Florida's Forest Stewardship Program, Alachua Conservation Trust & the Suwannee Chapter, Florida Society of American Foresters

Present a Workshop:

Longleaf Pine Restoration and Management

December 8, 2015; 9:00 am – 3:00 pm ET
Prairie Creek Lodge, Alachua County
7204 SE County Road 234, Gainesville, FL 32641
(location details on back)

Longleaf pine has many favorable characteristics for long-term, multiple-use land management objectives. Longleaf pine yields a large proportion of high value solid wood products, is adapted to fire and can be resistant to several insects and diseases. This workshop will explore the role of biomass chipping in longleaf restoration projects, longleaf forest management, and available assistance programs.

Agenda:

9:00 am	**Sign-in, meet & greet, coffee**
9:30	**Welcome and Introduction,** Ivor Kincaid, Alachua Conservation Trust
10:00	**Field stop #1 – The beginning of restoration: site preparation, demonstration of biomass harvest option**
10:45	**Field stop #2 – A planted longleaf pine restoration five years later**
11:45	**Lunch -**Thanks Sponsors!
12:45 pm	**Introduction to the Longleaf Pine Ecosystem**, Ad Platt, The Longleaf Alliance
1:10	**Establishing Longleaf Pine - Start with Site Preparation**, Ad Platt
2:00	**Break**
2:15	**Planting Longleaf Pines**, Dave Conser, Florida Forest Service
2:45	**Managing Longleaf Pine Forests and Available Assistance**, Joe Vaughn, Florida Fish and Wildlife Conservation Commission
3:30	**Evaluation, adjourn**

Foresters, this workshop is **approved for 4 Category 1 CFEs**.

Funding for Florida's Forest Stewardship Program is provided by the USDA Forest Service through the Florida Department of Agriculture and Consumer Services Florida Forest Service and the Florida Sustainable Forestry Initiative Implementation Committee.

Table of Contents

Resource Contacts

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Jib Davidson Forester Columbia Timber & Environmental Services, United Country 4424 NW 13th St, Suite C-2 Gainesville, FL 32609 (352) 375-1473 jib@columbiatimber.com	**Ivor Kincaid** Land Manager Alachua Conservation Trust 7204 SE County Road 234 Gainesville, FL 32641 (352) 373-1078 act.landmanager@gmail.com	**Barton Wilder** Extension Agent UF/IFAS Alachua County Extension 2800 NE 39 Ave Gainesville, FL 32609 (352) 955-2402 bwilder@ufl.edu

Questions about this or other Forest Stewardship Program activities can be directed to Chris Demers at (352) 846-2375 or by email at cdemers@ufl.edu. For more information and events see the UF Forest Stewardship web site at:

http://www.sfrc.ufl.edu/forest_stewardship

Florida's Forest Stewardship Program

Forest Stewardship is active management of forests and related resources to keep these lands in a productive and healthy condition for present and future generations, and to increase the economic, environmental and social benefits of these lands. Forest Stewards are landowners who manage their forestlands on a long-term basis by following a multiple resource management plan.

The Forest Stewardship Program addresses the improvement and maintenance of timber, wildlife, soil and water, recreation, aesthetics, as well as forage resources.

Eligibility

Private forest landowners with at least 20 acres of forest land and have a desire to manage their ownerships according to Stewardship principles can participate in the Forest Stewardship Program. Also, adjacent landowners, with similar management objectives, may combine their holdings to meet this acreage limitation.

Benefits to Landowners

- A customized management plan that is based on the landowner's objectives. The plan will include forest stand characteristics, property maps, management recommendations, and a five-year time line for future planning. This plan also serves as documentation of active management on the property that may help reduce tax liability.
- An opportunity for future public recognition as a certified "Forest Steward".
- Educational workshops, tours and a quarterly Stewardship newsletter developed and distributed by the University of Florida, IFAS Cooperative Extension Service.

Getting into the Program

Contact your local Florida Forest Service County Forester and tell them that you would like to have a Forest Stewardship Plan prepared for your property. More information and application here:

http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/For-Landowners/Programs/Forest-Stewardship-Program

Tree Farm Program

The American Tree Farm System® is a program of the American Forest Foundation and was founded in 1941 to promote the sustainable management of forests through education and outreach to family forest landowners. Nearly 26 million acres of privately owned forestland and 80,000 family forest landowners in 46 states are enrolled in this program and committed to excellence in forest stewardship. About half of all Tree Farms are located in the South.

Eligibility

Private forest landowners with at least 10 acres of forest land and have a desire to manage their ownerships according to sustainable forestry guidelines can participate in Tree Farm.

Benefits to Landowners

Tree Farmers are good stewards of their forestland committed to protecting watersheds and wildlife habitat and conserving soil. They manage their forestland for various reasons, including timber production, wildlife, recreation, aesthetics, and education/outreach. Tree Farmers receive many benefits:

- Representation on local, state, and federal issues affecting forestland owners.
- Exposure to a network of forestry professionals and landowners committed to sustainable forestry.
- Access to seminars, field days, and workshops to help manage their Tree Farm even better.
- Certification that meets international standards of sustainable forest management.
- Participation in local, state, regional, and national Outstanding Tree Farmer of the Year awards and recognition.

Getting into the Program

Contact your local Florida Forest Service County Forester and tell them that you would like to join the Tree Farm program. More information here:

https://www.treefarmsystem.org/florida

Florida Forest Service
Silviculture Best Management Practices

Silviculture Best Management Practices (BMPs)

Silviculture BMPs are the minimum standards necessary to protect our state's waterbodies and wetlands from degradation and sedimentation that can sometimes occur because of erosion from forestry operations. Silviculture BMPs should be applied on all bonafide ongoing forestry operations, especially those adjacent to waterbodies and wetlands, and may be enforced by federal, state and local authorities.

Silviculture BMP Courtesy Checks

Silviculture BMP courtesy checks are available for landowners, land managers, and loggers. These courtesy checks provide a "report card" on Silviculture BMP implementation for recent or ongoing forestry operations. This helps future management planning and evaluates the performance of contractors on your property.

Silviculture BMP Site Assessments

On-the-ground Silviculture BMP site assessments are available to determine which Silviculture BMPs apply to planned operations on a specific site. This helps with harvest plan development, road layout, mitigation of existing problem areas, etc.

Silviculture BMP Notice of Intent

The Silviculture BMP Notice of Intent (Rule 5I-6 F.A.C.) is a voluntary, one-time pledge that a landowner signs, indicating intent to adhere to Silviculture BMPs on their property. Once a landowner has signed the Notice of Intent, he or she will become eligible to receive a *presumption of compliance* based on reasonable evidence with state water quality standards during future ongoing forestry operations. This is very important if a landowner's property falls within an area covered by a Florida Department of Environmental Protection Basin Management Action Plan for impaired waters.

Additional Services

For information on the services listed above or any other services provided by the Florida Forest Service's hydrology section, please contact your local BMP Forester.

Roy Lima
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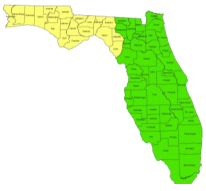
(850) 681-5942



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Florida Department of Agriculture and Consumer Services
Adam H. Putnam, Commissioner

Forestry
Wildlife Best Management Practices for State Imperiled Species

- Forestry Wildlife Best Management Practices for State Imperiled Species (WBMPs) were adopted into Florida Administrative Code (Rule 5I-8) on October 21, 2014.
- WBMPs were developed through a partnership between the Florida Department of Agriculture and Consumer Services' Florida Forest Service and the Florida Fish and Wildlife Conservation Commission (FWC).
- WBMPs are **voluntary** practices designed as a practical approach for avoiding and minimizing the loss of **State Imperiled Species** due to silviculture operations.
- WBMP practices address the 16 State Imperiled Species which are considered to be potentially vulnerable to silviculture operations including ten aquatic species, two burrowing animals, and four nesting birds.
- WBMPs are designed to supplement the existing water quality-based Silviculture BMPs which already provide many valuable benefits to the conservation and management of fish and wildlife in Florida.
- Landowners and other forestry resource professionals can enroll in the voluntary program by completing a WBMP Notice of Intent. Those who do not wish to enroll will continue to be subject to all current laws and regulations regarding State Imperiled Species.
- Once enrolled, applicants who **properly implement** WBMPs will no longer be required to obtain a permit authorizing the incidental take of State Imperiled Species during bonafide ongoing forestry operations. In addition, they will not be subject to any fines or penalties associated with an incidental take of the State Imperiled Species covered by the WBMP Manual.
- WBMPs are not designed to facilitate wildlife habitat restoration or species recovery and expansion. Also, they do not address any Federally Listed Species. For information on Federally Listed Species, refer to FWC's online "Florida Wildlife Conservation Guide."
- To obtain more information or a copy of the WBMP Manual and Notice of Intent, contact your local Florida Forest Service BMP forester (see below) or a FWC Landowner Assistance Program biologist (850) 488-3831.

<u>Florida Forest Service BMP Foresters</u>

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Got Invasives?

Invasive exotic plant problem? Find a program to help by using FloridaInvasives.org.

The Florida Invasive Species Partnership has collected, evaluated and categorized assistance programs into a single resource, making it easier to find the financial and/or technical assistance available to Florida landowners to prevent or control invasive exotic species problems. FloridaInvasives.org has an online resource of management assistance programs to help in your fight against problematic plant species. This resource takes the guesswork out of finding the agencies or organizations offering assistance and will direct you to available programs. The Landowner's Incentives Database will also provide the requirements for each program, to help you decide if they are a good match for your needs.

Why was FloridaInvasives.org developed?

Invasive species have been identified as being costly ecologically and economically statewide in Florida. The Florida Invasive Species Partnership (FISP) is a collaboration of public and private entities in Florida, formed to link efforts at preventing and controlling invasive exotic plants across agency and property boundaries. FISP has developed an on-line tool of available financial and technical assistance sources to make it easier for landowners and land managers to find them.

How does FloridaInvasives.org help you?

FISP has created a searchable database, the Florida landowner incentives database, accessible at FloridaInvasives.org that allows you to find an assistance program for your needs. Search by your county, target species or other pertinent information into the online tool, and you will retrieve a current list of available programs. Floridainvasives.org will help provide focus to your search so that you can get the right person at the right program.

FloridaInvasives.org:

- Builds community awareness,
- Leverages limited resources through cooperation and
- May reduce individual land management costs.

This resource will be regularly updated with the most current program information to provide you the most up-to-date opportunities.

Go to FloridaInvasives.org to find out more.

Species Shown from top to bottom:
Mexican Petunia, Boston Fern, Mimosa, Cogongrass, Camphor

FISP
Florida Invasive Species Partnership

Think Locally, Act Neighborly

invasive species know no boundaries!

FLORIDA FOREST SERVICE LANDOWNER PROGRAMS

Rural and Family Lands Protection Program
http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/For-Landowners/Programs/Rural-and-Family-Lands-Protection-Program

The Rural and Family Lands Protection Program is an agricultural land preservation program designed to protect important agricultural lands through the acquisition of permanent agricultural land conservation easements. The program is designed to meet three needs:

1. Protect valuable agricultural lands.
2. Create easement documents that work together with agricultural production to ensure sustainable agricultural practices and reasonable protection of the environment without interfering with agricultural operations in such a way that could put the continued economic viability of these operations at risk.
3. Protect natural resources, not as the primary purpose, but in conjunction with the economically viable agricultural operations.

Cogongrass Treatment Program
http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/For-Landowners/Programs/Cogongrass-Treatment-Cost-Share-Program

This program is available in all counties in Florida. It offers reimbursement of 50% of the cost to treat Cogongrass infestations with herbicide for two consecutive years, up to a maximum of $100 per year for treatment of up to one acre, and $75/acre per year for any additional area. Qualified applicants may apply to treat up to a maximum of 133 acres of infested area. Applications to begin treatments in **2016** will be accepted from **October 15, 2015 through February 29, 2016.**

Southern Pine Beetle Prevention Program
http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/For-Landowners/Programs/Southern-Pine-Beetle-Prevention

The program offers partial cost reimbursement or incentive payments for:

- first pulpwood thinning
- prescribed burning
- planting longleaf and/or slash pine
- mechanical underbrush treatments

There is 10 acres minimum per practice and up two practices can be completed up to $10,000.

