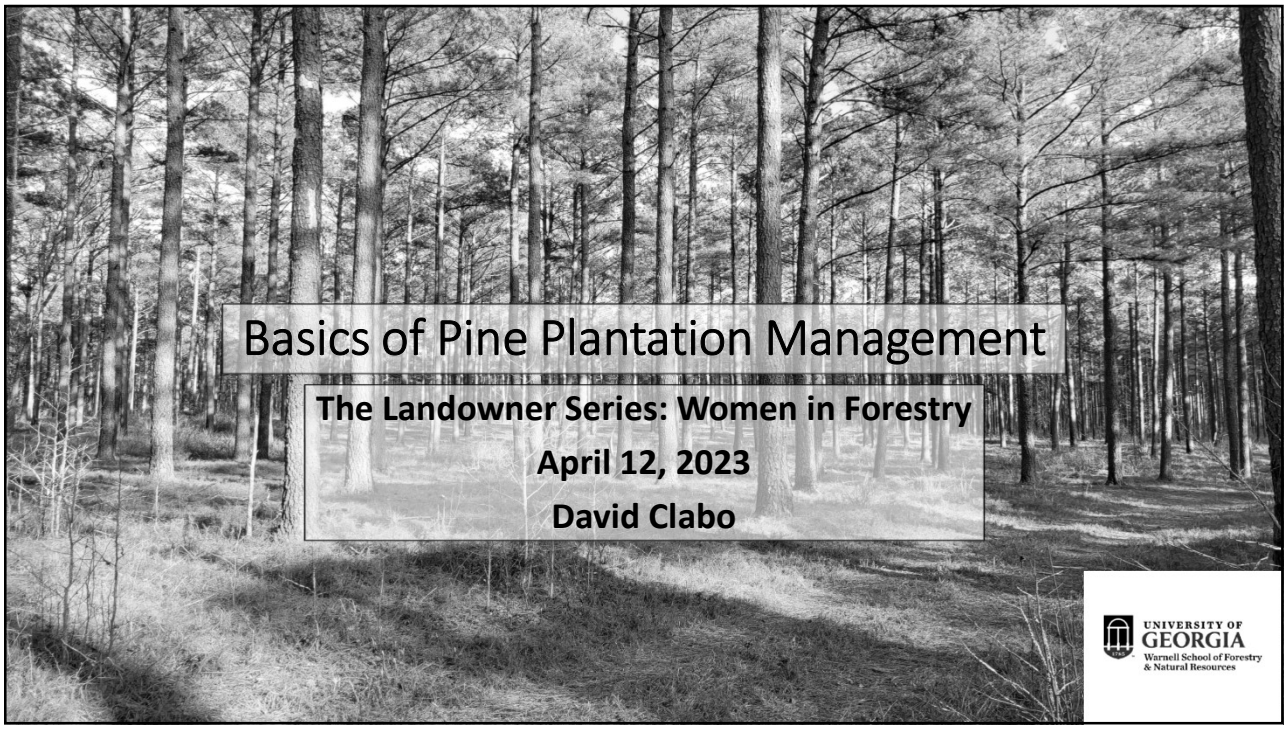


Advantages of Planting Pines

- Well-adapted to poor fertility or erodible soils
  - Many soils will not support good hardwood growth
  - Drought tolerant--taproot
- Cheaper and easier to plant than hardwoods
- Cheaper to establish and less time to harvest than hardwoods
- Important habitat component for some wildlife species

Disadvantages of Pine Management

- Some species are not tolerant of ice storms
  - May partially limit native range
- Destructive insect outbreaks can occur especially without proper management
  - Example: Southern pine beetle
- Timber production goals require active management
- Markets may not be available or favorable in all locations

Ecology of Southern Pines

- Four main species: loblolly, shortleaf, longleaf, and slash pine
- Southern pines are shade intolerant
  - Broadleaf trees, weeds, and grasses can outcompete young pines for resources and sunlight
- Usually species are fast growing
  - Some species develop an extensive root system before faster height growth occurs e.g. longleaf and shortleaf pine
- Cone and seed production usually begins between ages 10-20 yrs
  - Varies by species

Ecology of Southern Pines

- Most species do not produce adequate seed annually
  - Bumper and near failure years
  - Prediction is difficult
  - Spread by gravity and wind
  - Prescribed fire often improves seedbed for germination
- Disturbance dependent forest types
  - Will transition to mixed pine-hardwood and pure hardwood over time
  - Depends on site conditions
  - Natural and human disturbances

