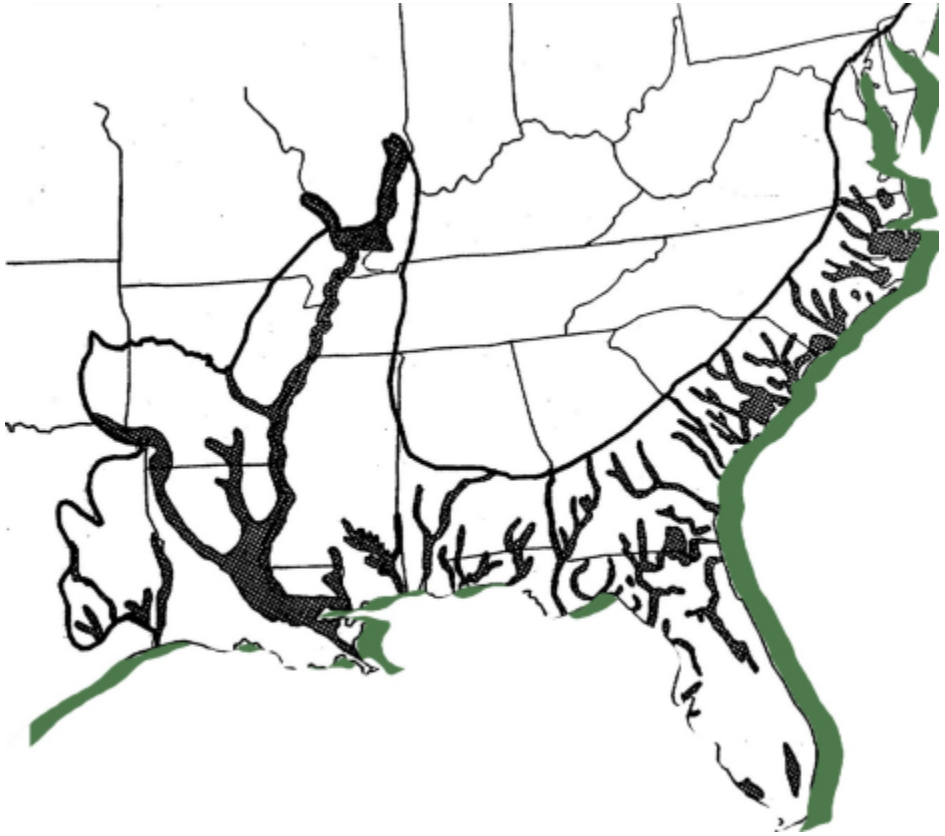
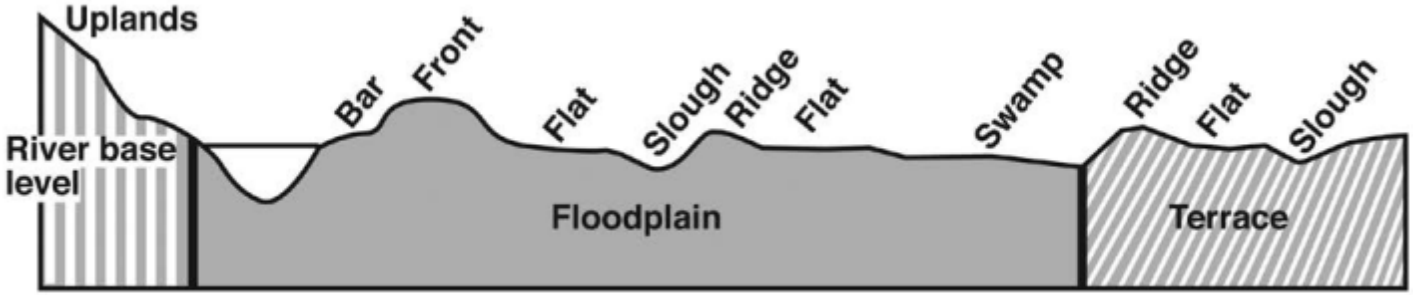
Presentation Overview

- What are Bottomland Hardwood Forests (BLH)?
- Why should we restore them?
- What strategies are being used?
- What techniques are successful?

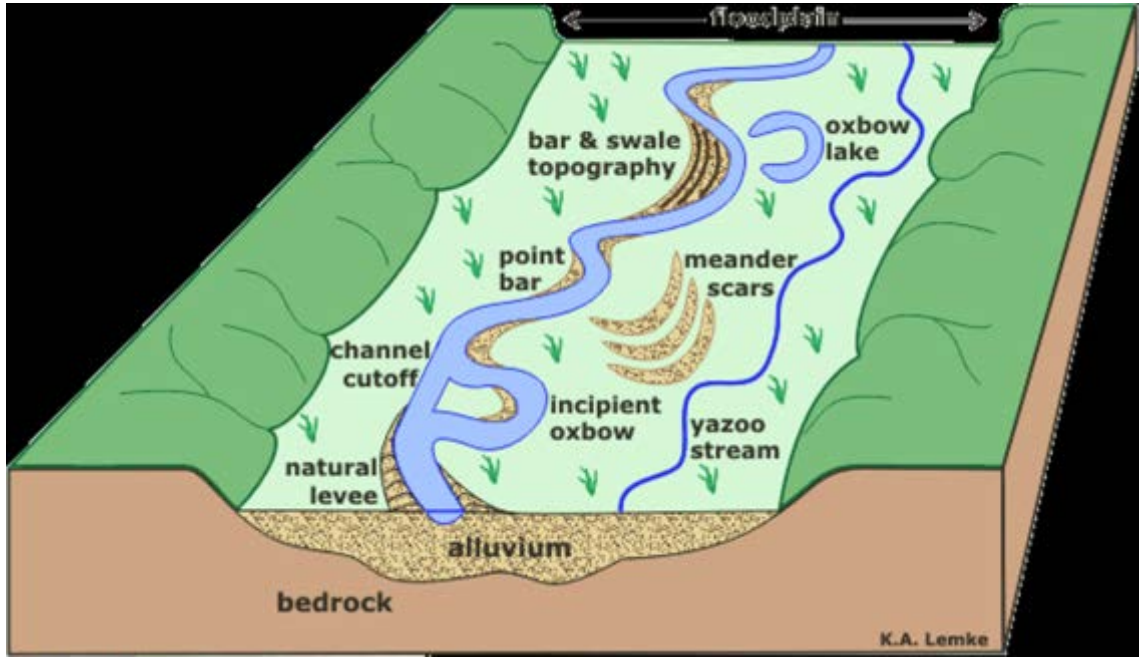
Where are BLH?