Longleaf Pine Private Landowner Incentive Program (Ocala)
http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/For-Landowners/Programs/Longleaf-Pine-Private-Landowner-Incentive-Program

The program offers incentive payments for:

- Longleaf pine seedling establishment
- Timber Stand Improvement
- Prescribed burning
- Native plant understory establishment
- Mechanical underbrush treatments
- Invasive exotic plant treatment

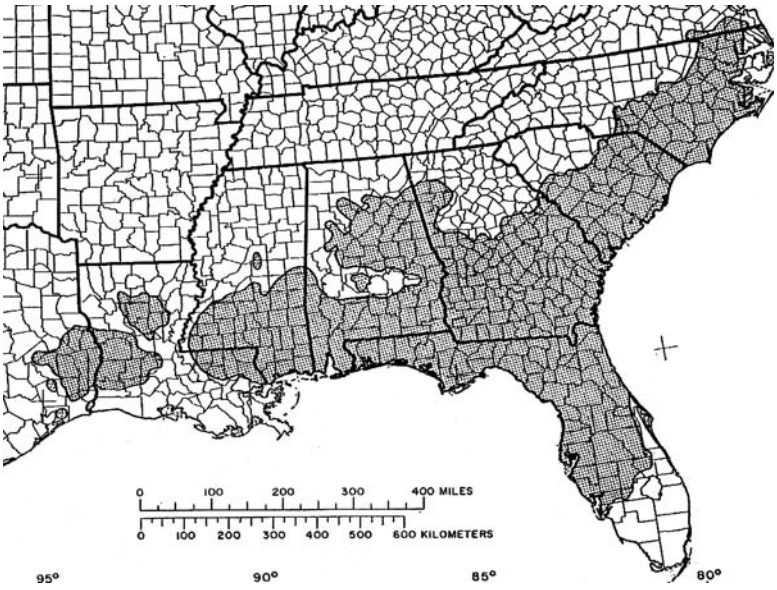
Qualified landowners may apply for up to four approved practices per year. The minimum tract size requirement is 10 acres, and funding requests may not exceed $10,000.

Forest Stewardship Program
http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/For-Landowners/Programs/Forest-Stewardship-Program

The Florida Forest Stewardship Program is designed to encourage the state's private non-industrial forest landowners to practice stewardship. Specifically, the program objectives are as follows:

- Encourage non-industrial landowners to manage their properties according to the multiple-use concept.
- Increase awareness among the general public of the important amenities that Florida's forestlands, particularly non-industrial private forestlands, provide to all citizens of the state.
- Improve coordination among natural resource agencies and groups, both public and private, to better serve the state's landowners and achieve common goals.

This program will provide a landowner that owns 20 or more forested acres a Forest Management Plan. This plan will assist them in reaching their land management goals.



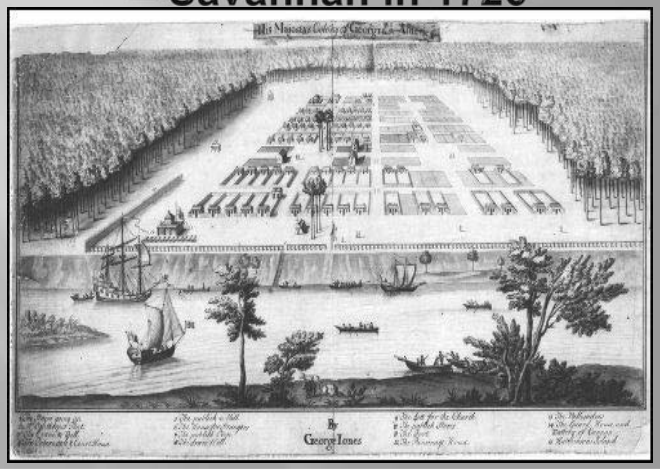
The First 400 years

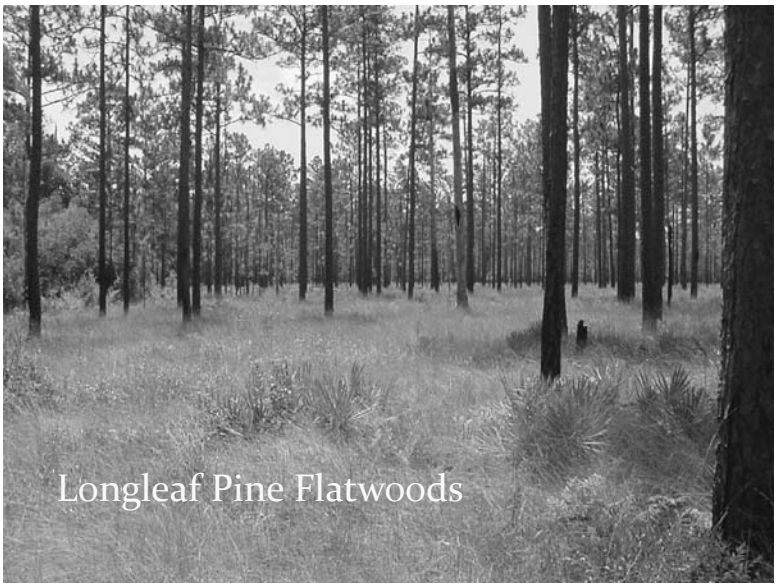
- **Longleaf occurred on an estimated 90 million acres at its peak, dominating on an estimated 60 million acres, probably the largest area on the continent dominated by a single tree species.**
- **By the mid-1900's, over half of that forest was gone.**
- **By 1995, an estimated 2.95 million acres remained, most of it in poor condition.**

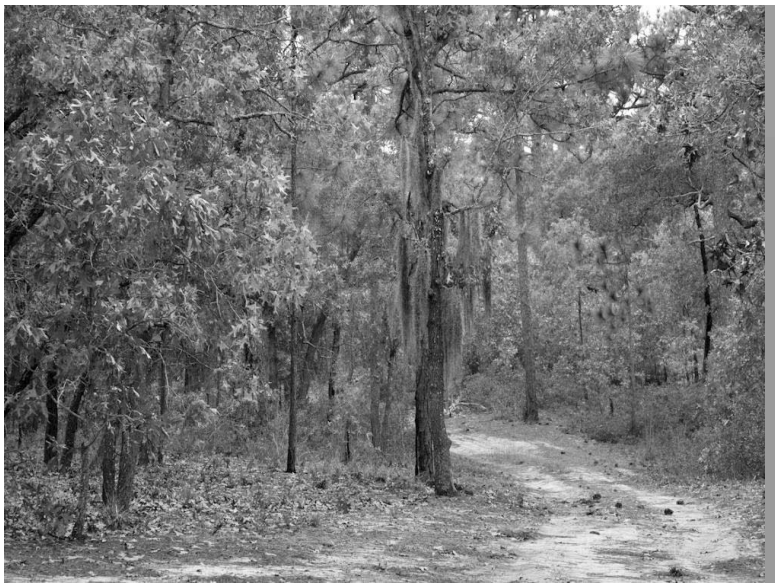
LONGLEAF

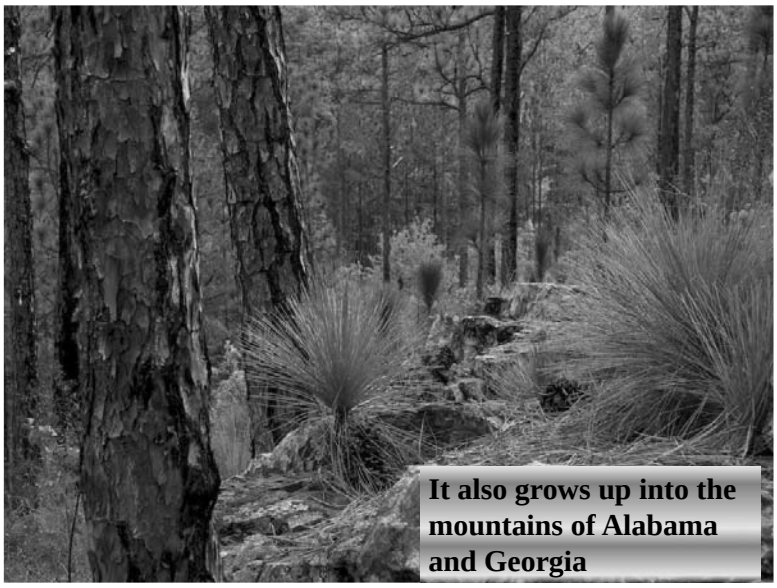
the forest that fire built

The Longleaf Forest as a Barrier – Savannah in 1726









Old Growth Remaining

- Of the original over 90 million acres of longleaf pine, now only 8,777 acres of old growth longleaf pine forest tracts remain.
- 56%, or 4,942 acres, can be found on Eglin Air Force Base, Florida.
- Another almost one third is found on various privately owned forests in Southeast and Southwest Georgia.

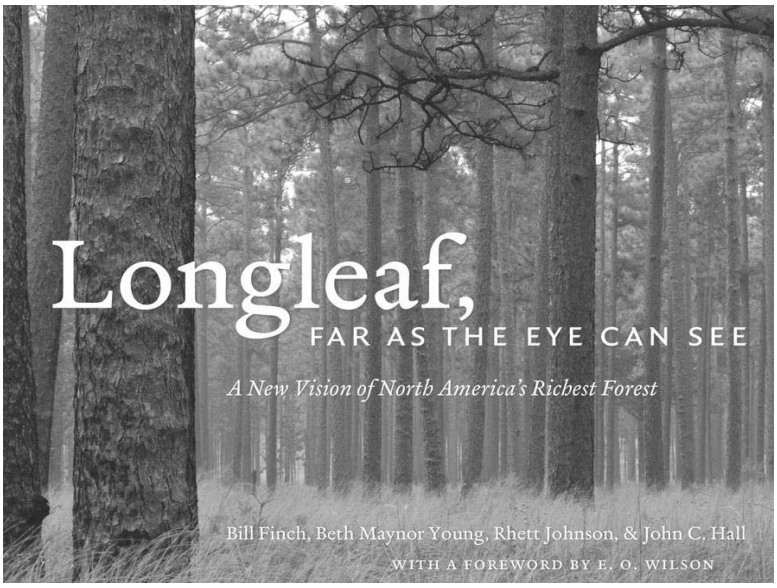
(Source: *The Fire Forest, Longleaf Pine-Wiregrass Ecosystem*, Georgia Wildlife Federation)

In 1995, The Longleaf Alliance was formed to be an advocate for longleaf retention and restoration, focusing on its ecological and economic values

Est. 1995
The Longleaf Alliance

The Longleaf Alliance

- The mission of The Longleaf Alliance is to ensure a ***sustainable future*** for the longleaf pine ecosystem through ***partnerships***, ***landowner assistance*** and ***science-based education*** and ***outreach***.



Academies provide the foundation, using a variety of teaching methods for best effect; classroom and field, solo and team

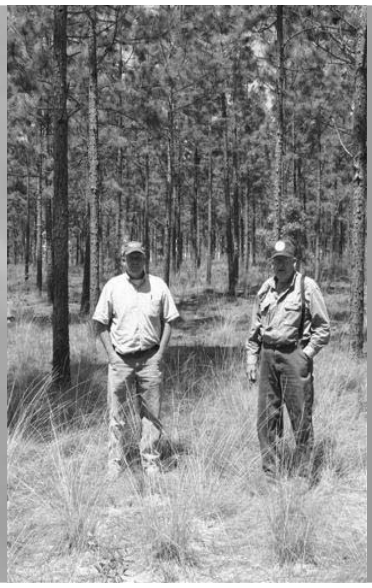
Natural regeneration success

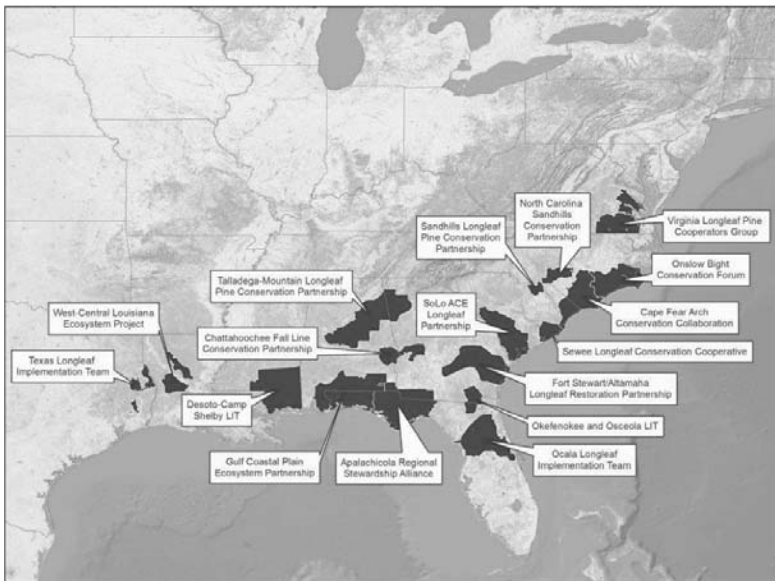
Seedling quality, and Planting for success