Site Selection for Pine Management

- Four species are soil generalists, but some differences exist

Pine Species	Native Range Rank	Common Soil Conditions	Soil Limitations
Shortleaf	1: 23 states; most cold hardy	Upland sites (moderate drought tolerance), low organic matter content, and usually clay soil texture	High soil pH, high calcium content, or poorly drained soils
Loblolly	2: 14 states; naturalized throughout the world fastest growing; genetic improvement	Soil generalist, good growth with a variety of soil moistures and textures	Absent or poor growth on high pH soils or excessively sandy soils

Site Selection for Pine Management

Pine Species	Native Range Rank	Common Soil Conditions	Soil Limitations
Longleaf	3: Gulf and Atlantic Coastal Plain	Tolerant of sandy, acidic, and infertile sites. Most commonly found on these sites	Better productivity sites where competing vegetation influence is greater limits longleaf
Slash	4: Coastal Plain; limited by minimum average temperature	Soil generalist, tolerant of a variety of soil moistures and textures	Growth is slowed on excessively sandy soils. Lacks cold-hardiness

Stand Establishment: Site Preparation

- Improves regeneration success (survival and long-term growth) of pines
- Alters soil conditions and pre-existing vegetation on site
- Type and amount dependent on previous land use and cover type

Mechanical

- Remove litter and upper organic layers (scarification)
- Improve soil texture , temperature, and permeability of upper soil layers
- Modify structure and porosity of moderately deep soil horizons (subsoiling)
- Improve soil drainage (bedding, ditching)

Stand Establishment: Site Preparation

Chemical Site Preparation

- Mechanical alone will not prevent future plant growth/competition
- Herbicides labeled for forestry use
- Products and rates used depends on vegetation present
- Different product formulations affect timing
- Applied as broadcast-aerial or ground (<100 acres), band, or spot treatments
- Often applied at full leaf out during mid-late summer
- May be followed by other site preparation methods
- Usually a waiting period after application

Stand Establishment: Site Preparation

Prescribed Fire

- Most common on cutover sites
- Cheap and effective if mechanical treatments are unavailable or not economical
- Clears debris and makes site more accessible
- Exacting weather conditions
- Prescription necessary
- Smoke management concerns

Natural vs Artificial Regeneration

Natural Regeneration

- Associated with a harvest of forested site
- Must have mature, seed producing trees on site, nearby (<0.25 mile) or regeneration in place
- Results more variable than artificial regeneration
- Less control over, genetics, spacing and density
- Less intensive site preparation often used
- Cheaper than artificial regeneration

Natural vs Artificial Regeneration

Ordering and Planting Timeline - Pine (*Pinus sp.*)

	Year 1												Year 2				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Ordering Window	/→													→/			
Sowing		/→			→/												

Artificial Regeneration

- Seed source should be adapted to climate and soils of the planting site
  - Loblolly pine PRS sheets
- Bareroot or containerized nursery seedlings
- Spacing dictated by objectives
  - More narrow spacings-faster crown closure, sooner intraspecific competition, sooner need for thinning, faster self pruning, less likely to need midrotation vegetation management
  - Wider spacings-later crown closure, faster individual tree growth, slower pruning, may be better for improved genetics

Natural vs Artificial Regeneration

Artificial Regeneration

- Timing depends on location, contractors, bareroot vs containerized--best results when seedlings are planted dormant during rainy periods
  - Later planting more northern latitudes
  - Containerized pine often improved survival and longer planting window
- Seedling handling critical at planting
- Proper planting technique important

Stand Establishment: Fertilization

- Added cost to increase seedling growth rates and pine straw production
- May be needed when straw is raked regularly
- May not be economical on all sites—past land use history
  - Usually not needed on old fields, some cutover sites can benefit
  - Consult with soil maps, take soil tests and/or foliage samples
  - Closely monitor fertilizer prices (DAP, MOP, TSP, poultry litter)
- Conduct soil and foliage tests to make decisions
- Nitrogen (N) and phosphorous (P) are two most limiting nutrients to growth
  - Some stands occasionally are K or micronutrient deficient
- Applied together, or as P alone at stand establishment
  - Inorganic fertilizers or poultry litter