Floodplains of major and minor rivers

- Rivers in the coastal plain
- Major and Minor bottoms
- Red river bottom—origin in the Mountains or Piedmont
- Black river bottom—origin in the Coastal Plain



Why Restore BLH?

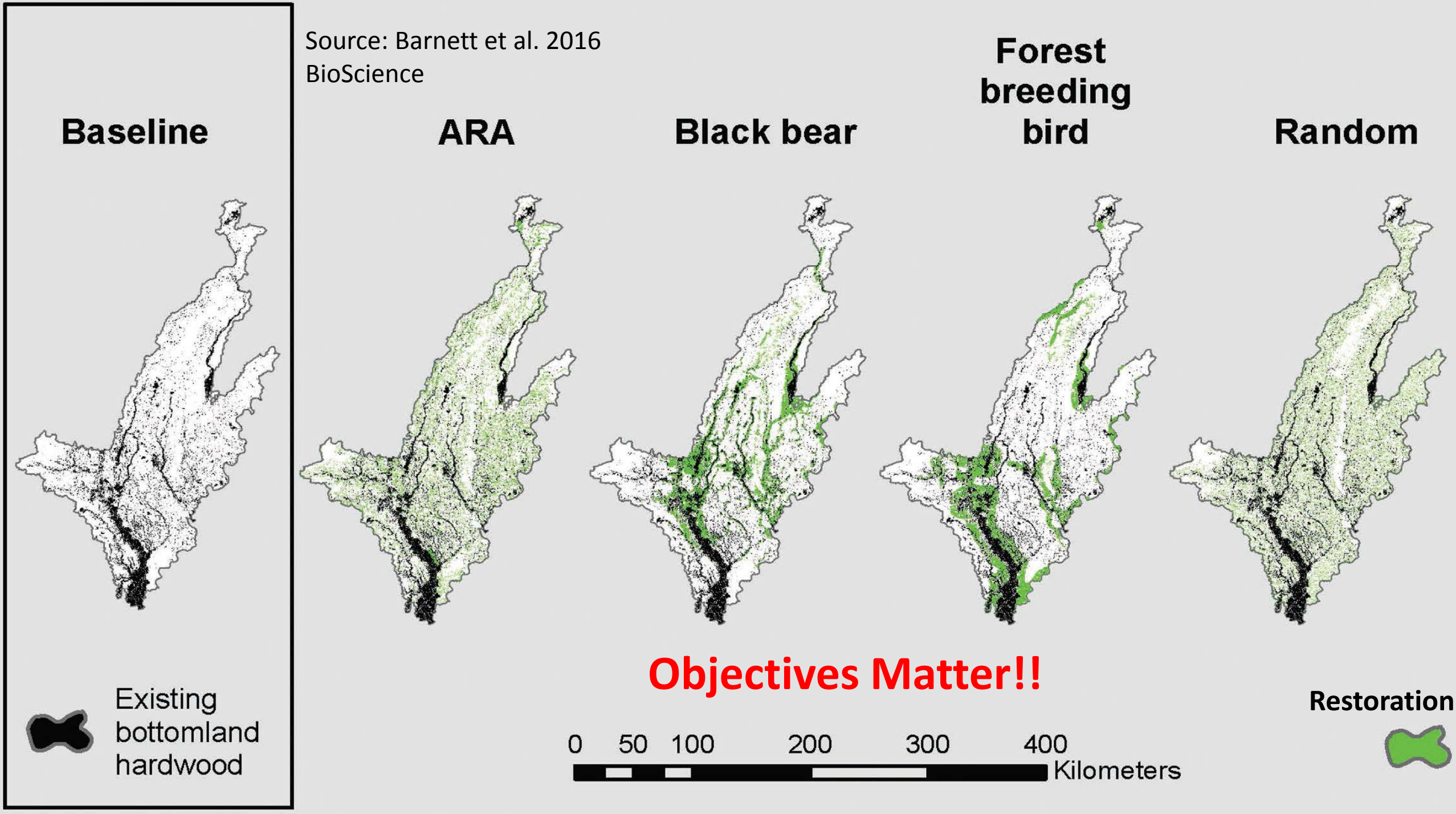
General restoration objectives

- Enlarge area of specific ecosystems
- Enhance biodiversity
- Repair ecosystem functions
- Mitigate and adapt to climate change

Specific BLH restoration objectives

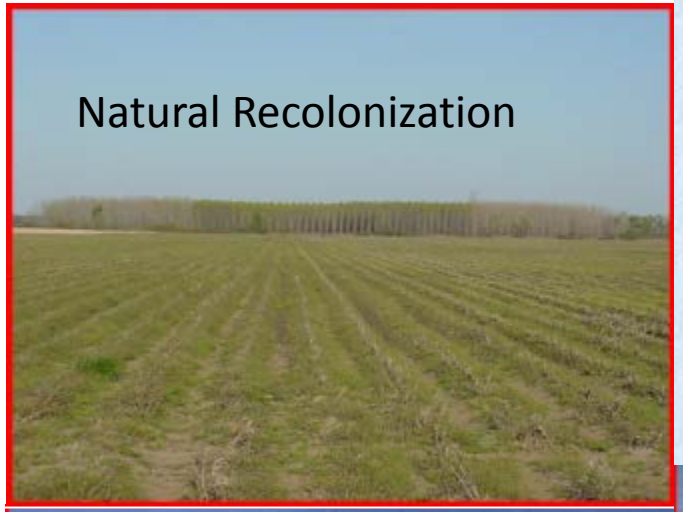
- Protect water quality
- Enhance wildlife habitat
- Modify hydrology
- Secure financial return
- Sequester carbon