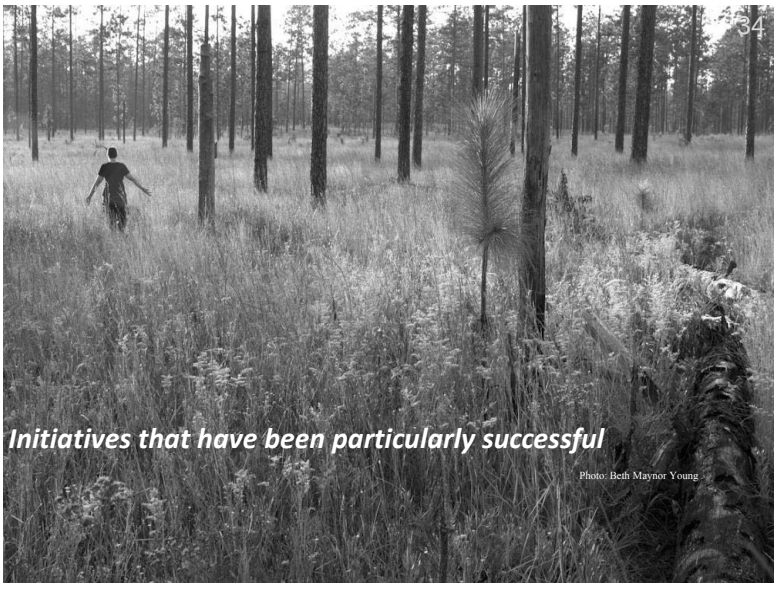
Hundreds of Field Days and Workshops

Longleaf at two & three years old

Fourteen year old Longleaf planted on an old field, burned regularly, thinned once with understory planting





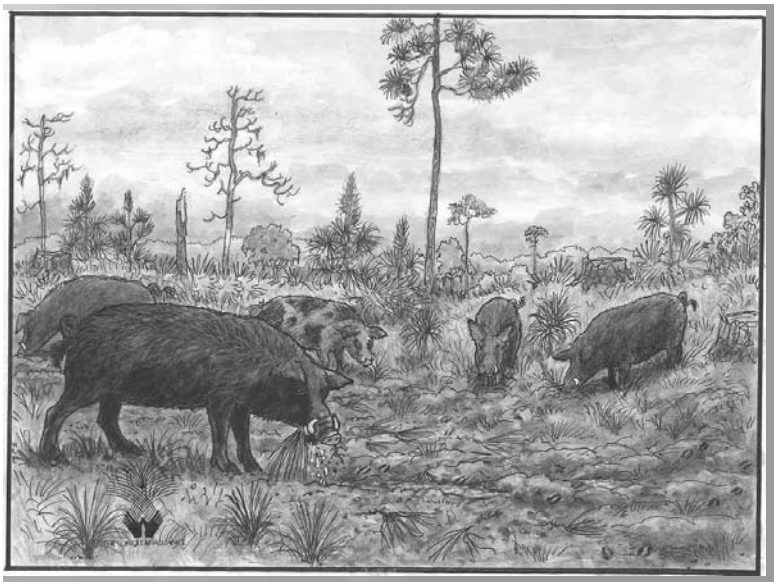


Initiatives that have been particularly successful

Photo: Beth Maynor Young

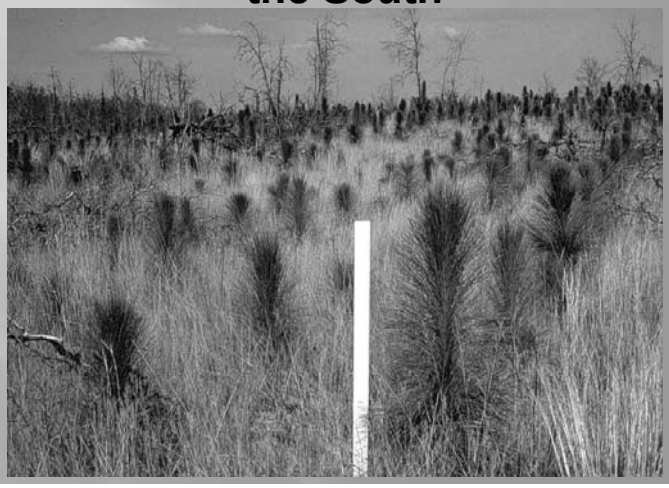
Advance Planning
Backup Plans
Day of Burn… and Followup

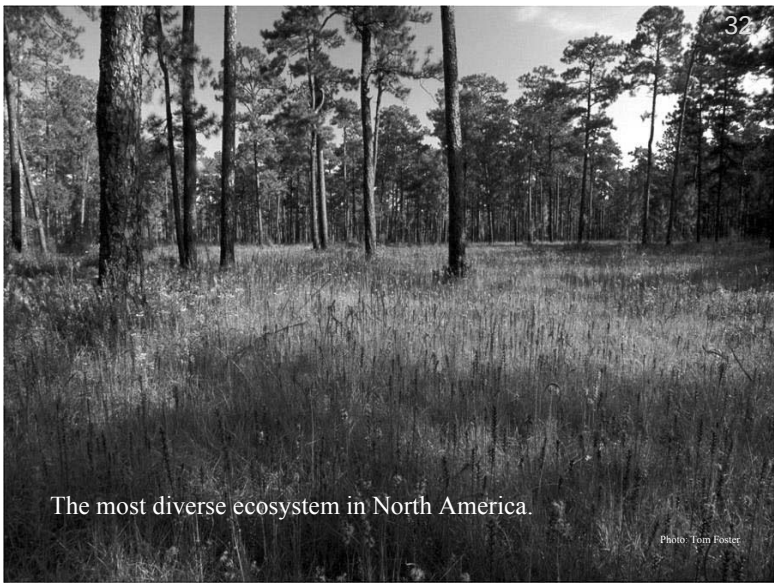
- Fire type (crown, surface, ground)
- Fire return interval (frequency)
- Fire behavior (intensity)
- Burn severity (effects on vegetation)
- Timing (seasonality)
- Size and pattern (shape and patchiness)



Rediscovering the beauty and strength of longleaf

Becoming a common sight across the South





Improved habitats can allow rare species to again become common

Many organizations, making progress

- In the past 19 years, we have grown and sold 1.46 billion longleaf seedlings, enough to have planted an estimated
- 2.47 million acres. If we conservatively assume that only 75% of those plantings were successful, we still should have established about 1.85 million new acres of longleaf. The latest estimate of longleaf acreage across the range is about 4.7 million acres, a net increase of an estimated 1.8 million acres.

SAVE THE DATE

11th Biennial Longleaf Conference

November 1-4, 2016

Savannah Marriott Riverfront
Savannah, GA

Longleaf Pine: Quality Timber You Can Enjoy Every Day

Questions?
Ad Platt (850) 982-8480
Ad@longleafalliance.org

Establishing Longleaf Pine

Site Preparation

Ad Platt
The Longleaf Alliance
Ad@longleafalliance.org

Management Objectives

- **Good Survival & Growth**
- **Aesthetics**
- **Risk Reduction**
- **Restore Native Plants & Animals**
- **Recreation**
- **A profitable forest that I can also enjoy every day**

It is a Longleaf Site if:

- **In general, within or close to longleaf's natural range**
- **Longleaf will survive and grow well once established**

- **OK, it is a "longleaf site";**

does longleaf meet the landowner's objectives?

Can I manage this long-term as a forest?

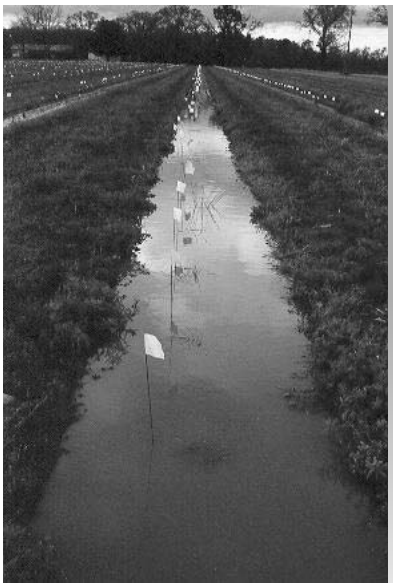
Soils

- **Clays**
  - **Longleaf is tolerant of very heavy soils**
    - **Reduced incidence of little-leaf disease**
    - **Gulf States / Westervelt plantings on clay soils**
- **Loams**
  - **Better the soil, the faster longleaf grows**
- **Sands**
  - **Longleaf is tolerant of well-drained soils**
    - **More volume as compared to other southern pine**
  - **Occasionally, some sands are too poor for longleaf**
    - **Some Lakeland sands in Florida**

Prairie/Blackbelt Type Soils

Is the Site Appropriate?

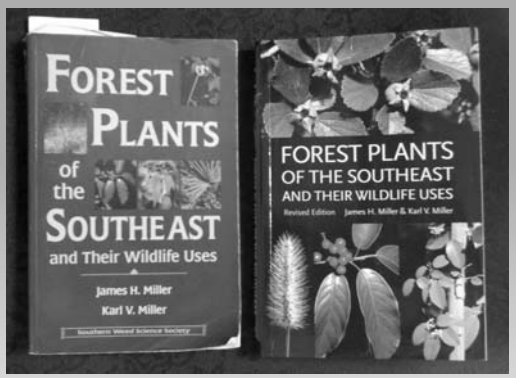
- **Avoid high pH soils (>7.0)**
  - Blackbelt/Prairie soils
  - Heavily limed soils (used in tomato production)
- **Test soil nutrients**
  - Excessive chicken litter applications may lead to toxic concentrations of some nutrients
- **Avoid the wettest soils**
  - Sites that have standing water for weeks at a time
  - Pelhams, Gradys, etc.



Monroeville Demonstration Planting

Values of the Longleaf Forest are many!

Suggested Reading



Perennials Legumes used by Wildlife

Hairy Lespedeza

Lespedeza hirta

Low Bush Blueberry & Huckleberries are Accessible to Quail & Gopher Tortoises

Grasses are necessary for fuel – and susceptible to imazapyr

Protect your fuels

Fully address invasive species before site preparation.

Cogon grass = imazpyr

Climbing fern = glyphosate

Long Term Management Concerns

Site Preparation on Cutover Timberland

Contrasting chemical vs. mechanical methods

Fire Only – 2 Years old

Wider window for planting behind imazapyr site prep.

Better growth with herbicide site prep at 3 years old, but – where are the blueberries? Use objectives to drive methods!

Sprayed in summer 2011. Burned in fall. Planted in winter.

The developing stand, 11/2015

An Overlooked Treasure of the Longleaf Ecosystem –

The Heath Family (*Ericaceae*)

Blueberries = *Vacciniums*

Huckleberries = *Gaylusaccias*

Low Bush Blueberry & Huckleberries (*Gaylusacchia spp*.) are rhizomatous

Keep the Blueberries

Heavier soils & more sweetgum = imazapyr site prep treatments.

Thousands of offsite oaks (laurel & water) oak = broadcast site prep. recommendation.

Post oak

Scrub oaks are natural components of upland longleaf ecosystems: sand post, turkey, bluejack, sand live, etc.