Post-Planting Operations

Herbaceous Weed Control

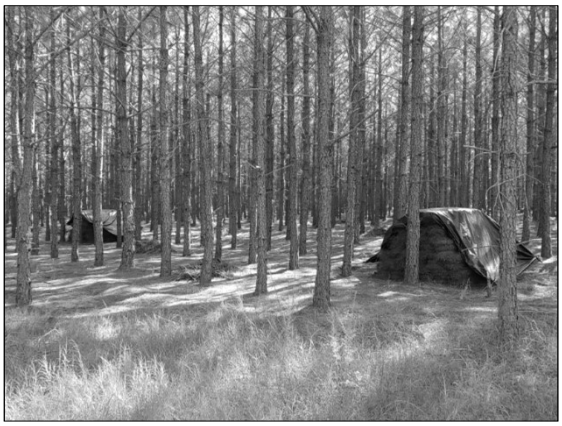
- Improves seedling survival and growth—sometimes 10+ years
- Herbicides that are safe to apply over pine seedlings at recommended rates
  - Rates can vary by pine species and weeds treated—CHECK LABEL
- Applied first and/or second spring after planting
  - Pre-emergent or after weeds first emerge (<1 ft tall)
  - Better results on sites with more competition
  - Broadleaf weed (some grasses controlled) or grass control only herbicides
- Usually banded application (4-6 ft) overtop of seedling

Post-Planting Operations

Pine Straw Production

- Intermediate income source--$1 for every $6 of wood income
- Check to see if contractors are in your area (mostly Coastal Plain)
- Per acre or bale value greatest with longleaf pine
- Begin at canopy closure—sooner for loblolly<slash<longleaf—to first thinning
- Usually completed annually—spring and summer
- Productivity depends on species, site productivity, stand density, competition control (herbicides, fire (early), and mowing), rakeable stand area, fertilizer use, and raking frequency

'Clean' stand free of understory vegetation and most woody debris



Hand-raked, rectangular bales ready for shipping

Post-Planting Operations

Woody Release

- Attempted control of woody brush and hardwoods in pine plantations after plantation establishment
  - Usually done because of poor site preparation
- Less options to control vegetation than during site preparation
  - Herbicides and application rates must be pine-friendly—damage risk to pines
  - Competing vegetation species mix may make release not possible with herbicides
  - Mowing or mulching are possibilities between rows
  - More difficult with pine species other than loblolly
- May be less expensive than site prep but pine growth rates reduced on most sites
- Typically completed prior to stand age 5—Earlier the treatment the greater the growth response due to longer release time

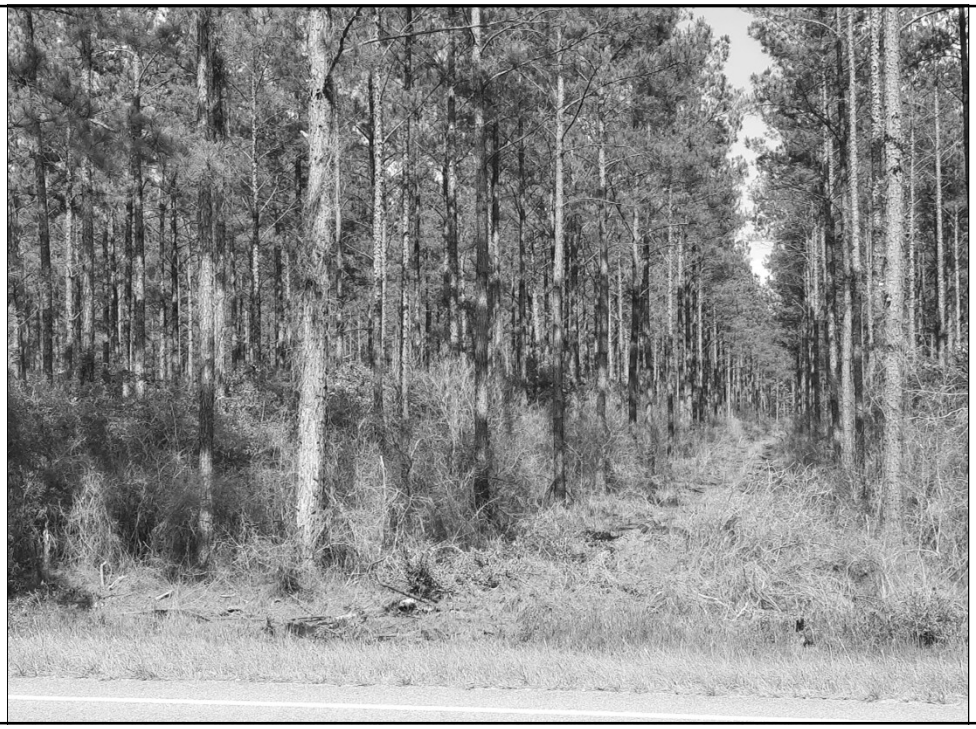
Woody release for planted pine using imazapyr applied by a mist blower after first growing season

