The Basics of Longleaf Understory Establishment & Enhancement

Longleaf Understory Benefits

Plant Diversity

- Frequently burned sites have higher species number at small spatial scales
- Species Richness increases with higher soil moisture content
- Composition varies across the region as well as across moisture gradients

Wildlife Diversity

- Higher wildlife diversity in early successional stage
- Understory species provide both cover and food for many wildlife species
- Gamebirds also thrive in herbaceous habitat
- High quality understory contains many species that are beneficial to pollinators

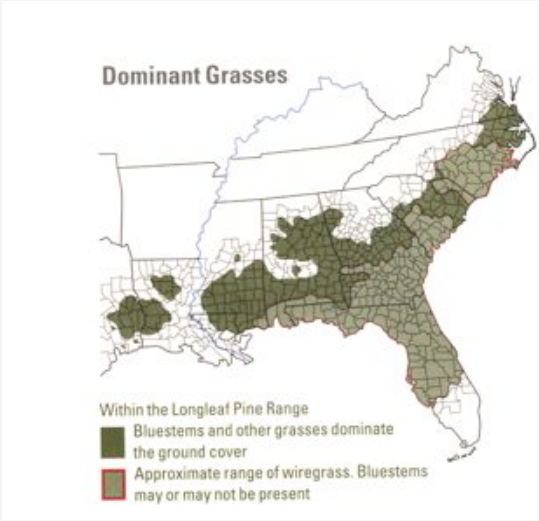
Fine Fuels

- Understory species provide necessary fine fuels
- Grasses are especially beneficial
- Perennial species that are adapted to fire
- Some species require fire for blooming and seed set

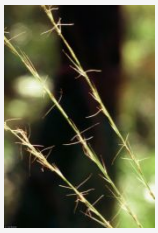
Longleaf Understory Components

- Highest quality sites are maintained as early successional habitats with regular fire intervals
- Largest plant families represented are grasses, legumes, and composites

Native Warm Season Grasses



Wiregrass
Aristida stricta / beyrichiana



Identifying Characteristic: densely tufted bunchgrass, seeds bear 3 hair-like awns, leaves with tuft of hair near the base

Habitat: pine savannas and flatwoods

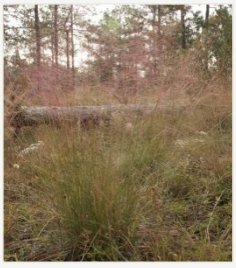
Wildlife Usage: provides nesting sites for quail, provides cover and forage for gopher tortoises and seeds are occasionally consumed by songbirds.

Muhly Grass
Muhlenbergia capillaris

Identifying Characteristic: bunchgrass with wiry leaves, open panicle of inflorescence is purple in color.

Habitat: grows in a range of habitats including seepage slopes, sand dunes, pine savannas, and flatwoods.

Wildlife Usage: provides cover for wildlife, seeds eaten by birds.



Pineywoods Dropseed
Sporobolus junceus

Identifying Characteristic: bunchgrass with wiry leaves, leaves are a blue/green color, inflorescence is pyramid shaped panicle.

Habitat: found in open dry sites in pine savannas, flatwoods, and sandhills.

Wildlife Usage: seeds consumed by songbirds, provides cover, foliage eaten by deer.

Big Bluestem
Andropogon gerardii

Identifying Characteristic: large bunch grass up to 8' tall, brown inflorescence resembling a turkey foot

Habitat: common in prairies, hillside bogs, pine savannas, and flatwoods.

Wildlife Usage: provides good cover and nesting sites, seeds eaten by gamebirds and songbirds, foliage eaten by deer.

Splitbeard Bluestem
Andropogon ternarius

Identifying Characteristic: long inflorescence stalks up to 2" in length

Habitat: found in dry, sandy soils

Wildlife Usage: seed eaten by songbirds and quail, cover and forage for wildlife.

Splitbeard Bluestem

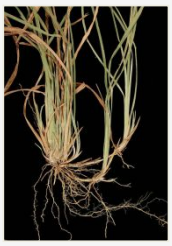
Broomsedge
Andropogon virginicus

Identifying Characteristic: common bunch grass up to 4' tall, leaves flattened at the base, inflorescence with 2-4 racemes

Habitat: grows in a wide variety of habitats including grasslands, pastures, and open forests.

Wildlife Usage: provides good cover and nesting sites, seeds eaten by small mammals and songbirds.

Little Bluestem
Schizachyrium scoparium



Identifying Characteristic: common bunch grass up to 4' tall, inflorescence a single raceme, leaves turn purplish-red in fall.

Habitat: grows well in wide variety of habitats including old fields, open forests, and prairies.

Wildlife Usage: provides good cover for birds and small mammals, seeds eaten by birds.