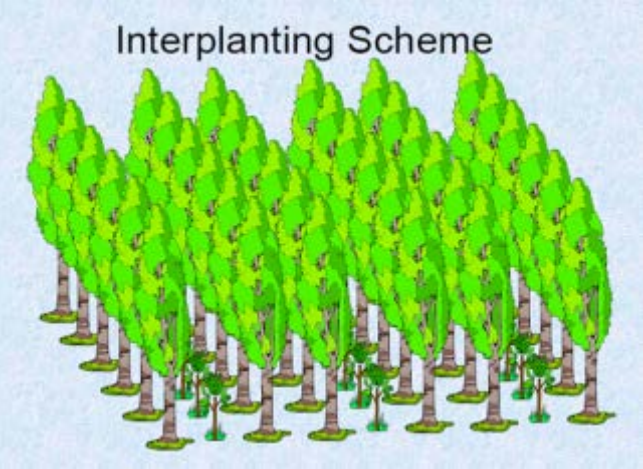
Source: Barnett et al. 2016
BioScience

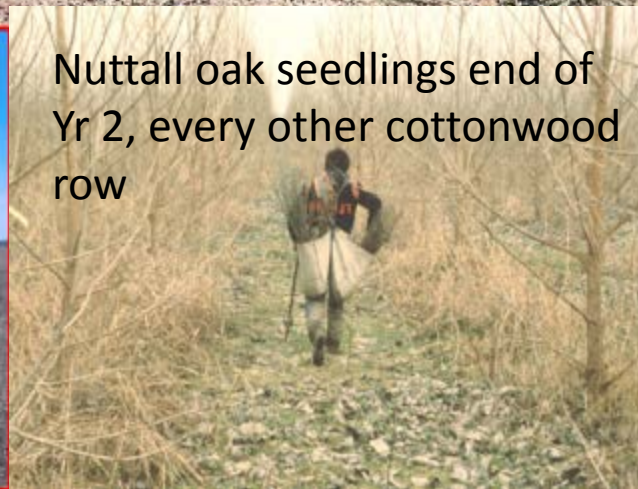


Strategies

- Passive
- Extensive
- Intensive
- Example: Sharkey Restoration Site, Anguilla, Mississippi

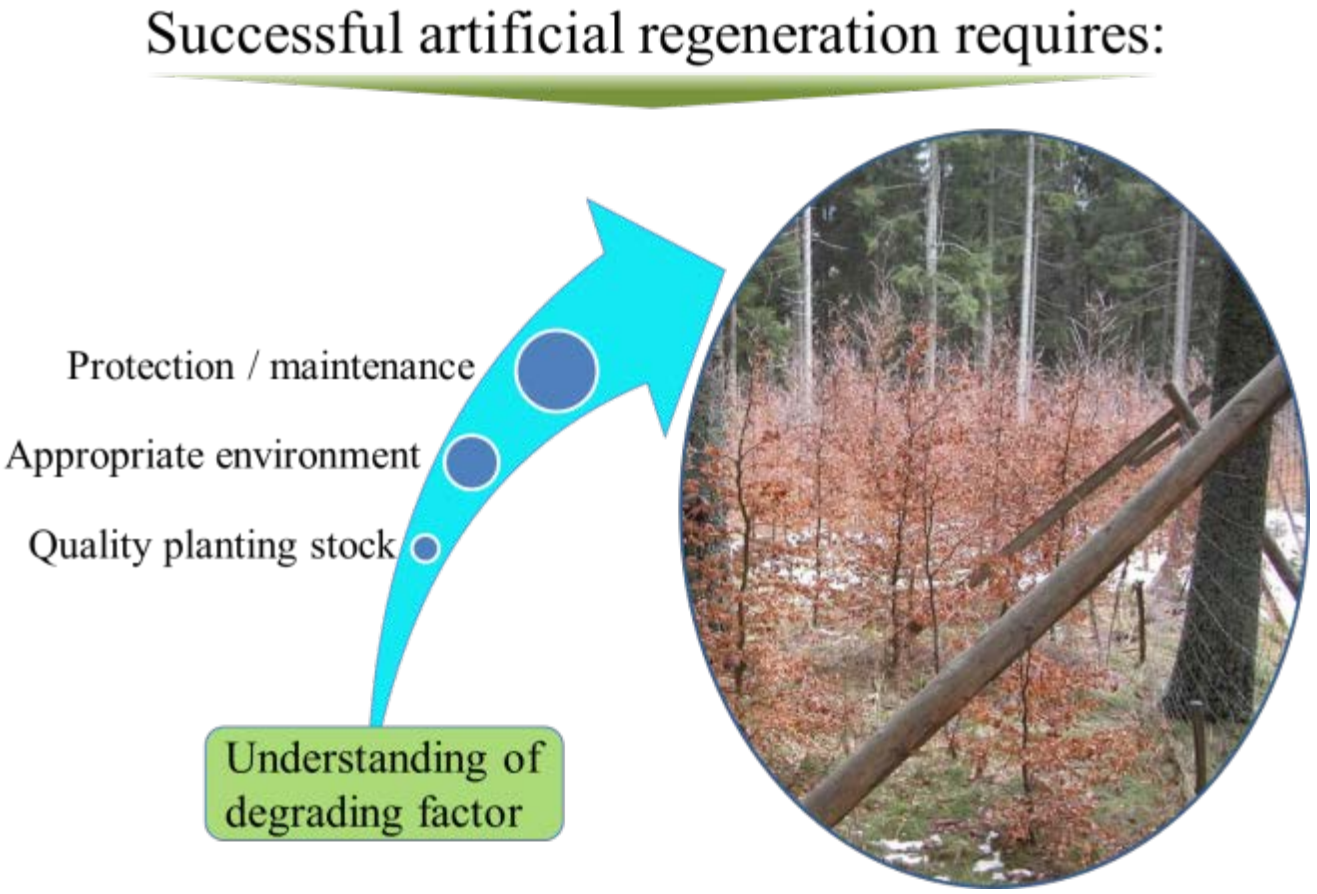






Techniques

- Use quality planting material
- Match species to site
- Prepare the site and manage competing vegetation
- Protect from herbivory
- Diversify species and structures
- Connect forested patches in the landscape



Target Plant Concept: Planting stock quality is Based on field performance and driven by:

- Morphology
- Physiology
- Genetics


Seed


Cuttings


Rooted cuttings


Bareroot seedlings


Container seedlings


RPM oak seedlings


Tissue cultured stecklings

Matching Species to Site: Inundation Regime

Waterlogging tolerance classes, in terms of flooding duration and season

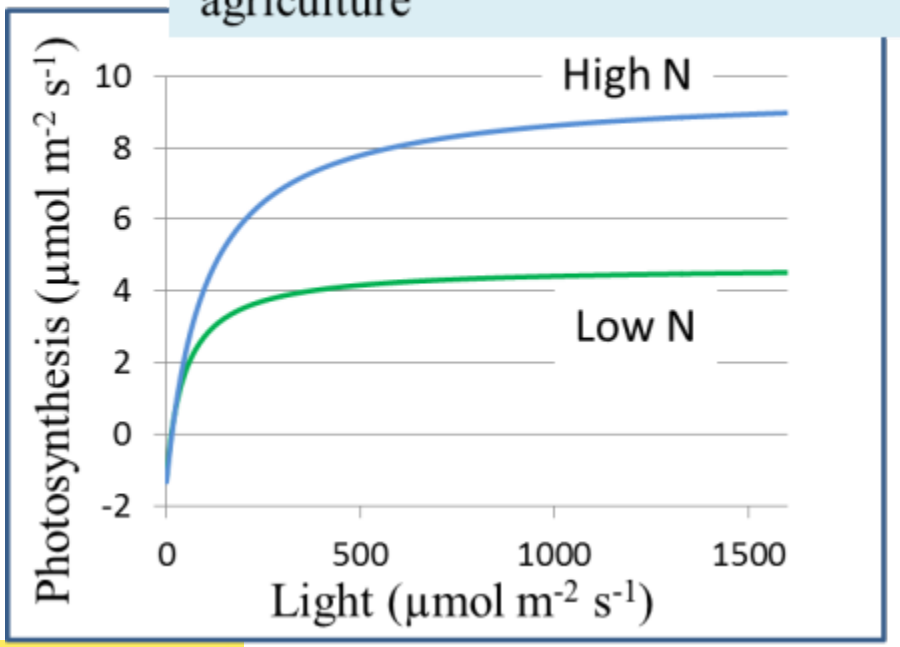
	Most	Highly	Moderately	Weakly	Least
Duration	100 %	50-75 %	50 %	10 %[1]	2 %[1]
Winter	Yes	Yes	Yes	Yes	Yes
Spring	Yes	Yes	Yes	Yes	Seldom
Summer	Yes	1-3 months	Early only[1]	Seldom	No
Example	*Cypress*	*Overcup Oak*	*Water Oak*	*Cherrybark Oak*	*White Oak*

[1] Refers to growing-season flooding

Matching Species to Site: Soil Conditions

- Physical conditions
  - Texture
  - Compaction and pans
- Chemistry
  - pH
- Nutrient availability
  - Low organic matter and nitrogen on afforested sites
  - Phosphorus deficiency in some Coastal Plain soils
- Use Baker and Broadfoot as a guide; 54 – 63 % maximum productivity

Quercus texana - site degraded from agriculture



Site Preparation on Ag Fields

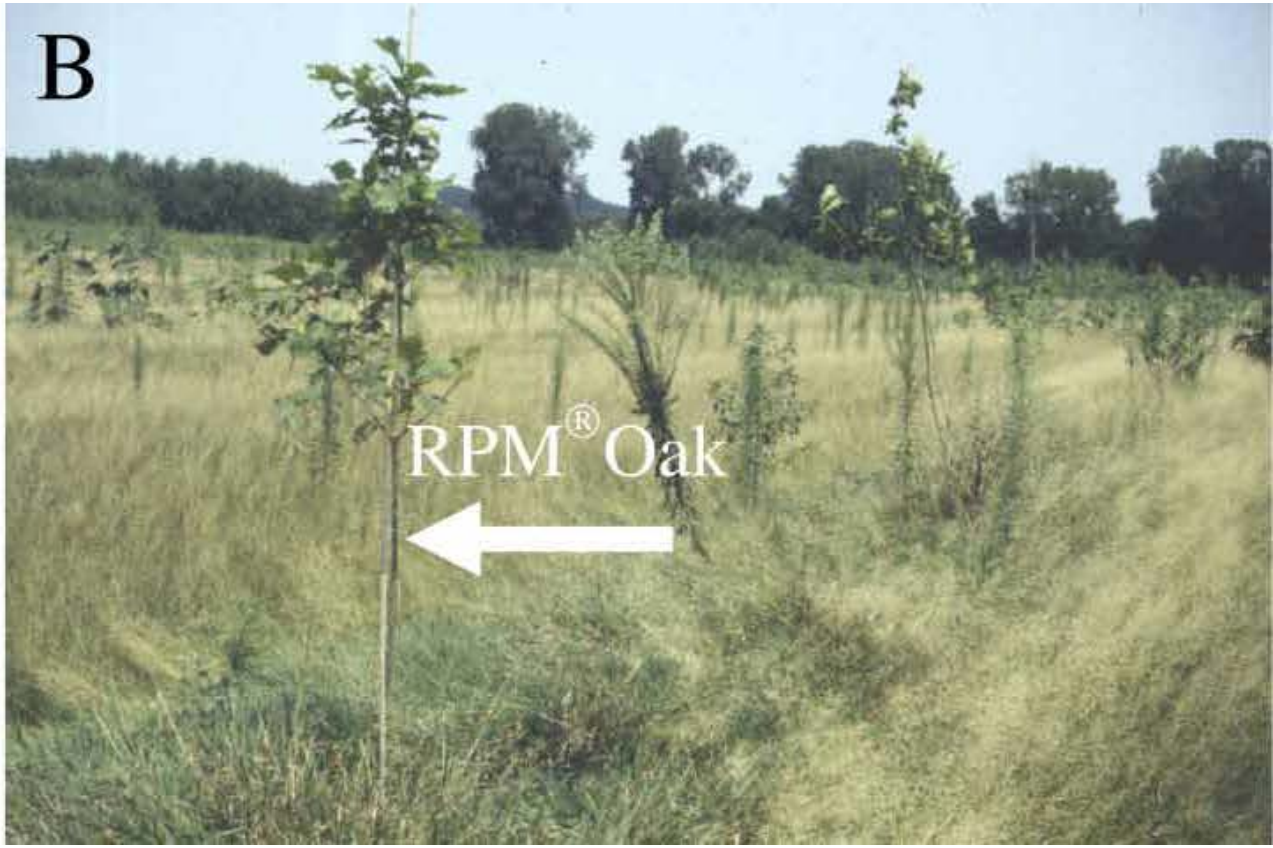
- Disk at least twice
  - Late summer or early fall
  - 8 to 15 inches (20-38 cm)
  - Rip compacted sites
  - Straight shank in heavy clay soils
- Cottonwood requires more intensive site prep
- Fertilize at planting to get early height growth
  - Broadcast fertilization stimulates weeds
- Chemical site prep?