Woody release of young planted pines by spot herbicide spraying

Post-Planting Operations

Mid-Rotation Release

- Free pines of competing hardwood and shrub competition
- Often done soon after first thinning
- Not really release since pines typically not overtopped—may be termed 'cleaning'
- Almost like thinning--not thinning pines just competing hardwoods, shrubs and vines
- Overtop (helicopter) or understory (usually a skidder) application
  - Understory application needed if done to control waxy leaf flatwoods vegetation
    - Herbicides needed will damage pines if applied overtop
- Long lasting response—additional wood growth over untreated control reported for up to 14 years after application in some studies



Post-Planting Operations

Mid-Rotation Fertilization

- May be used to improve stand growth
- Depends on expected wood yield and pine straw gains, markets, materials and application costs
- Same fertilizers as establishment, often different rates
- Often more difficult to predict the need for fertilizers
- Diagnostic tools should be used
  - Leaf area index (LAI), soil sampling, foliage sampling, and soil maps
- Fertilizer effects may be realized for 6-8 years.

Thinning—The Premise

- Differences in height growth between individual stems occurs over time—vigor declines
- Results in some smaller, weaker stems
- Affected by species, site productivity, tree spacing, and growth rate
- Growth rate slows over time as growing space and resources become limited
- Self-mortality begins to occur without disturbance

Thinning

- Thinning reduces stand density to improve growth rates, improve health and vigor, and recover potential mortality of individual trees
- Necessary to maintain growth rates
- Frequency--spacing and desired product classes—done 1 or 2+ times before final harvest
  - Objectives dependent
- Opportunity for intermediate income

Thinning

- Basal area and live crown ratio as easy indicators
- Methods
  - Pine plantations-row thinnings with operator's choice or free thinning on adjacent rows
  - Remove suppressed, poorly formed, and diseased trees
  - Depending on stand health and target structure, better trees may be removed too
- Minimum size for merchantability is pulpwood size class—sold by weight

Thinning

- Loblolly pine stand example--reduce the risk of catastrophic insect outbreaks (e.g. southern pine beetle) and/or reduce wildfire risk by reducing stand density (basal area)

Basal area (ft^2 per acre)	Age (years)	SPB Hazard Rating
<70	<10	Very low
70 - 90	10 – 13	Low
90 - 120	14 – 17	Medium
120 – 145	18 – 21	High
>145	>21	Very high

Commercial vs. Precommercial Thinning

- Commercial Thinning-produce a net income from cut trees
  - Usually 5” minimum dbh up to a ≈3” top diameter—merchantable length
- Precommercial Thinning-carried out as an investment
  - Costs of operation exceeds income from the cut
  - Done to improve stand growth, improve individual tree health, and stand structure
  - Not common-Usually only conducted in dense, naturally regenerated pine stands
  - >5,000 stems/acre or when live crown ratios are expected to dip below 35% by the first commercial thinning

Example of a precommercially thinned pine stand in South Carolina. Photo: Stephen Peairs

Other Management Options

- After final thin, other objectives such as wildlife habitat improvement may take precedence
- May preclude earlier costly management such as fertilization
- Periodic prescribed burning in thinned pine plantations (e.g. 2-5 years)
  - Improve plant and insect diversity and richness
  - Valuable wildlife habitat (with thinning) for a variety of species
  - Hazard fuel reduction
  - Competing vegetation suppression
  - Disease management
  - Aesthetics, access and recreation

Examples of longleaf and shortleaf pine stands thinned more than once and treated with regular, periodic prescribed fire—high plant diversity and wildlife habitat value for many species

Pine Product Classes

Price reported per ton

Based on 1. defects/form and 2. diameter class to a given length

Stumpage prices vary locally so consult a local forester or timber buyer

Increasing Value ($)