Toothache Grass
Ctenium aromaticum

Identifying Characteristic: bunch grass that forms dense clumps, leaves dark green on top and lighter on bottom, inflorescence looks like comb and curl as seeds mature

Habitat: found in wet to moist pine flatwoods, savannas, prairies, and pitcher plant bogs

Wildlife Usage: provides cover.

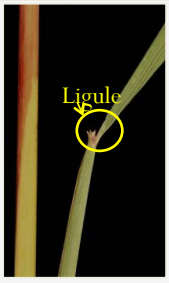
Switchgrass
Panicum virgatum

Identifying Characteristic: rhizomatous grass up to 6 ft., open panicle inflorescence, ligule of dense hairs up to ¼" long

Habitat: grows in a variety of habitat types but prefers wet-mesic to mesic soil conditions

Wildlife Usage: seeds eaten by wild turkeys, quail, and songbirds, provides cover.

Yellow Indiangrass
Sorghastrum nutans



Identifying Characteristic: membranous ligule up to ¼" long, rhizomatous , long awns on spikelets

Habitat: grows well in plantations, open forests, forest margins, and right-of-ways.

Wildlife Usage: seeds eaten by songbirds and small mammals; cover for wildlife; foliage eaten by deer.

Lopsided Indiangrass
Sorghastrum secundum

Identifying Characteristic: membranous ligule up to 1/8" long, non-rhizomatous clump grass, inflorescence a one-sided panicle, spikelets with long, twisted awns

Habitat: grows well in well-drained soils of upland sites.

Wildlife Usage: seeds eaten by songbirds and small mammals; cover for wildlife

Composites

Asteraceae
Sunflower or Composite Family

- One of the largest flowering plant families (~1100 genera & 19,000 species)
- Many well adapted to all climates
- Found from xeric to wet-mesic sites within the longleaf ecosystem
- Characterized by flowers arranged in a head subtended by bracts
- High pollinator value

Tall Ironweed
Vernonia angustifolia

Identifying Characteristic: vibrant purple discoid inflorescence, alternate narrow leaves with deeply incised midvein.

Habitat: inhabits dry soils in longleaf pinelands and pine savannas.

Wildlife Usage: songbirds eat seeds, provides browse for deer, good pollinator plant.

Brown-eyed Susan
Rudbeckia hirta

Identifying Characteristic: large, bright yellow flower heads, stems & leaves covered with rough hairs

Habitat: found in plantations, open forests, forest openings, and right-of-ways.

Wildlife Usage: songbirds eat seeds, deer browse foliage.

Anise-Scented Goldenrod
Solidago odora

Identifying Characteristic: late summer yellow flowers, leaves smell like licorice when crushed.

Habitat: common in open forests, along forest margins and right-of-ways.

Wildlife Usage: seeds consumed by small mammals & songbirds, leaves provide browse, and is good pollinator food source.

Rayless Sunflower
Helianthus radula

Identifying Characteristic: rough, basal leaves that run along ground, dark maroon/brown flower heads, heads with no ray flowers or much reduced.

Habitat: pine flatwoods, savannas, and pine barrens

Wildlife Usage: seeds consumed by small songbirds and is good pollinator food source.

Spiked Blazing Star
Liatris spicata

Identifying Characteristic: rose-purple flowers arranged in a spike on slender plants reaching 5' in height; tuberous root.

Habitat: found in forests openings, bogs, and meadows growing on mesic-wet soils.

Wildlife Usage: songbirds eat seeds, provides browse for deer, good pollinator plant.

Legumes

Importance of Legumes

- Important contributors to the overall diversity of the longleaf pine ecosystem
- Foliage of legumes is preferred forage for white-tailed deer, gopher tortoises, rabbits, and pocket gophers
- Seeds are a component of the diets of bobwhite quail, wild turkey, small mammals, and seed-eating songbirds
- Legumes can convert atmospheric nitrogen into forms usable by plants



Hairy Lespedeza
Lespedeza hirta

Identifying Characteristic: erect plant covered with silvery hairs, leaves oval shaped, white to pale yellow flowers

Habitat: grows in forest openings, old fields, and right-of-ways.

Wildlife Usage: seeds eaten by quail, dove, & wild turkey and foliage is eaten by deer and gopher tortoises

Goat's Rue
Tephrosia virginiana

Identifying Characteristic: pinnately compound leaf, bicolored flower, clonal, erect growth

Habitat: found in open forests, fields, and right-of-ways on dry sandy soils.

Wildlife Usage: seeds of Tephrosia are eaten by quail and other seed-eating songbirds; foliage is eaten by deer & gopher tortoises; good cover plant

Spurred Butterfly Pea
Centrosema virginianum

Identifying Characteristic: twining or trailing vine, large 1" purple flowers with spreading petals

Habitat: found in mesic, open woods

Wildlife Usage: seeds eaten by quail and other songbirds; foliage eaten by deer and gopher tortoises

Partridge Pea
Chamaecrista fasciculata

Identifying Characteristic: large yellow flowers with red centers, branched erect annual up to 3', small flat gland at the base of the petiole

Habitat: commonly found in plantations, roadsides, old fields, and open forests.