Blackjack oaks

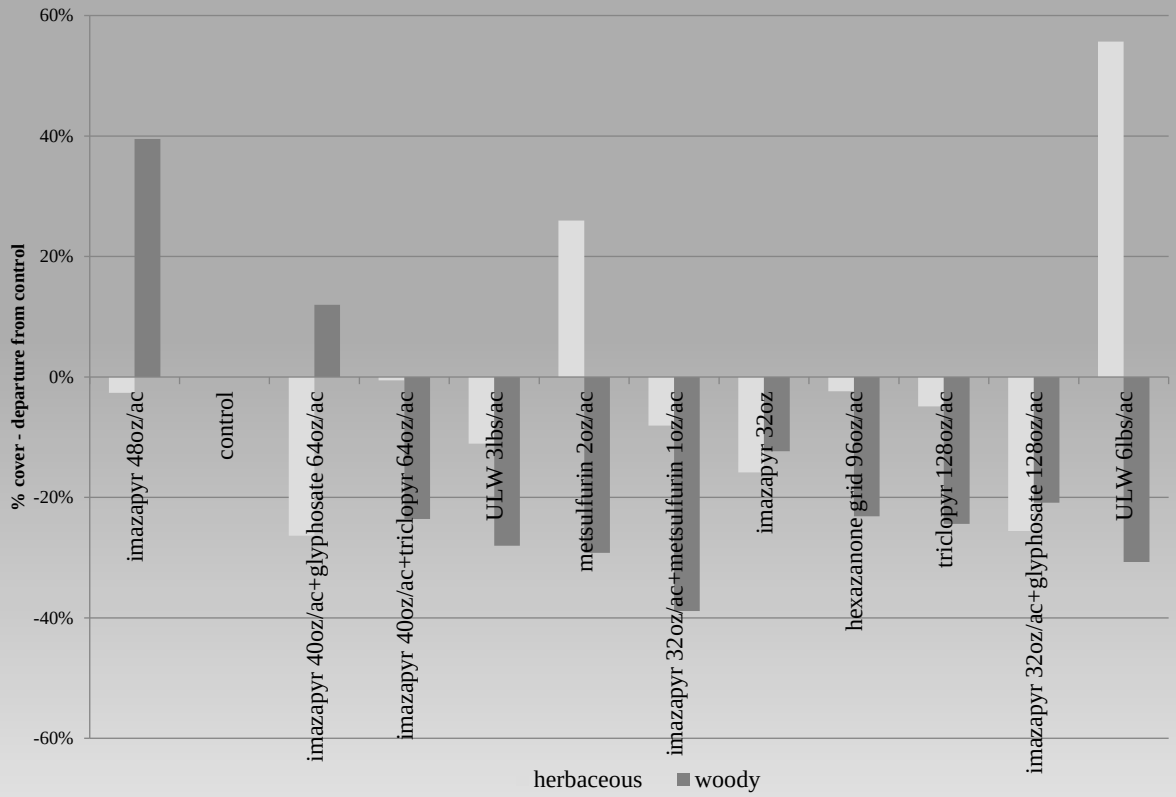
Callicarpa americana is tolerant of hexazinone (Velpar)

Flatwood sites are often dominated by waxy leaf species.

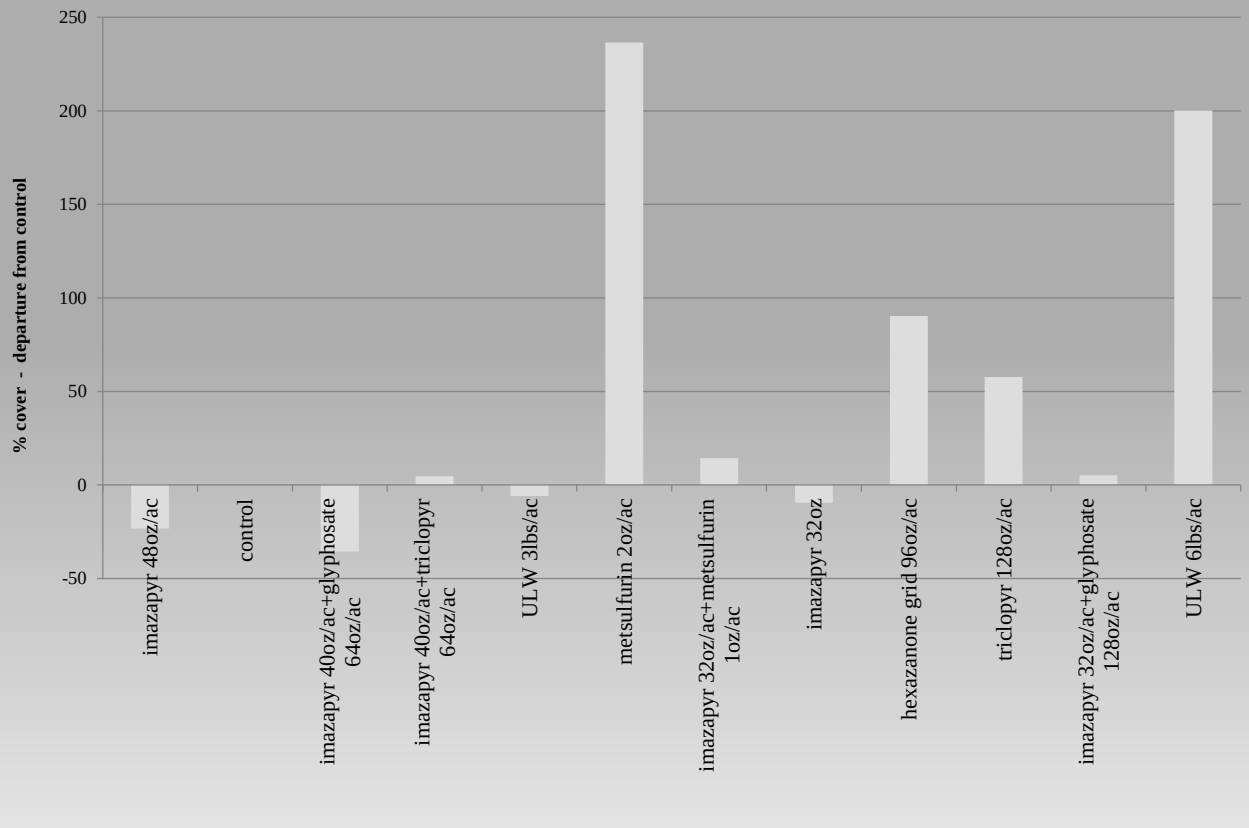
Waxy leaf species targeted with triclopyr (Garlon): Gallberry, tall gallberry, yaupon holly, etc.

GA DNR Site Prep Study @ Silver Lake:		Info from Nathan Klaus
Single Herbicide Treatments		
Herbicide	Rate	Common Brand names
mazapyr 2 pound active ingredient	32 ounces/ac	CHOPPER, Rotary 2SL etc.
mazapyr 2 pound active ingredient	48 ounces/ac	CHOPPER, Rotary 2SL etc.
Triclopyr 61.6% active	128 ounces/ac	Garlon 4
Metsulfuron Methyl 60% active	2 ounces/ac	Escort
ULW	3 Pounds/ac	ULW
Hexazinone 25% active	3.1 ml 5X5 grid	Velpar-L
ULW	6 Pounds/ac	ULW
Herbicide Tank Mixes		
Herbicide One	Rate	Herbicide Two
mazapyr 2 pound active ingredient	32 ounces/ac	Metsulfuron Methyl 60% active
mazapyr 2 pound active ingredient	40 ounces/ac	Triclopyr 61.6% active
mazapyr 2 pound active ingredient	32 ounces/ac	Glyphosate 41% active
mazapyr 2 pound active ingredient	40 ounces/ac	Glyphosate 41% active
Check Plot		

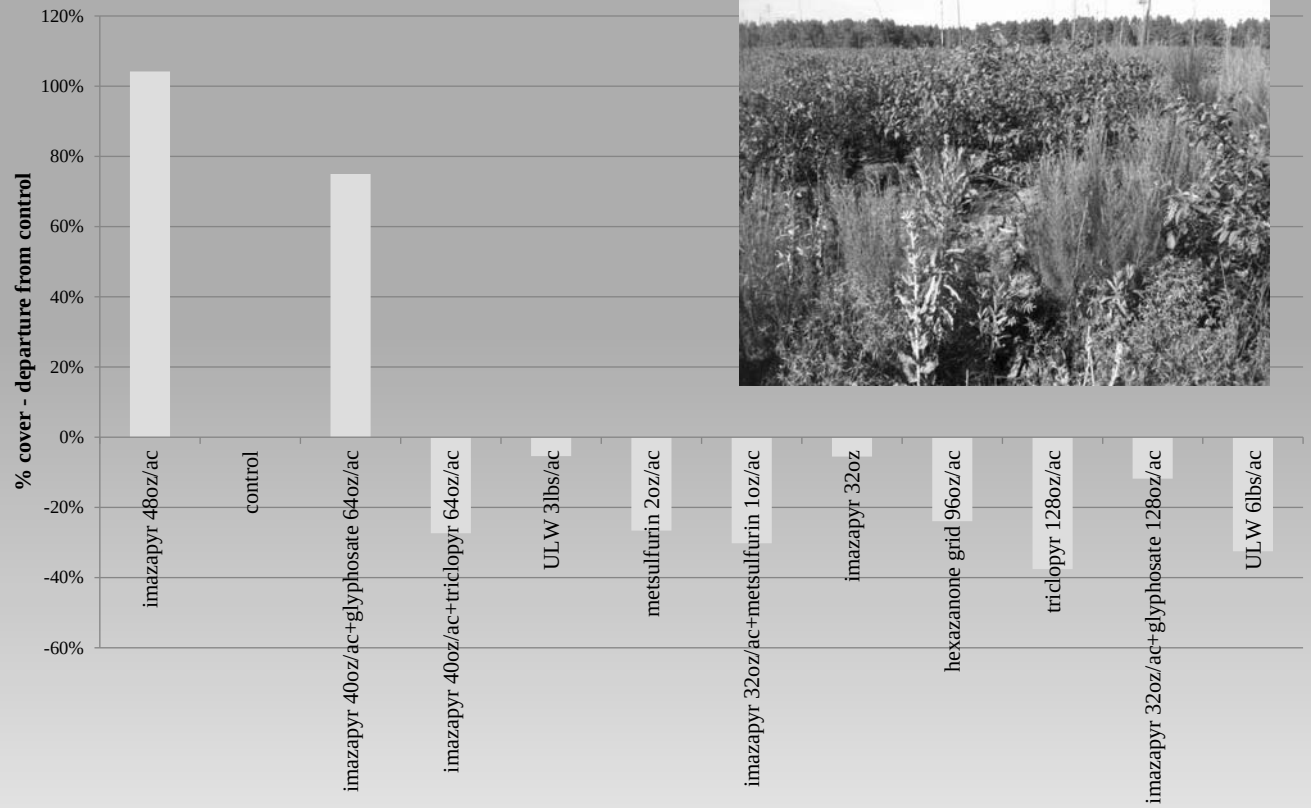
Change in woody and herbaceous cover



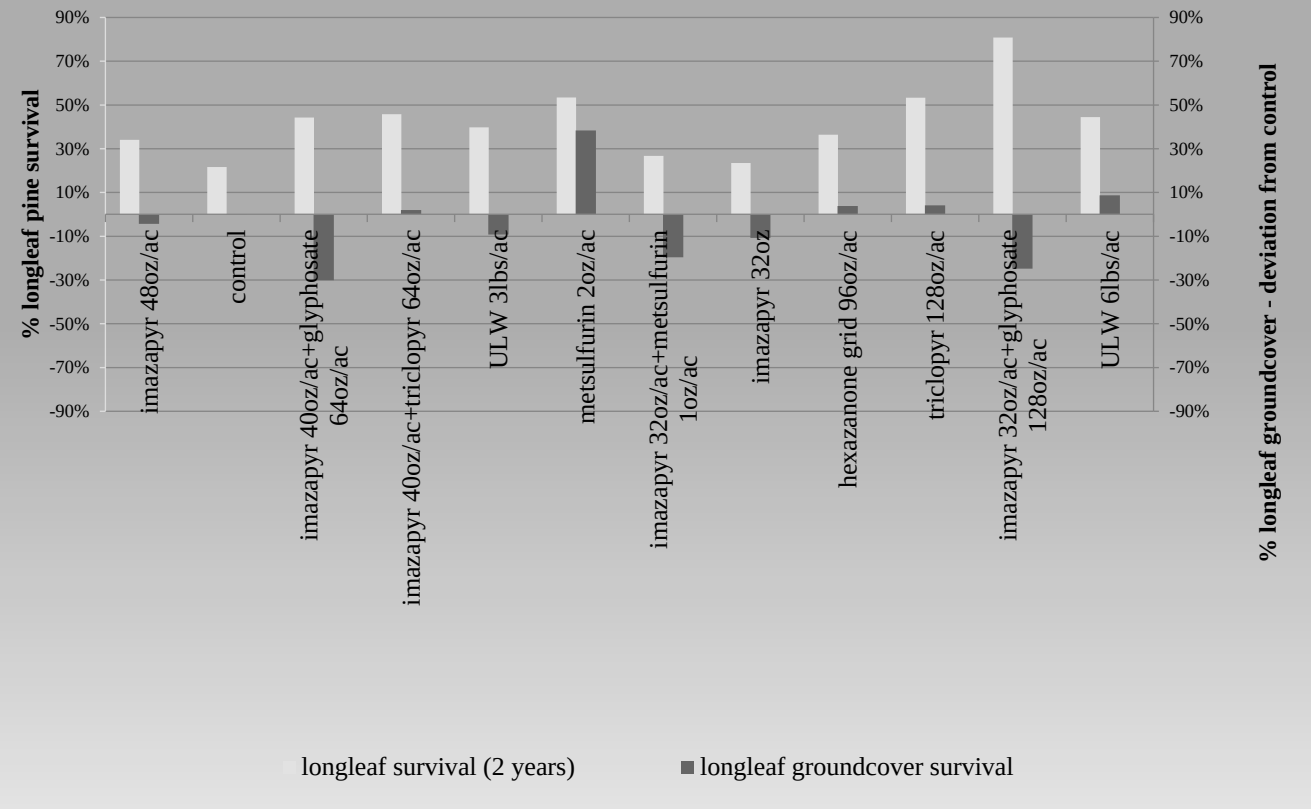
Change in grasses associated with longleaf pine



Change in weedy cover



Longleaf survival (2 years) and change in longleaf groundcover



Site Preparation and Herbaceous Release for Longleaf Establishment in Old Fields & Pastures

Bermuda = high rates imazapyr
(48 oz. Chopper Gen II)

Bahia = Escort (1.25 oz) or
high rates of glyphosate

Fescue = high rates of glyphosate

Consider including Escort for blackberry on pasture sites.
Ammonium sulfate aids uptake on grasses
Effective control depends on stage of grass and timing!