Planting

- Bareroot seedlings should be dormant when planted
- Delayed planting using container stock
- Planting in standing water
  - Heavily root pruned
  - Baldcypress and tupelo yes, green ash no

Stock quality can be compromised by improper handling, storage, and planting

Planting with Cover Crop to Control Competing Vegetation

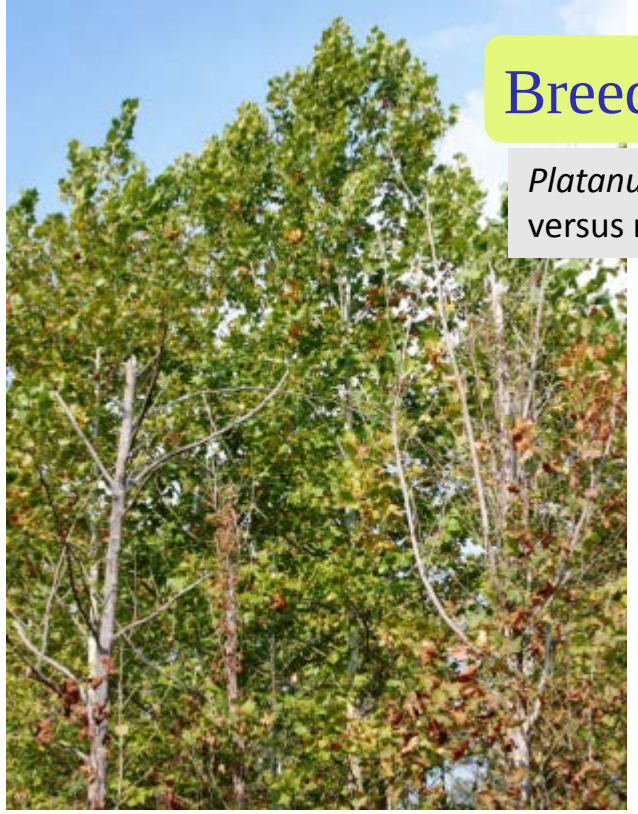


(A) Natural vegetation first summer; (B) Cover crop of redtop grass (*Agrostis gigantea* Roth) significantly improved the survival of pin oak (*Quercus palustris*) and swamp white oak (*Quercus bicolor*) seedlings 3 years after afforesting fields in the Lower Missouri River Valley. (Source: Dey et al. 2010 Scandinavian J Forest Research

Protecting plantings

Fire breaks

Tree shelters



Breeding for resistance

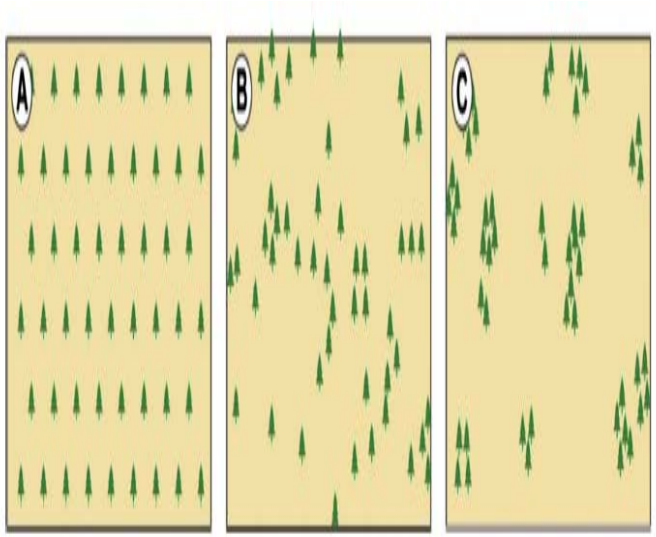
Platanus occidentalis – diseased versus resistant families