Wildlife Usage: seeds eaten by quail, wild turkey, and small mammals; foliage is eaten by deer and gopher tortoises; host plant for butterfly larvae.

Sensitive Brier
Mimosa quadrivalvis

Identifying Characteristic: pink pom-pom flowers, thorny spreading plant, pinnately compound leaves, flowers look like Mimosa tree flowers

Habitat: open forests with dry, sandy soils

Wildlife Usage: seeds eaten by quail other songbirds, and gopher tortoises; foliage is eaten by gopher tortoises and wild turkeys

Florida Ticktrefoil
Desmodium floridanum

Identifying Characteristic: perennial herb that can reach 3' in height; rough feel to the leaves and stem; fruit sticky

Habitat: grows in open forests

Wildlife Usage: seeds eaten by quail, dove, wild turkey, small mammals, and other songbirds; pollinator host plant; deer forage.

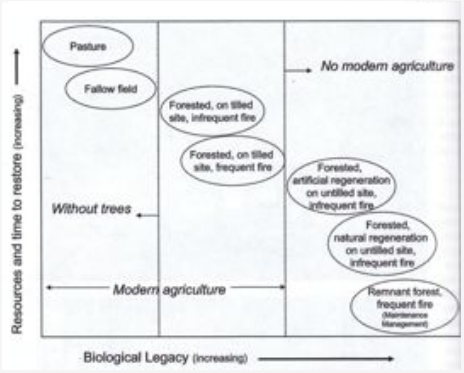
Understory Restoration Process

Developing a Restoration Plan

- Identify degradation factors
- Define goals & objectives
- Identify reference community
- Determine necessary restoration activities
- Develop realistic restoration schedule

Determine Site Needs and Landowner Objectives

- May not need extensive site preparation and planting if understory already occurs
- More intensive prep required if invasives or other competitors are an issue
- What plant species you plant depends on your objectives
  - Diversity
  - Wildlife
  - Pollinator Enhancement
  - CRP



Relationship between time and resources needed for restoration and the abundance of remnant biota on the site to be restored (Walker & Silletti 2006)

Implementing a Restoration Project

- Preparing the site for restoration
- Managing competition
- Increasing biodiversity and coverage of understory species
- Monitoring

Preparing the Site

- Key factors to address:
  - Soils
  - Hydrology
  - Light

Managing Competition

- Take a botanical inventory
- Use aggressive chemical treatments to manage invasive species
- Mowing is an option for controlling some annual weeds
- Woody competition can be controlled with fire, mechanical, and/or chemical treatments

Increasing Biodiversity

- Reintroduction of fire can increase understory plant diversity in some sites
- When no understory exists, site must be supplemented with plant material

Plant Material Sources

- Obtain material from:
  - Commercial producers
  - State nurseries
  - Donor sites
- Planting options:
  - Live Material (plugs)
  - Seed Material
- Best to look for ecotype seed/ plants that are locally sourced

TABLE 3. Comparison of direct seeding and outplanting options.

Direct seeding	Outplanting
Advantages	*Advantages*
Economical ($3K/acre)	Can choose individual target species
Simultaneously introduce multiple species known to co-occur	No need to disrupt existing conditions
Can create custom seed mixes by varying timing and methods of collection	No special planting tools
Can be done concurrent with site preparation	Can be done on slopes where seeding equipment cannot be used safely
Can be done in winter, before frost, when competition for labor is lower	Conducive to volunteer assistants
Mechanized approaches can treat large areas	Good success for many species
Genetically diverse seeds can be used so that site conditions "select" most suitable individuals	Reduced susceptibility to drought at early stages
	Appropriate for rare species
	Few seeds are needed to ensure establishment objectives
	Stock can be propagated any time when seed is available
	Shorter period of competition control needed in many cases
Disadvantages	*Disadvantages*
Unreliable establishment requires large seed supplies	Expensive (up to $10K/acre)
Not as useful for rare species	Introduce only one species at a time
Special care needed to create seed mixes	Available stock may be limited by the need for hand-collecting seed and size of nursery
Seeding rates difficult to determine to ensure outcome	Germination and initial establishment in greenhouse conditions may favor genotypes less suitable for future establishment in field conditions
Competition control essential	

(Walker & Silletti 2006)

Planting Live Material

- Target density for most species is ~3 plants/m^2
- Can be planted by hand or with mechanical tree planter equipment