Address *Rubus* species during site preparation with Escort (metsulfuron).

Silvopasture Site (planted Dec 2000, picture July 2001)

Comparison of Site Preparation Methods and Herbaceous Releases for Longleaf Pine Establishment in an Old Pecan Orchard

Installed 1998

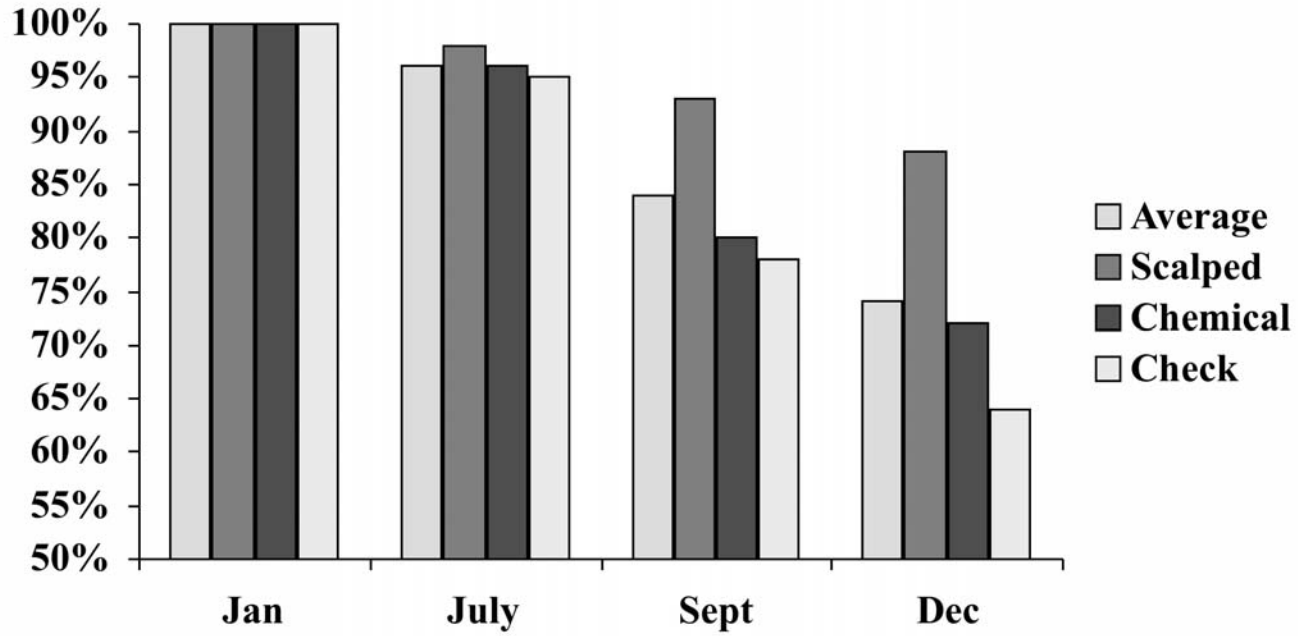
Study Site

- **Covington Cy, Alabama**
- **70 + y/o old pecan orchard till 1996**
- **Lower coastal plains soils (sandy loams)**
- **History of frequent liming and fertilization**
- **Full compliment of old-field broadleaves and grasses & very little woody competition**

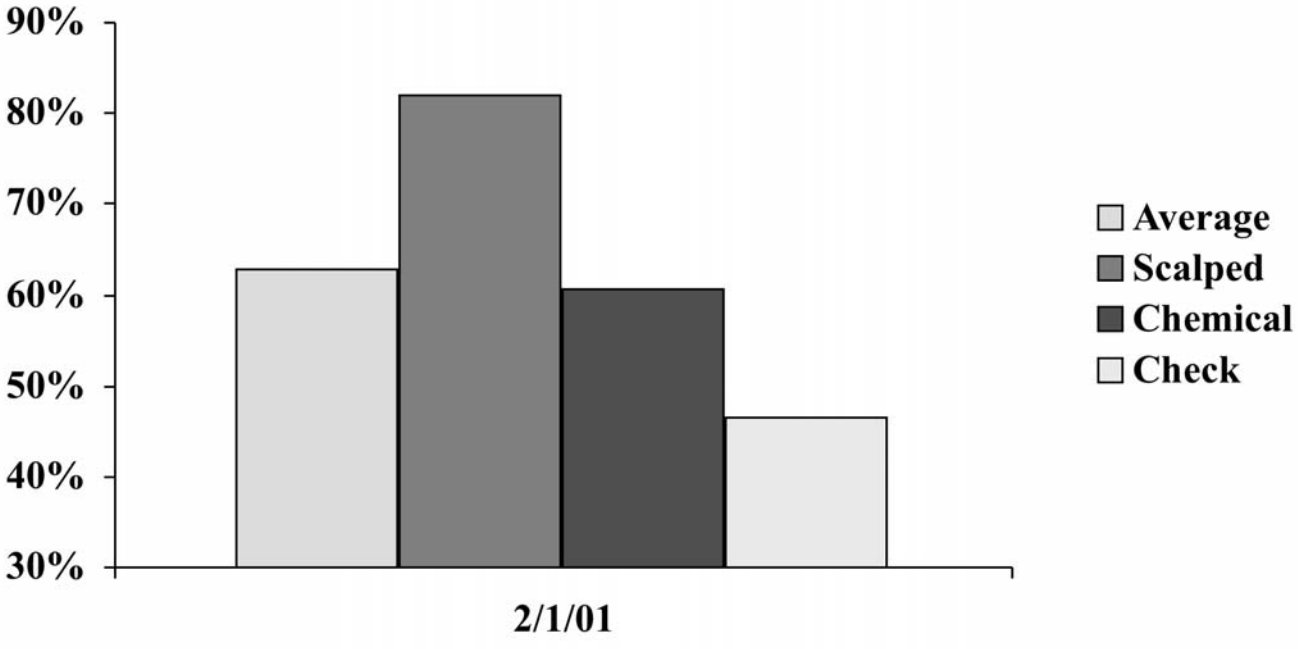
Site Preparation (Main Plot Treatment)

- **Scalping & Subsoiling**
- **Broadcast Chemical & Subsoiling**
- **Subsoiling Only**

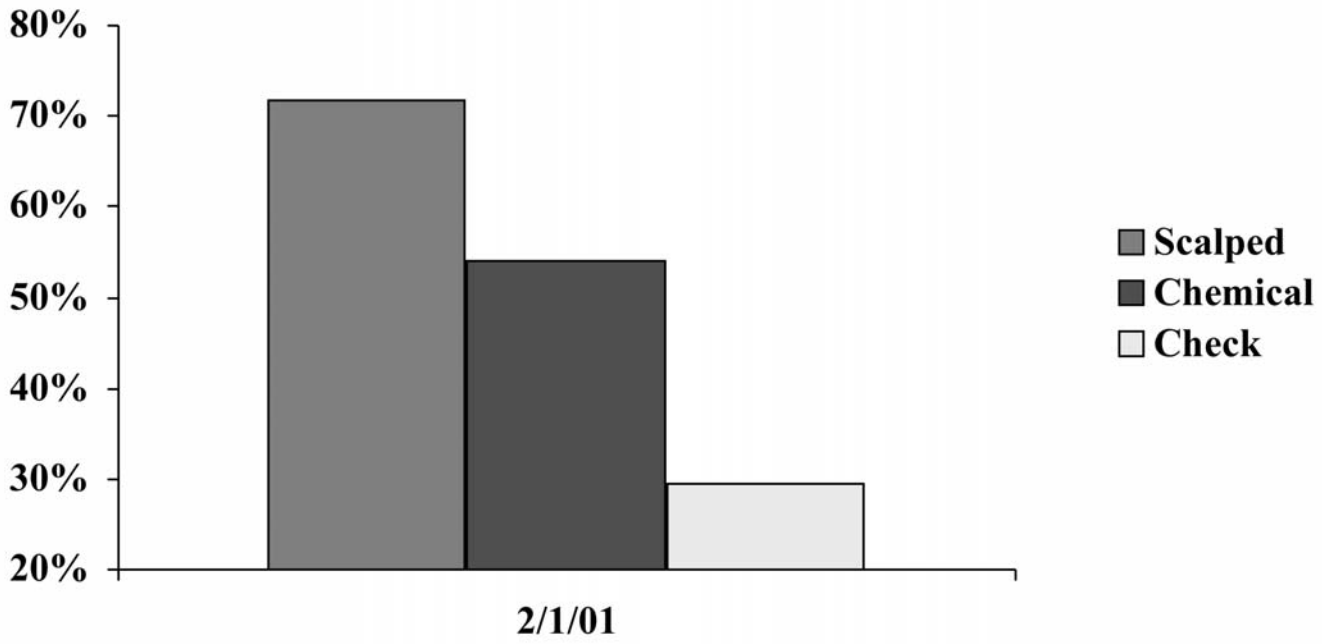
% Surviving by Site Prep (Age 1)



% Surviving by Site Prep (Age 2)



% Starting Hgt. Growth by Site Prep (Age 2)



What does it cost?

Total $$ for Site Prep, Plant, Seedlings & Herb. Release	Check (Rip Only)	Chemical Site Prep	Scalp Site Prep
$$ / Acre	$175.00	$245.00	$195.00
$$ / Surviving Seedling (Age 2)	$0.77	$0.86	$0.48
$$ / Seedling Starting Hgt. Growth (Age 2)	$3.48	$2.21	$0.78

Check SP, Velpar/Oust Tankmix Release Treatment

1 year post

1 ½ yrs post

Chemical SP, Velpar/Oust Tankmix Release Treatment

1 year post

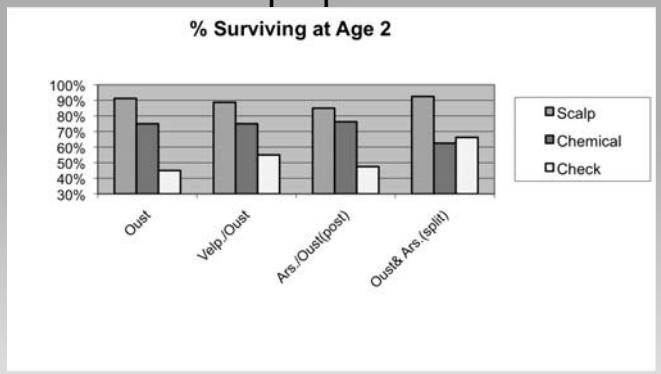
1 ½ yrs post

Scalp SP, Velpar/Oust Tankmix Release Treatment

1 year post

1 ½ yrs post

All herbaceous release treatments performed best following a scalping site preparation.



A Developing Silvopasture

Longleaf Pine: Quality Timber with Diverse Ecosystems

Questions?
Ad Platt (850) 982-8480
Ad@longleafalliance.org

Planting Longleaf Pine

Provided by Dave Conser, Florida Forest Service

The history of planting longleaf pine was marked by many years of planting failure. Therefore, in the past longleaf was set aside for other species. But now we know the keys to planting longleaf. We CAN successfully restore this wonderful species.

The introduction of containerized seedlings (tubelings) has improved planting survival success, over the use of bareroot seedlings.

Proper depth is the most critical element.

Longleaf has a stem! The admonition to "Bury the bud" got us in trouble. The bud needs to be at the ground line or a little above after soil settling. Soil settling may be settling in ("silting in") or the packing wheel soil bulge weathering down. Leave the top ½" to 1½" of the containerized plug exposed. Roots emanate from the bottom of the plug. The exposed plug will not wick out moisture and kill the seedling.

Check by digging around the seedling. Use visual cues – needles flattened upward into one plane indicates too deep, needles flopped downward indicates too shallow, needles at an upward angle of 30 to 45 degrees indicates proper depth.

Early planting

For containerized seedlings: November-December in North Central Florida. Possibly even into mid to late October. January might work, but is not ideal. Try hard to avoid February. Or rainy season planting: July – August (June if rainy, September is probably ok too, if good soil moisture.)