4. Pulpwood
Dimensions: 4.5-9.5” dbh to a 3” top
Price: $7-20/ton
Very location dependent

3. Chip-n-saw
Dimensions: 9.6” to 12.5” dbh to a 5-6” top diameter and good form
Price: $16-28/ton

2. Sawtimber
Dimensions: >12.5” dbh to 8-10” top and good form
Price: $23-35/ton

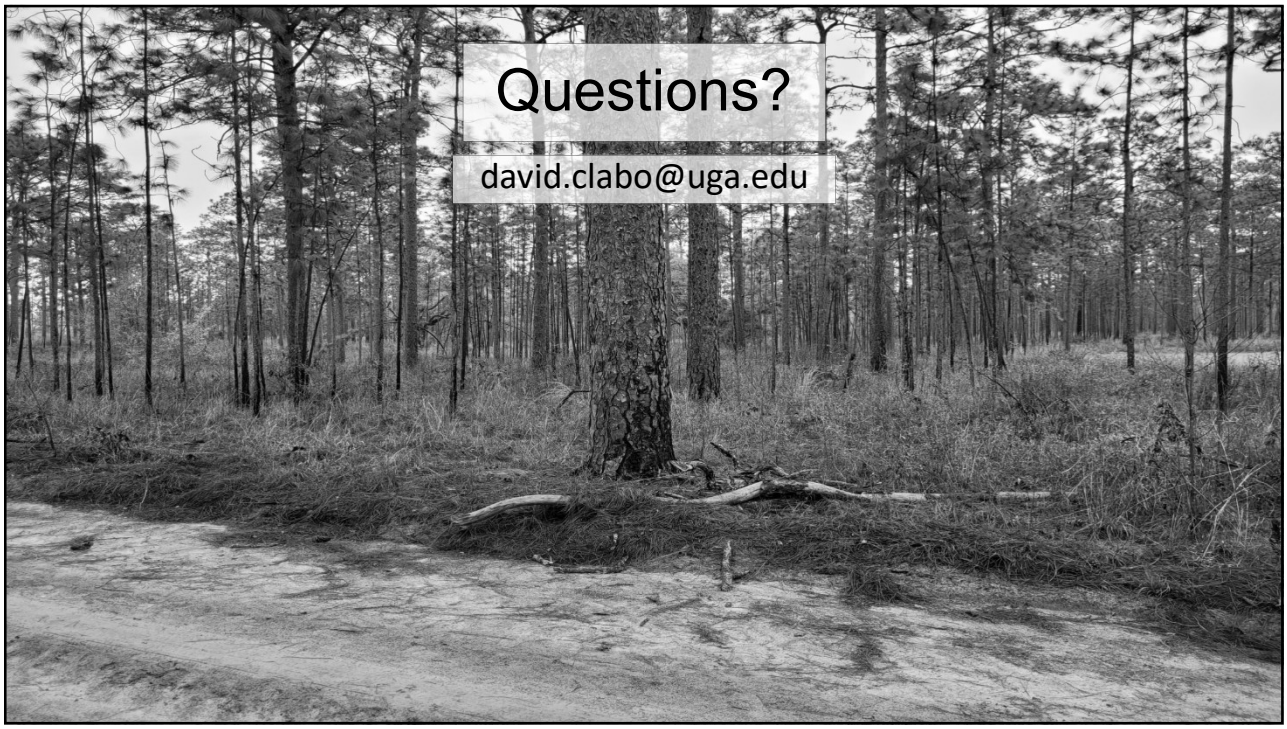
1. Poles
Dimensions: >8” dbh to 6” top diameter and no defects to ≥32’; considerable variation
Price: $40-44/ton

Final Harvest Considerations

- Timber product type and value will be affected by site conditions, disturbances, stem defects, management decisions over the life of the stand and timber markets at harvest
- Higher value products (poles, sawtimber) take longer to grow than less valuable products (chip-n-saw, pulpwood)
  - More risk of damage with longer rotations (insects, diseases, storms, fires, etc.)
  - Shorter rotations usually have a higher rate of return
  - Monitor timber markets regularly—sell high

Final Harvest Considerations

- Work with a consulting forester or natural resource professional
- Express your objectives or goals for your land
- Create a timber contract
- Timber harvests can take months to plan and execute (many contracts last 18 months)
- Be aware of your state's rules and regulations (environmental, taxes, etc.)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