Planting Seed Material

- Need good seed to soil contact
- Plant no more than ¼ inch deep
- Seeding Methods
  - Seed Drills
    - Grasslander is used for seed collected with seed stripper (Bulk Seed)
    - Tru-Ax drill is used with clean seed (Pure Live Seed)
  - Broadcast seeding
    - Disked sites must be compacted prior to and following seeding
    - Use a carrier

Seeding/Planting Rates

- Widely variable among restoration practitioners
- Seed sowing rates
  - Seed drill: 15-60 PLS seeds/ ft^2
  - Broadcast: 10-20 lbs bulk seed/acre
- Plug planting density
  - Varies by species
  - Wiregrass: 2000-4000 plugs/acre

Monitoring the Site

•Monitoring is essential to determining the success of a restoration project

•Photomonitoring can be used to measure qualitative change from year to year

•Vegetation monitoring can be used to measure vegetation change over time

Restoration Scenarios

Old field site

•Current Conditions: little to no existing desired understory, no canopy

•Goal: establish understory in order to reintroduce fire for site management; establish longleaf canopy

•Site Prep: multiple chemical treatments; disk & cultipack prior to seeding

•Understory Treatment: sow basic seed mix using grain drill

•Management: spot chemical treatment; fire

Old Field Seed Mix

Native Warm Season Grasses

- Big Bluestem (*Andropogon gerardii*) 1.5 lbs/ac
- Indiangrass (*Sorghastrum nutans*) 1.5 lbs/ac
- Little Bluestem (*Schizachyrium scoparium*) 1.5 lbs/ac

Forbs

- Partridge Pea (*Chamaecrista fasciculata*) 0.25lb/ac
- Native Lespedeza (*Lespedeza* spp.) 1.0 lb/ac
- Florida Ticktrefoil(*Desmodium floridanum*) 1.0 lb/ac

Plantation Site

•Current Conditions: 18 year old longleaf plantation recently thinned; widely scattered native understory present; no invasives present

•Goal: manage site for timber and wildlife; enhance existing understory and supplement with desirable species

•Site Prep: prescribed burn prior to planting seed

•Understory Treatment: sow understory species with seed drill

•Management: fire

Plantation Site Seed Mix

Grasses	Rate (lb/ac)
Little Bluestem	1.5
Splitbeard Bluestem	1.15
Lopsided Indiangrass	.5
Sporobolus junceus	.25
Muhly Grass	.50
Toothache Grass	.25
Wiregrass	.10
Fall Panicum	.25
TOTAL	**4.5 lbs/ac**

Forbs	Rate (lb/ac)
Partridge Pea	1.5
Florida Ticktrefoil	1.15
Sensitive Brier	.5
Spurred Butterflypea	.25
Spiked Blazingstar	.50
Lespedeza sp.	.25
TOTAL	**1lb/ac**

Forested Site

•Current Conditions: Mature longleaf forest with altered fire regime; thick midstory of hardwoods; understory impacted by shade

•Goals: Restore regular fire regime; enhance wildlife populations, enhance plant diversity

•Site Prep: Burn if possible; alternatively use mechanical and/or chemical treatments to remove midstory; follow with regular fire.

•Understory Treatment: Supplemental planting not necessary if understory rebounds; augment site with rare species or wiregrass if desired

•Management: Use prescribed fire at 2-5 year intervals

Forested Site Enhancement

- Regular burns will continue to enhance understory diversity
- Wiregrass seed planted with seed drill in open forest patches (.5 lb/ac)

Resources

Seed Sources:

- Roundstone Native Seed – www.roundstoneseed.com
- Ernst Conservation Seed – www.ernstseed.com
- Lolly Creek – www.lollycreek.com
- Southern Habitats – www.southernhabitats.com
- The Natives – www.thenatives.net
- State Nurseries

Technical Advice:

- The Longleaf Alliance – www.longleafalliance.org
- J.W. Jones Ecological Research Center – www.jonesctr.org
- State Agencies (Forestry Commission, DNR, Wildlife Resource Commission, etc…)
- Southern Native Plant Restoration and Seed Increase Project – www.snprsip.com

Manuals & Other Publications

- Groundcover restoration in forests of the Southeastern United States. CREOR Research Report 2009-01.
- Groundcover Restoration Implementation Guidebook. Florida Fish & Wildlife Conservation Commission.
- Walker, J.L and A.M. Silletti. 2006. Restoring the Ground Layer of Longleaf Pine Ecosystems. In S. Jose, E.J. Jokela, and D.L Miller (Eds) The Longleaf Pine Ecosystem - Ecology, Silviculture, and Resoration (pp. 297-325). New York, NY: Springer Science+Business Media.
- Norden, H. and K. Kirkman. Field Guide to Common Legume Species of the Longleaf Pine Ecosystem.
- Kaiser, M.J. and L.K. Kirkman. Field and Restoration Guide to Common Native Warm-Season Grasses of the Longleaf Pine Ecosystem.