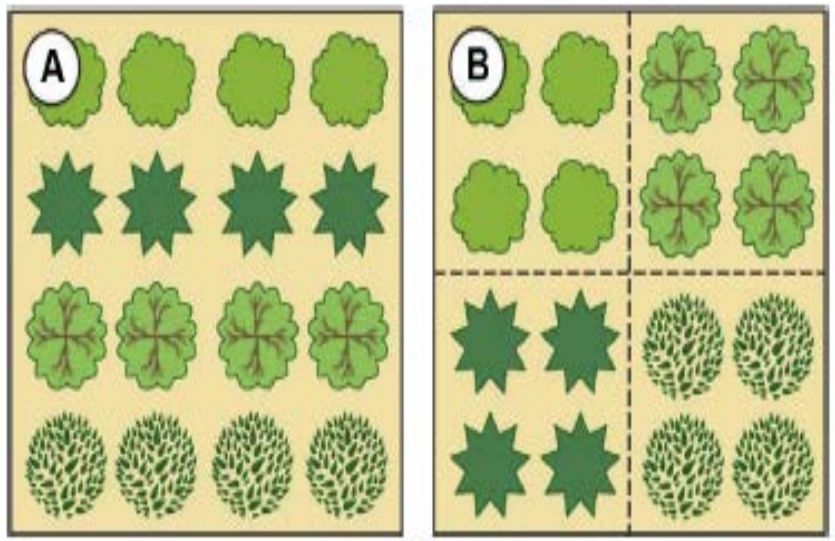
Fencing

Simple Planting Designs
Single Cohort

Single Species

Multiple Species





Rows

Random

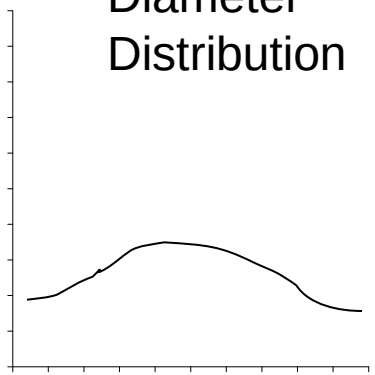
Cluster

Mixture by Rows

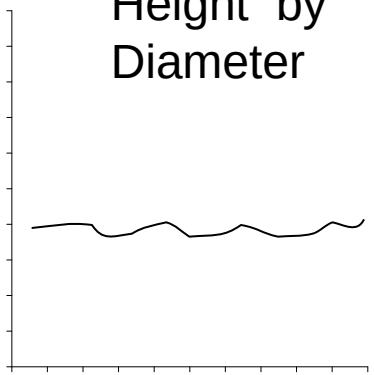
Species Blocks

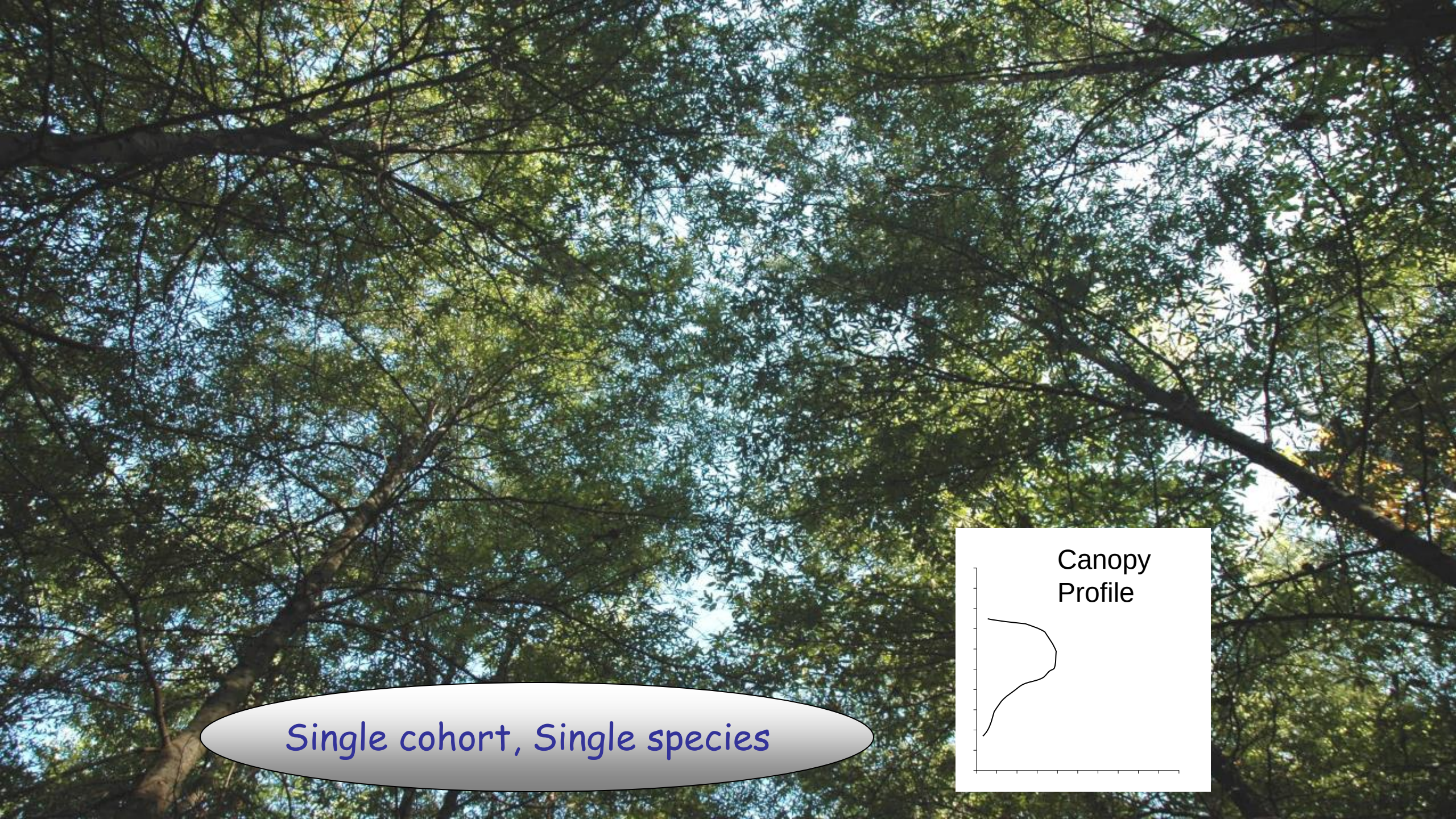
Single cohort, Single species

Diameter Distribution



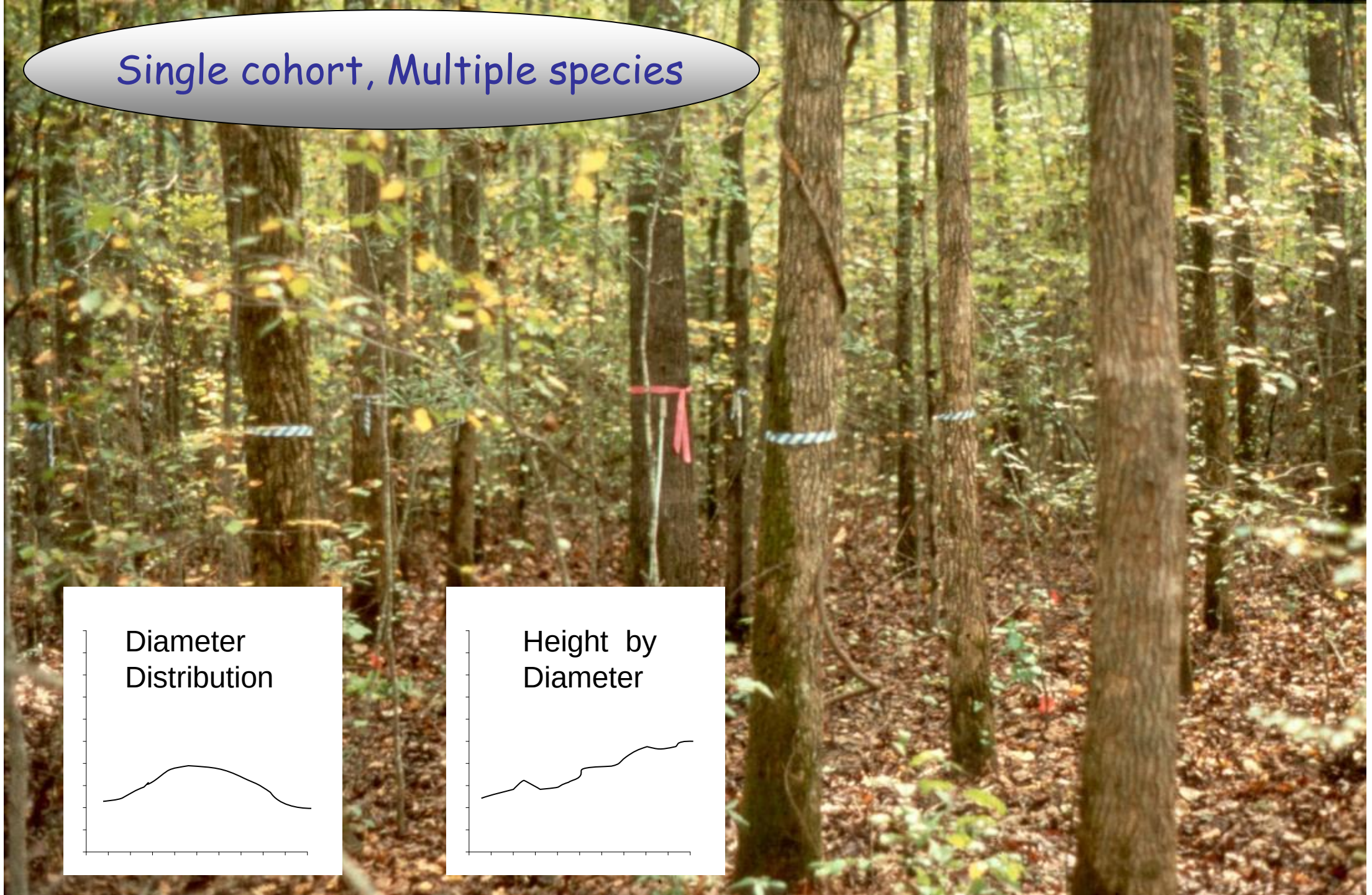
Height by Diameter





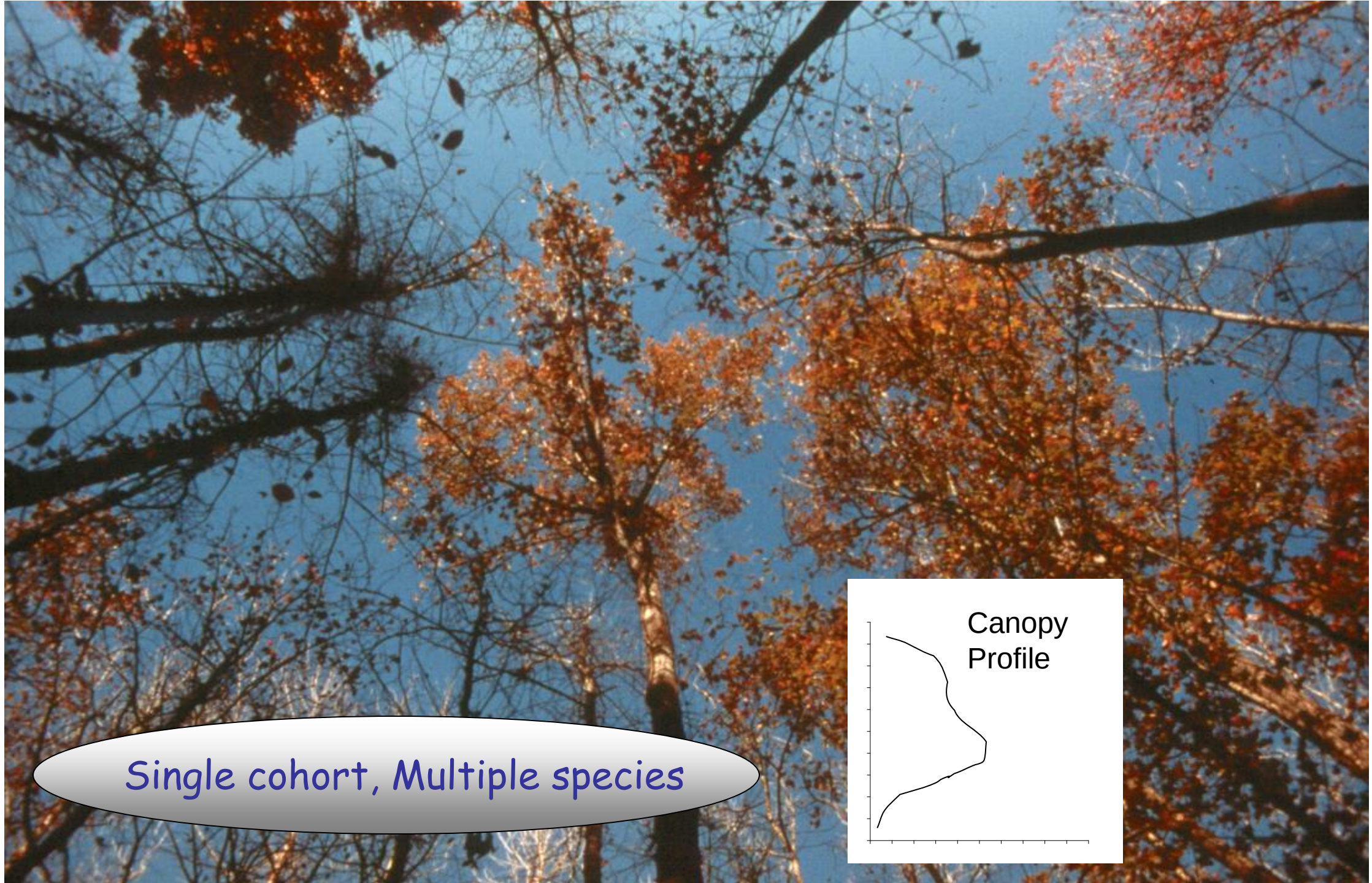
Single cohort, Single species