For bareroot seedlings: December – January in North Central Florida

Good quality seedlings

Containerized seedlings (tubelings) survive better than bareroot. There are better containerized seedlings than others. Check with your Natural Resource Professional for which nurseries grow the best seedlings. Larger bareroot seedlings, with a bigger taproot and more lateral roots, are better than smaller.

Correct Tree Planting Contractor. Check with your Natural Resource Professional.

Proper spacing / stocking (number per acre) is based on your objectives, expected mortality and seedling type

Plant more bareroot than containerized if you're going that route. They're cheaper so this is doable.

Reasons for expected mortality:

Rough site. Lots of debris.

Site is drier than desired due to lack of rainfall

Lots of expected herbaceous competition (former crop field, or pasture with dormant population of hairy indigo, or other legumes, or bedding mechanical site prep in the flatwoods. This assumes no herbaceous herbicide treatment.)

Less than ideal planting time

Planting bareroot rather than containerized

Less than ideal Tree Planting contractor (try to avoid this)

Clay at or near the soil surface – consider hand planting. The machine gums up with clay and plants poorly.

Spacings / Stocking Rates (considering objectives, expected mortality, type of seedling)

8’ x 12’	454/ac	Wildlife Primary Objective	No Survival Issues/Tubelings
6.5’ x 12’	558/ac	Wildlife	Survival Issues /Tubelings
6.5’ x 12’	558/ac	Wildlife	No Survival Issues/Bareroot
5’ x 12’	726/ac	Wildlife	Survival Issues/Bareroot
6’ x 12’	605/ac	Timber Primary Objective	No Survival Issues/Tubelings
5’ x 12’	726/ac	Timber	Survival Issues/Tubelings
5’ x 12’	726/ac	Timber	No Survival Issues/Bareroot
5’ x 10’	871/ac	Timber	Survival Issues/Bareroot

These numbers may need to be reduced for sandhill sites, which cannot support large numbers of trees

You can reduce your row spacing instead of your between tree spacing, e.g. 5’ x 12’ = 6’ x 10’ (726/ac)

As always, consult with your Natural Resource Professional

Types of Planting: Machine (Farm Tractor), Hand Planting, and V-Blade Planting

Pastures, cropland and sites with no significant debris can be planted with a farm tractor (Scalp!)

Cutover sites with logging debris usually require a V-blade or hand planting (Herbicide!)

Extremely rough sites may best be planted by hand, since the individuals on foot can step over and around heavy logging debris

To achieve random spacing, hand plant your seedlings

It is difficult to hand plant bareroot seedlings. You’re much better off with tubelings. Machine or V-blade planting orients the roots of bareroot longleaf into the ground much better.

Don’t fertilize after planting – this will cause weeds to grow 10’ tall and suffocate your seedlings

Don’t prune the roots of bareroot longleaf. Allow them to air prune if they’re sticking out of the ground.

How to Integrate Wildlife and Forestry

Joe Vaughn
Florida Fish & Wildlife Conservation Commission
Landowner Assistance Program (LAP)
Joseph.Vaughn@MyFwc.com
352-955-2241

What are the Issues

Why have we lost so much wildlife in our pine stands

Conversion

Pine Straw Production

Bedding when not needed = loss of groundcover

Not bedded, retained groundcover

Root Raking

WHY?

So if you want wildlife, protect the groundcover

If this is what your stand looks like, what can you do to recover and maintain the groundcover?

You Can

- Thin your stand at the earliest age possible
- Burn your stand on a short rotation (2 to 4 years)
- Manage for longer rotation
- Favor longleaf pine over slash or loblolly, where appropriate
- Leave snags (Dead Trees)
- Create openings
- Plant at lower densities – 400 to 600 trees/acre

Thin

Basal Area (BA) is the average amount of a given area, usually an acre, occupied by tree stems, usually expressed as square feet per acre. For more information, ask a Forester!

- BA = 100+, you start to lose wildlife
- BA = 70 TO 90, good timber revenue, fair wildlife value
- BA = 50 to 70, reduced timber value, high wildlife value
- BA = 40 or below, little to no timber value, excellent wildlife value

Burn (but why)

- Lowers the amount of fuel build-up, thereby, lowering fire intensity
- Reduces competition from oaks and shrubs
- Stimulates native grasses and forbs to set seed
- Increases the amount, the palatability and the nutritional value of native forage
- Consumes forest litter while recycling nutrients
- Builds in vegetative structural diversity, especially summer burning

What about the ground nesting birds?

Research has shown that 1 to 6% of turkey nest are lost to prescribed fire.

Turkey and Quail are re-nesters. They will re-nest if they lose the 1st nest.

Remember: These birds evolved with natural lighting season fire and flourished until humans intervened.

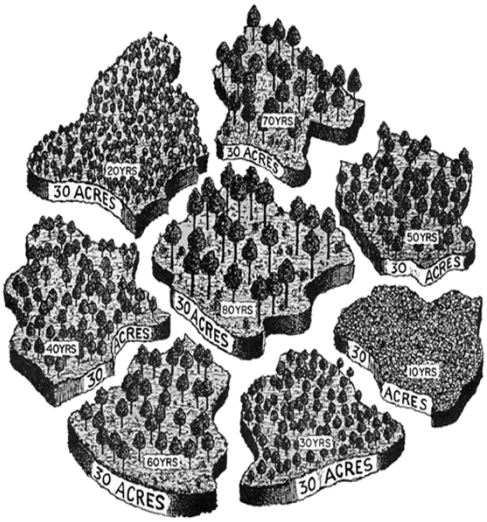
Burning less than 500 acres at a time does not negatively effect the turkey population. For quail, burn units should be less than 200 acres.

If you fail to burn in spring/summer, you will save a very few nest but over 3 to 5 years you will have lost the habitat needed for turkeys to nest.

To maintain GOOD nesting habitat, you have to break a few eggs!

Rotation

- In this example, 240 acres are managed in 30 acre plots
- This is an outstanding example of structural diversity across the landscape
- Does not have to be this detailed but this is the idea of providing the various habitat conditions for a wide range of species



Convert

- Slash pine plantation on right, 20 year old
- 2 to 3 year old longleaf pine on left
- Notice the oak control as site prep for the LLP site
- There is diversity in the species planted, in the density and in the age

Favor LLP over LOB

- 5 to 10 year old LLP on left
- Same age Loblolly pine on right
- Planted at the same density, 600 tpa
- Note the difference in amount of groundcover and canopy closure

Snags
(Dead Trees)

- Homes for 30 to 40 species of cavity nesting birds, mammals and reptiles.
- Absent from most pine plantations

Snags come in many forms

Snags

- Cabbage palm that has become a wildlife condo

Create Openings

- An important concept in managing for wildlife on a particular property is the realization that wildlife prefer many different types of vegetation to be present, i.e., diversity
- Transition zones are areas where 2 or more habitats converge, in which the vegetative cover is a mix of the adjacent habitats. Transition zones are also called edges or ecotones.

Maintain your Openings

- Use old logging decks/ramps
- Burn or Mow every 1 to 3 years
- Bigger is better
- Design with irregular borders, if you can

Invasive Plants
Learn to identify the most common threats

- Cogongrass
- Chinese tallow Tree
- Tropical soda apple
- Japanese climbing fern
- Hairy indigo

Planting Density

- 726 tpa = great for silviculture, ok for some species wildlife
- 600 tpa = good for silviculture, good for many species of wildlife
- 400 tpa = ok for silviculture, great for most species of wildlife
- Less than 400 tpa = not considered as silviculture but outstanding for wildlife

- What is the right choice? It is your land, your goals, it is the landowner's decision to make!

Landowner Assistance

NRCS Natural Resources Conservation Service

EQIP – Environmental Quality Incentive Program
Contact your local NRCS service center

LAP – Landowner Assistance Program
Technical assistance and conservation planning
Contact your FWC regional office

FSP – Forest Stewardship Plan
SPB – Southern Pine Beatle Program
Cogongrass Cost Share Program
Contact your county forester

Thank You!

UF UNIVERSITY of FLORIDA
IFAS Extension

SS-FOR-13

Longleaf Pine Regeneration[1]

Chris Demers, Alan Long and Patrick Minogue[2]

Longleaf pine (*Pinus palustris*) has many favorable characteristics for landowners who have long-term, multiple-use resource management objectives. Of all the southern pine species, longleaf pine is the most insect-, disease-, and fire-resistant and has the greatest longevity. When burned regularly, longleaf pine forests develop a stable grass savannah ecosystem, providing ideal habitat for many plants and animals.

Longleaf pine is a pioneer species on a variety of sites but is intolerant of competition and flooding during its grass stage, when it appears like a clump of grass. Historically, fire and moisture have been the principal factors controlling longleaf distribution within its natural range. In the lower Coastal Plain longleaf grows on sandy, well-drained to excessively well-drained soils where loblolly or slash pine perform more poorly. Fire removes competing vegetation, exposing the bare soil necessary for successful seedling establishment. In the historic fire-dominated longleaf pine grass savannah ecosystem, relatively stable plant communities are characterized by an overstory of uneven-aged, widely spaced longleaf pines and fire-tolerant oaks such as bluejack oak (*Quercus incana*) and turkey oak (*Quercus laevis*) and a predominate ground cover of bunch grasses such as wiregrass (*Aristrada stricta*) and bluestems (*Andropogon* spp) which facilitate ignition and spread of periodic fires (Landers 1991). It is interesting to note that, despite this tree's performance on high, dry ground, its Latin name means "swamp pine." It does grow sparsely in wet areas as well.

Artificial Regeneration

Options for artificial regeneration include planting of bareroot or containerized seedlings or direct seeding. Control of pine stocking (density) is best when seedlings are planted and container-grown seedlings generally provide the best survival rate. However, direct seeding may be a viable option for some situations, such as regenerating relatively small areas.

Site Preparation

Longleaf pine is very intolerant of shade and is difficult to regenerate successfully without vegetation control. Vegetative competition around seedlings must be kept at a minimum until an adequate number of seedlings emerging from the grass stage are at least as tall as the competition. The type and degree of site preparation and the choice of

1. This document is SS-FOR-13, one of a series of the School of Forest Resources and Conservation, UF/IFAS Extension Service, Institute of Food and Agricultural Sciences, University of Florida. First published January 2000. Revised November 2010. Reviewed August 2013. Please visit the EDIS website at **http://edis.ifas.ufl.edu**.

Chris Demers, forest stewardship coordinator; and Alan Long, former professor, Forest Operations and Environmental Regulations; and Patrick Minogue, assistant professor, Silviculture, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville 32611.

2. All chemicals should be used in accordance with directions on the manufacturer's label.

site preparation methods before planting longleaf seedlings will depend on the regeneration technique used, site conditions and your management goals.

At the very least, prepare the area for direct seeding by first performing a prescribed burn. Disking also enhances seeding by exposing mineral soil and reducing competing vegetation for a short period of time. More challenging site conditions require more extensive site preparation techniques to increase the likelihood of success.

The most common situations encountered include recently harvested forest sites and conversion of old fields and pasture land. On recently harvested forest sites, most residual hardwoods should be removed with heavy machinery such as a root rake or controlled using various herbicides (Table 1). Following herbicide treatment, broadcast site preparation burning is often done to improve hand or machine planting access. V-blade planters are used to improve machine planting access by pushing debris away from the planted row. On old fields and pastures ripping will help break hardpans (compacted soil layers) and scalping a narrow (1–2 ft) strip, about 2 to 3 inches deep, along the planted row will break up the sod and improve the effectiveness of the planting machine in setting the seedlings with good soil contact. Scalping and ripping are usually done following the contour on sloping land to avoid erosion problems. It is best to rip the soil during dry periods in the summer to obtain good soil fracture and well in advance of the planting season, so that eventually rain will settle the soil prior to planting in the late fall or winter. When planting into established grass sod, the most effective practice is to deaden the sod with glyphosate herbicide (Table 1) either by broadcast application or by treating a 5–6 ft wide band centered on the planted row *prior to planting*. Herbicide control of grasses is very important for successful longleaf establishment, and glyphosate is most effective when applied during periods of active growth. Disking established sod prior to planting is not recommended because it makes herbaceous vegetation control after planting very difficult.