Single cohort, Multiple species



Diameter Distribution

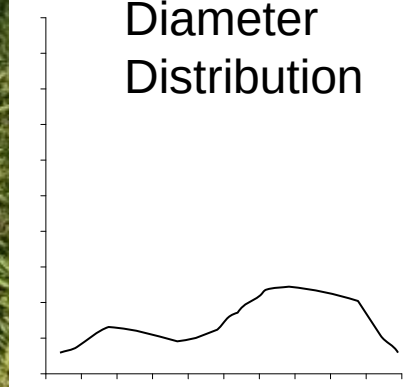
Height by Diameter



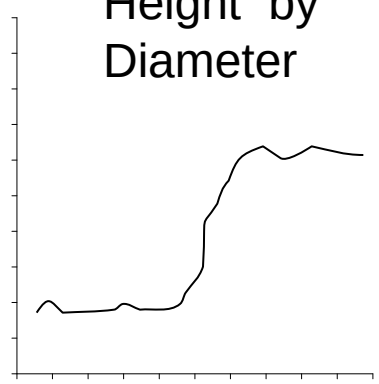
Single cohort, Multiple species

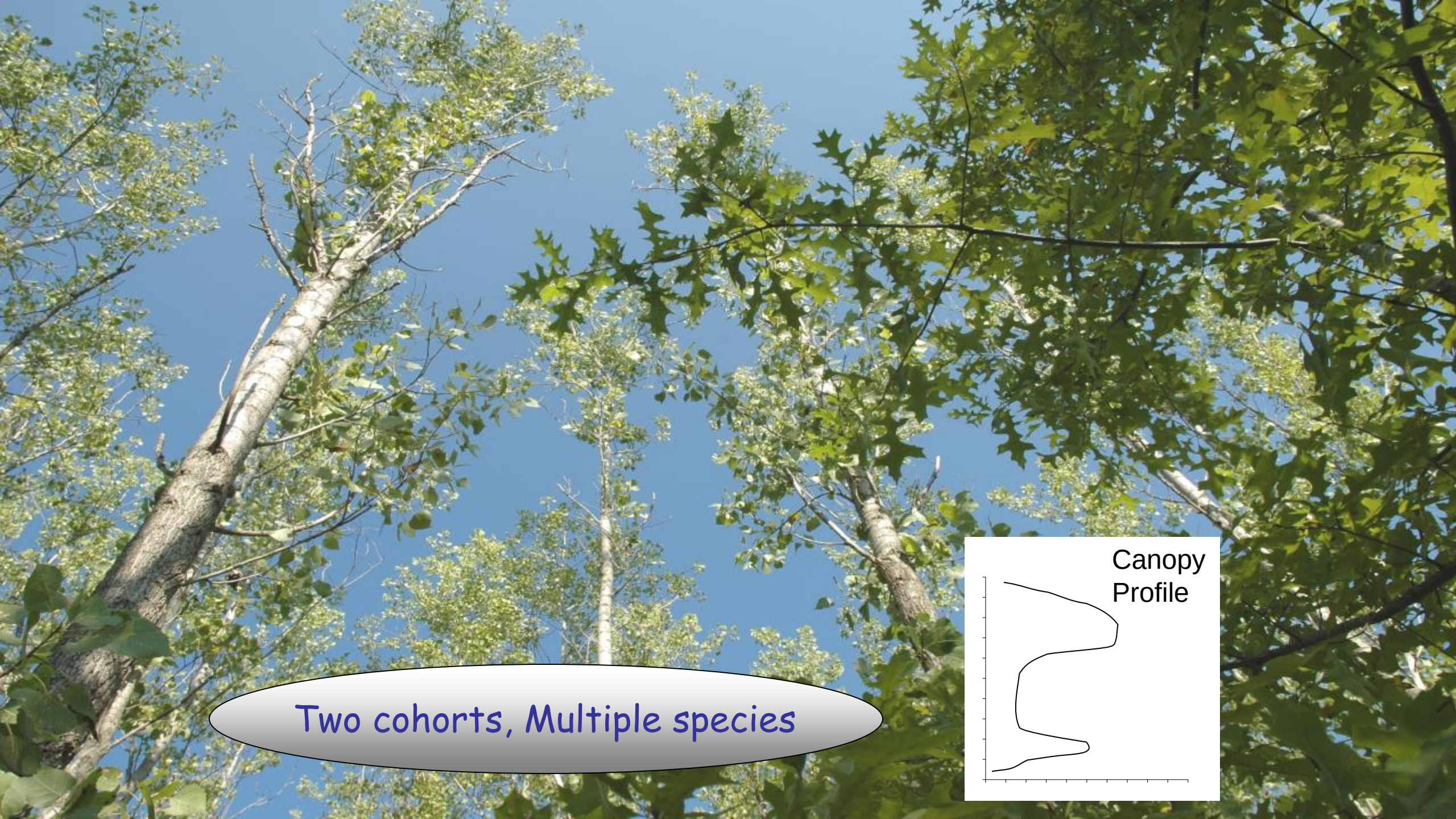
Two cohorts, Multiple species

Diameter Distribution



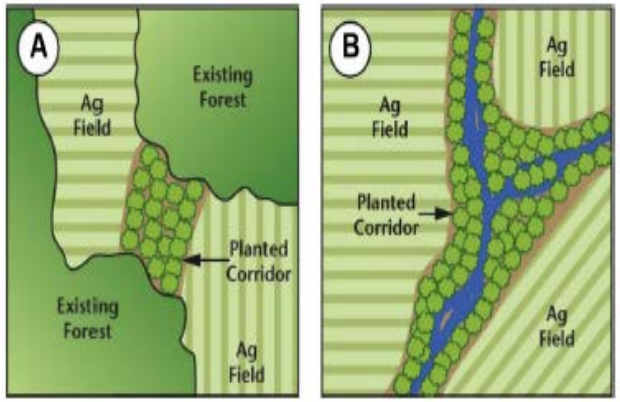
Height by Diameter

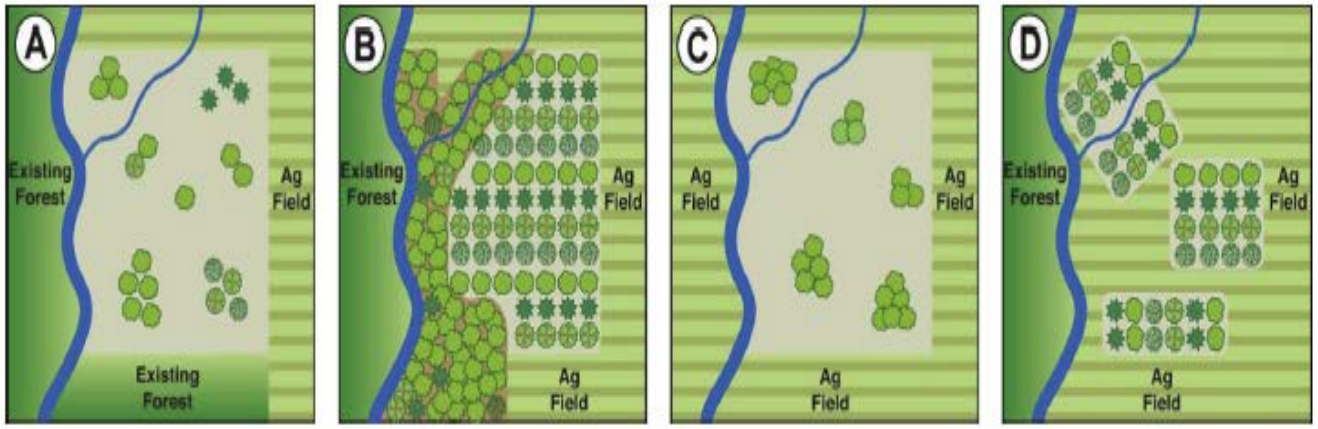




Two cohorts, Multiple species

Landscape designs—Corridors, natural colonization, nucleation, clusters





Keys to Success

- **Consider landowner objectives**
  - **Critical for successful design and establishment**
  - **Determines willingness and ability to manage in the future**
- **Explicitly state objectives**
  - **Carbon sequestration measured in tonnes/ha over specific rotation**
  - **Quality timber or wildlife management influence initial composition and spacing**
- **On-going management and multiple interventions over time**
- **Lack of explicit objectives may result in reduced outputs or possibly failure**