The best results are obtained when vegetation is managed both before and after planting. During the first and sometimes the second growing season following planting, selective herbicides are used to control grasses and broadleaf weeds (herbaceous weed control). This practice significantly improves seedling survival, and accelerates seedling growth rates by reducing the period that seedlings remain in the grass stage by one or more years. In longleaf plantations in the sandy soils of the Coastal Plain, hexazinone and sulfometuron methyl are the most commonly used herbicides for herbaceous weed control in longleaf pine plantations (Table 1). These herbicides may be applied directly over planted seedlings safely when care is taken to ensure the proper herbicide rate is applied and labeled method is followed. Pine tolerance to these herbicides is best when seedlings have initiated new root growth following transplanting. Many growers excavate a few trees to check for new roots, which are white in color, prior to herbicide application. Herbaceous weed control treatments are most effective when weeds just start to develop in the Spring, which is typically in late March through mid-April.

Once seedlings are established, a prescribed burning program is a natural and cost-effective means to manage hardwood vegetation and also shift the ground cover to grass savannah species which provide desirable habitat for many desired wildlife species (Platt *et al*. 1998, Noss 1989).

Planting

Since longleaf pine seedlings do not become truly dormant, they require greater care in handling and planting than other southern pines. The success of longleaf pine planting depends on: (1) good soil moisture at and following planting (2) a well-prepared, competition-free site; (3) fresh, healthy, top quality planting stock; (4) extreme care in handling the stock from lifting to planting; (5) quality planting; and (6) managing competing vegetation through stand establishment. High quality seedlings can be grown as either bareroot or container stock, but container stock is somewhat more forgiving of less than optimum conditions.

The appropriate planting density will depend on your objectives. Low planting densities, 300 to 500 seedlings per acre or less, may be appropriate for longleaf ecosystem restoration and/or to provide wildlife habitat (such as that for bobwhite quail), whereas 750 seedlings per acre or more may be desirable to optimize timber production and pine straw raking.

Supplies of longleaf pine seedlings may not be sufficient to meet demands, so order your seedlings by early summer at the latest. For a list of longleaf nurseries, call your DOF County Forester (http://www.fl-dof.com/field_operations/county_foresters/index.html) or the Longleaf Alliance, at 334-427-1029, and request a copy of the *Longleaf Nursery List*. This is also available on their website: http://www.longleafalliance.org/.

Choose a tree planting contractor that has experience with planting longleaf pine. Planting failures frequently result from improper seedling handling and planting. Hiring an experienced and reputable contractor may help to ensure

seedling survival and minimize the possibility of having to replant.

BAREROOT SEEDLINGS

Longleaf pine seedlings at the nursery are stem-less and resemble a carrot with a clump of pine needles on top. Ideally, bareroot seedlings should have: (1) a root collar diameter (RCD) of 0.4 to 0.6 inch; (2) a stout, 6- to 8-inch or longer tap root; (3) at least 6 well-developed, 6- to 8-inch lateral roots with evidence of ectomycorrhizal development; (4) a winter bud with scales; (5) abundant, large, fascicled needles that are free of brown-spot disease; (6) been grown at a reputable nursery; (7) been undercut in the nursery bed well before lifting; and (8) a seed source from the same region as the planting site. Seedlings with a RCD of 0.3 inch or less generally have low survival rates.

Longleaf seedlings come out of the grass stage and initiate stem height growth when the seedlings have a RCD of about one inch. After planting, longleaf seedlings allocate their growth to develop a tap root prior to initiating stem height growth. As noted above, seedlings may initiate height growth at a younger age if competing vegetation is controlled. Once the seedlings emerge from the grass stage, height growth is comparable with loblolly or slash pine of the same age.

CONTAINERIZED SEEDLINGS

There is increasing interest in using containerized longleaf pine seedlings (plugs) because they generally have greater survival than bareroot seedlings. Also, containerized seedlings can be planted throughout the year, whenever soil moisture is adequate *before and after planting.* Containerized seedlings have even been successfully planted during the hot summer months, when afternoon rains are common. They can be used to replant partial regeneration failures in the year they occur as well. Studies have shown that both fall-planted and late winter-planted containerized longleaf seedlings *often* have better survival and growth than winter-planted bareroot seedlings. Seedlings grown in large containers (large plugs) can enhance survival on adverse sites, but to ensure success sufficient site preparation and vegetation control measures must be taken.

The main drawback of containerized seedlings is cost. On average, the price per thousand is about twice as much for container-grown seedlings as the cost for bareroot seedlings. The larger the plug volume, the greater the cost to produce the plugs. Also, containerized seedlings are more bulky to handle during shipping and planting. However, cost-share programs and increased survival make them a feasible option.

NURSERY TO FIELD

Proper care and handling of seedlings from the nursery to the field includes several steps: (1) pick up seedlings from the nursery the day they are lifted; (2) protect roots from desiccation; (3) protect seedlings from wind and refrigerate them if possible during transportation to the planting site (place plugs loosely in large coolers or waxed boxes); (4) store seedlings in a cool, well-ventilated area for no more than three days before planting (or up to 3 weeks in refrigeration, 5 weeks with humidity control); and (5) do not expose seedlings to sunlight or heat. To optimize success, plant seedlings within three days of pickup from the nursery. Large planting jobs may require multiple trips to the nursery.

Longleaf seedlings are normally planted between November and the beginning of March when cool temperatures are prevalent and soils are normally moist. Planting during the early part of this time frame is best to give seedlings time to grow new roots before the dry weather of April and May. Containerized seedlings can be planted earlier whenever available soil moisture is adequate and rainfall occurs as noted above, but risks are diminished during the winter planting season. Avoid planting during periods of low soil moisture, dry weather, high temperature, low relative humidity, high winds or when soil is frozen.

Take enough seedlings to the field for one day of planting and keep them moist, but not submerged. When hand-planting bareroot seedlings, keep a little water or wet Tera-Sorb in the bottom of the planting bag. Make sure tree planters carry seedlings in the bag to prevent the roots from drying out.

For bareroot seedlings, machine planting is preferable to hand planting because the larger slit created by the machine provides for better root alignment. If hand-planting, bareroot seedlings should be planted with a shovel or large dibble. Containerized seedlings can be planted with a cylinder-type dibble or any of the flat-bladed implements used to plant bareroot stock.

For bareroot stock, position seedlings with taproots straight down and root collars at or slightly below the ground line (no more than 1 inch below), which allows the bud to be exposed once the soil has fully settled. Attention to detail during planting is critical -- a seedling planted too shallow will die quickly, and a seedling planted too deep will die slowly.

For containerized seedlings, position the plug so that the terminal bud is well above the soil surface. Tell planters to "leave the upper part of the plug exposed." This insures the seedling is not planted too deep.

Don't plant directly in a subsoiled/ripped furrow because the seedlings may sink. Instead, offset 2–4 inches to the side of the ripped furrow.

On scalped sites, anticipate soil movement back into the scalped furrow and plant more shallowly, leaving approximately 1 ½ to 2 inches of the plug above the soil surface. Very shallow planting also works well on wetter sites.

A WORD ABOUT COST-SHARE CONTRACTS

If you have a cost-share contract under the USDA's Conservation Reserve Program or Wildlife Habitat Incentives Program, the planting crew must know about it. If not, they may plant more than the maximum number of seedlings allowed in the terms of the contract, causing problems with your funding.

POST-PLANTING CARE

Once seedlings are planted, the principal factors affecting seedling development are vegetative competition and brown-spot needle blight. Prescribed fire is the most common cultural treatment used to control both. If average brown-spot infection exceeds 20% of the cumulative foliage on sampled seedlings, a burn will be needed to control the disease unless it will result in excessive mortality. Seedlings in the early stages of height growth (coming out of the grass stage) are most susceptible to fire kill, especially when heavily infected by brown-spot.

Direct Seeding

Due to increases in seed costs, this once cost-effective regeneration option is now potentially cost prohibitive, and it involves substantial risk. Failure can occur as a result of inadequate control of competing vegetation, low seeding rates, using seed not treated with bird or rodent repellent, seeding at the wrong time, or adverse weather conditions. Often, direct seeding results in stands with patchy stocking, with some areas not adequately stocked and some areas with too many trees. Low, poorly drained sites that are likely to be covered with standing water a week or more after seeding should be avoided. Likewise, deep upland sands that dry out rapidly after a rain are also unsuitable for direct seeding. Generally, sites that can be successfully planted can also be successfully seeded. As with planting, site preparation methods must control vegetative competition and expose at least 50% of the mineral soil. Seeds must be in contact with the mineral soil for germination to take place. Seeds lodged in non-soil material will probably not become established.

In general, local seed sources are best. Seed or seedlings from North and South Carolina tend to grow poorly when planted on the Florida peninsula and vice versa. Most genetic improvement work with longleaf pine is concentrated on breeding for brown-spot disease resistance and accelerated initial height growth.

Purchase seeds from a reputable seed dealer. Longleaf seeds should be refrigerated at subfreezing temperatures until sowing. Sowing can take place in fall, when moisture is adequate and maximum daytime temperatures drop below 85 degrees. Seed can be sown at low cost by broadcast seeding at 3 pounds per acre, or spot seeding (dropping 3 to 5 seeds per spot). Row seeding, at 1 to 2 feet spacing between seeds, can be used when better control over spacing and density is desired. Large areas are best seeded by aircraft which use carefully calibrated equipment. After establishment (two to three years), clumps of seedlings can be thinned down to one tree.

Natural Regeneration For Even-Aged Stands

Landowners who already have stands of longleaf pine can take advantage of a practical, inexpensive natural regeneration method known as the *shelterwood* system, a natural seeding method well-suited to the biological requirements of this species. The shelterwood method maximizes per-acre seed production and yields sufficient needle litter to fuel fires hot enough to inhibit hardwood regeneration and to prepare a seed bed. Regular prescribed burns should be scheduled throughout the rotation to maintain a low understory. Most of the mature stand is removed at the end of the rotation, but a portion is left standing as a seed source until regeneration is well established. Success with this method depends on: (1) a good seed year with adequate seed supply, (2) a receptive seedbed, (3) minimal vegetative competition and (4) ample soil moisture.

The shelterwood system requires 3 cuts that serve 3 basic purposes: (1) to prepare the stand for production of abundant seed, (2) to modify the environment in a way that promotes germination and survival, and (3) to build up the amount and size of advance regeneration to ensure a well-distributed stand following overstory removal.

Preparatory Cut

The preparatory cut is 10 or more years before the planned harvest date of the stand and at least 5 years before the seed cut. This cut is essentially a thinning which reduces the basal area (BA) of the stand to a maximum of 60–70 square feet per acre of dominant and codominant pines. This cut promotes crown development and cone production. Most of the hardwoods not controlled by fire should also be cut at this time.

Seed Cut

The seed cut is made 5 years prior to the planned harvest date and leaves no more than 30 square feet BA per acre of dominant trees at least 15 inches diameter at breast height (dbh), with well-developed crowns. Trees with evidence of past cone production are favored. Cone production peaks in the range of 30 to 40 square feet BA per acre, but the lower end of this range is preferred because logging-related seedling losses increase when more trees are removed in the final cut.

Monitor the cone crop by taking spring binocular counts of both flowers (next year's cone crop) and 1 year-old conelets (this year's cone crop) on selected sample trees in the regeneration area. These counts will give an estimate of the potential for the cone crop to regenerate the stand so that the seedbed can be prepared before the cones open. Generally, few seeds are produced by trees under 30 years old or under 10 inches dbh.

In order to achieve adequate natural regeneration, the available seed supply must feed various forms of wildlife with enough left over to establish a satisfactory stand. A minimum of 750 to 1,000 or more cones per acre is needed for successful regeneration. Longleaf cone crops are highly variable. Good seed crops occur every 5 to 10 years. Seedfall begins in late October and continues through November, but most seeds fall within a period of 2 to 3 weeks. About 70% of viable seeds fall within 65 feet of the parent tree. Under favorable weather conditions, seeds will germinate one or two weeks after dispersion. A prescribed burn 1 year before seedfall will remove accumulated litter and expose sufficient mineral soil for seedling establishment. A late-spring burn is most effective in controlling woody stems.

Removal Cut

Once an acceptable stand of seedlings is established, the parent overstory can be removed. This cut can be delayed if necessary for management needs or market conditions. Seedlings can survive 8 or more years under the parent overstory with little or no effect on survival given exclusion of burning. However, logging damage becomes more serious once seedling height growth begins.

Naturally regenerated stands require the same attention as planted stands with respect to brown-spot disease and competing vegetation. Young stands should not be burned until at least 2 years after the removal cut to allow time for logging slash to decay and the seedlings to respond to release.

Natural Regeneration for Uneven-Aged Stands

Uneven-aged stands are created using the selection system. In the selection system, trees representing a range in size are harvested at fixed intervals (called the cutting cycle, which ranges from 10 to 25 years). Regeneration (either natural or artificial) occurs in the harvested openings. This management approach allows periodic harvests, while maintaining a continuous forest cover. Smaller, lower quality trees are also removed to improve the overall quality of the stand. This method is covered in detail in this publication on opportunities for uneven-age management: http://edis.ifas.ufl.edu/fr132

Conclusion

Longleaf pine has many desirable characteristics for landowners who have multiple-use forest management objectives. On appropriate sites, and with careful attention to detail during the regeneration phase, it is possible to enjoy the versatility of this species without compromising growth rates.

References

Anon. Keys to successfully planting longleaf pine. Brochure by the Longleaf Alliance. Andalusia, AL.

Barnett, J. P., D. K. Lauer, and J. C. Brissette. 1989. Regenerating longleaf pine with artificial methods. Pages 72–93 in: Proc. of the symposium on the management of longleaf pine; 1989 April 4–6; Long Beach, MS. Gen. Tech. Rep. SO-75, New Orleans, LA: U.S. Dept. of Agr., Forest Service, South. Forest Exp. Sta.

Beam, L. G. 1996. Longleaf pine on the Guerry Farm. Pages 20–21 in: Proc. of the 1st Longleaf Alliance conference; 1996 September 17–19; Mobile, AL. Longleaf Alliance.

Boyer, W.D. 1997. Long-term changes in flowering and cone production by longleaf pine. Pages 92–98 in: Proc. of the 9th biennial southern silvicultural research conference; February 25–27; Clemson, SC. Gen. Tech. Rep. SRS-20, Asheville, NC: U.S. Dept. of Agr., Forest. Service, South. Res. Sta.

Boyer, W. D. 1993. Regenerating longleaf pine with natural seeding. Pages 299–309 in: Proc. of the 18th Tall Timbers fire ecology conf.;1991 May 30–June 2; Tallahassee, FL. Tall Timbers Res. Sta.

Boyer, W. D. and J. B. White. 1989. Natural regeneration of longleaf pine. Pages 94–113 in: Proc. of the symposium on the management of longleaf pine; 1989 April 4–6; Long Beach, MS. Gen. Tech. Rep. SO-75, New Orleans, LA: U.S. Dept. of Agr., Forest Service, South. Forest Exp. Sta.

Croker, T. C., Jr. 1989. Longleaf pine - myths and facts. Pages 2–10 in: Proc. of the symposium on the management of longleaf pine; 1989 April 4–6; Long Beach, MS. Gen. Tech. Rep. SO-75, New Orleans, LA: U.S. Dept. of Agr. Forest Service, South. Forest Exp. Sta.

Dennington, R. W. and R. M. Farrar, Jr. 1991. Longleaf pine management. Forestry Rep. R8-FR 3. Atlanta, GA: U.S. Dept. of Agr., Forest Service, South. Region. 17 p.

Earley, L. S. 1996. Learning from Choctawhatchee: ninety years of longleaf pine management. Pages 4–5 in: Proc. of the 1st Longleaf Alliance conf.; 1996 September 17–19; Mobile, AL. Longleaf Alliance.

Franklin, R. M. 1997. *Stewardship of Longleaf Pine Forests*: *A Guide for Landowners*. Longleaf Alliance Report No. 2. Andalusia, AL. 41p

Landers, J. L. 1991. Disturbance influences on pine traits in the Southern United States. In: Proc. Tall Timbers Ecol. Conf., Tall Timbers Research Station. Tallahassee, Florida. 17:61–98.

Noss, R. F. 1989. Longleaf pine and wiregrass: Keystone components of an endangered ecosystem. Nat. Areas J. 9: 211–213.

Platt, W. J., G. W. Evans, S. L. Rathbun. 1988. The population dynamics of a long-lived conifer (*Pinus palustrius*). Am. Naturalist 131: 491–525.

Shoulders, E. 1989. Identifying longleaf pine sites. Pages 23–37 in: Proc. of the symposium on the management of longleaf pine; 1989 April 4–6; Long Beach, MS. Gen. Tech. Rep. SO-75, New Orleans, LA: U.S. Dept. of Agr., Forest Service, South. Forest Exp. Sta.

South, D. B. 1997. Needle-clipping longleaf pine and top-pruning loblolly pine in bare-root nurseries. South. J. Appl. For. 22(4):235–240.

Table 1. Common herbicide treatments for longleaf pine establishment on sandy, Coastal Plain sites. Read and follow all label directions.

Common Name	Herbicide Rate	Trade Name	Amount Product	Comments
A. Site preparation of recently harvested forest sites primarily to control hardwood and shrub vegetation				
Hexazinone	1.9 to 3 lb ai/A	Velpar L	2.5 to 4 lb/A	Hand "spotgun application" on grid pattern or to individual rootstocks, same sites as above
Imazapyr + Glyphosate	0.625 lb ae/A + 3lb ai/A	Chopper Gen2 Accord XRT II	40 oz + 2.2 qts	Tank mix, broadcast aerial or ground sprayer, clay soils, where maple, ti ti present
B. Site preparation in established pasture or grass sod				
Glyphosate	2 lb ai/A	Accord XRT II	1.5 qts	Foliar application, broadcast or apply to a band on tree rows prior to planting
C. Herbaceous weed control (grasses and broadleaf weeds) over-the-top of planted seedlings				
Hexazinone + Sulfometuron	6 oz ai/A 1.5 oz ai/A	Velpar L Oust XP	24 oz plus 2 oz	Tank mix, very broad spectrum
Hexazinone Sufometuron	7.6 oz ai/A 1.4 oz ai/A	Oustar	12 oz	Pre-package mix, very broad spectrum Use 10 oz product on sandy soil.

ESTABLISING LONGLEAF PINE

PROPER SITE PREPERATION IS CRITICAL

Practical Landowner Information to Grow With

INFO —TO— GROW

The purpose of this Info To Grow is to discuss a few fundamental requirements that will help to insure successful establishment of longleaf pine. Attention to these principals will increase longleaf pine survival.

Successful Longleaf pine restoration starts with proper site preparation

Recognize that a fundamental ecological principal is that longleaf pine is very intolerant to competing vegetation including shade. Therefore, successful longleaf pine establishment starts with eliminating both the vertical and horizontal competing vegetation.

Three techniques are used to control the vertical vegetation. The density and distribution of the vertical vegetation determines which technique is used.

Scattered and short vertical vegetation is best controlled using an appropriate herbicide. The herbicide may be applied by ground or air. Small parcels (less than 40 acres) require ground application; larger parcels that are not adjacent to semi-urban environments may use the less expensive air application.

More densely populated vertical vegetation can be either harvested for biomass or raked and piled using bulldozers and root rakes. Harvesting the vegetation for biomass removes the material from the site and eliminates piles. Piling and raking retains the vertical vegetation on the site.

A more traditional technique uses bulldozers and root rakes to shear and pile the vertical vegetation, often times into windrows. Raking, piling and windrowing displaces the topsoil, creates piles that will last for decades, is unsightly, and is more expensive. Costs may range from $50 to $150 per acre.

Biomass harvesting removes almost all of the vertical vegetation. This process leaves little to no piles or windrows, retains the top soil with little to no disturbance, keeps the site aesthetically pleasing, and best of all, does it at less cost. Dense vertical vegetation is often harvested for free, moderately dense might cost the land owner, but very dense can pay the land owner.

Neither biomass harvesting nor piling and raking will remove any of the horizontal vegetation. Often the horizontal component will need chopping. In most cases, a single pass roller drum chopper will control the ground cover. In rare cases, a double pass may be required.

A necessary component of all successful longleaf restoration is the use of an approved herbicide. There are two vegetative targets; woody and herbaceous. Typically both are an issue. The herbicides may be applied to the soil or to the foliage. It is critical that a processional resource manager or forester help with proper selection.

Once the site has been properly site prepared, it is ready for planting. Seedling handling and property planting technique is the subject of another Info To Grow.

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BIOMASS HARVESTING

Practical Landowner Information to Grow With

INFO —TO— GROW

On April 29, 2009, Gainesville Regional Utilities (GRU) entered into a power purchase agreement with Gainesville Renewable Energy Center (GREC). GREC agreed to supply electrical power to GRU and GRU agreed to buy all of their power. Subsequently, a 100 Megawatt (MW) 450 million dollar power plant was built north of Gainesville and opened for business in 2013.

Biomass Harvesting saves the landowner significant site preparation costs

The fuel used to generate the electricity is biomass. Biomass is "organic matter, especially plant matter that can be converted to fuel and is therefore regarded as potential energy source[1] ". The fuel is totally renewable and is procured within 100 miles of Gainesville. The 100 MW power plant requires about one million green tons of biomass per year, or almost 80,000 tons per month if it operates at 100% capacity.

The definition of exactly what constitutes biomass fuel is defined by the power purchase agreement. The required fuel load comes from urban wood waste, mill residues, and biomass generated from agricultural lands.

Urban wood waste is generated by cities, tree service companies, landscaping and land clearing companies. It is taken to urban wood waste concentration yards where it is processed into biomass fuel and delivered by supply contractors.

Forest biomass is similar to urban biomass but, by definition, is harvested from agriculturally classified lands which includes timberland. Forest biomass supplies 2/3 of the biomass plant's required fuel load.

Columbia Timber Company has a ten-year agreement with GREC to supply 35% of the forest generated fuel. This gives Columbia the ability to buy and harvest both traditional forest products such as pulpwood and saw timber, as well as vertical biomass.

Vertical biomass, as the name implies, is composed of vertical vegetation such as oak thickets, scrub oaks, and hardwood areas.

Forest biomass harvesting should not be confused with traditional timber harvesting for timber products such as pine and hardwood pulpwood, chip-n-saw or saw timber. The pricing is very different.

Lands that contain both vertical vegetation and lands that are growing traditional forest products will continue to receive full payment for their forest products. Landowners will continue to market their forest procures as they always have. The more valuable trees are separated using the same logging equipment and trucked to the same mills as before.

What has changed is how traditional sites look after logging and how much the cost of site preparation has decreased.

Prior to the biomass plant's arrival, vertical woody vegetation never left the site. It was raked and piled using bulldozers and root rakes. This type of site preparation created numerous piles and windrows across the land.

The old style of raking, pushing and piling has been eliminated. It increases the amount of usable acreage, leaves the top soil where it belongs, and significantly decreases site preparation costs. Now, while harvesting merchantable timber, all of the non-merchantable thickets and saplings can be harvested. This includes unmanaged pine plantations that lost their growth due to an overabundance of oaks, converting a young pine plantation to pasture, or a post-harvest cleanup – anything with vertical biomass.

The essential point is that land owners now have a new and more efficient means of clearing and managing their property. Who can argue with saving money? Maybe oak thickets and timber might be worth more than you think!

[1]Dictionary.reference.com

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UF UNIVERSITY of FLORIDA
IFAS Extension

Controlling Hardwoods in Longleaf Pine Restoration[1]

Patrick J. Minogue, Kimberly Bohn, and Rick Williams[2]

Historically in the longleaf pine (*Pinus palustris*) ecosystem, periodic fires ignited by lightning during the growing season fostered a relatively stable community characterized by widely spaced, uneven-aged pines and an understory dominated by bunch grasses and a diversity of forbs (broad-leaved plants that often produce seed favored by wildlife) (Platt et al. 1988; Noss 1989) (Figure 1). Many game species such as deer, turkey, and quail; as well as some endangered species such as red-cockaded woodpecker; threatened species such as gopher tortoise; and species of special concern such as Shermans fox squirrel and Florida mouse; all prefer the habitat of a relatively open pine overstory, no midstory, and a grassland understory. The plant communities of the longleaf pine savannah contain few shrubs or hardwood trees because native bunch grasses such as wiregrass (*Aristida stricta*) and broomsedge (*Andropogon* spp.) facilitate the ignition and spread of surface burns during the growing season, limiting the development of all but the most fire-tolerant hardwood species such as bluejack oak (*Quercus incana*) and turkey oak (*Quercus laevis*) (Landers 1991). Like longleaf pine, these bunch grasses are resilient to fire, and fires during the growing season induce them to produce abundant and viable seed, supporting wildlife and the proliferation of the ecosystem. With the exclusion of fire, these communities succeed to hardwood forests which are characterized by higher shading, greater litter accumulation, and less herbaceous ground cover. In the absence of management, shrubs and oak hardwoods will slowly encroach into the midstory, creating unfavorable conditions for groundcover and many wildlife species' wildlife habitat. Restoration of longleaf stands that have been unmanaged for long periods will require additional investments to restore the appropriate species composition and structure.

We have several tools available, used alone or in combination, to manage the hardwood component of longleaf stands including:

- tree felling
- machinery
- fire
- herbicides

Tree Felling – Cutting down individual trees is an option but this treatment alone will give rise to additional sprouting stems around the stump and

1. This document is FOR125, one of a series of the School of Forest Resources and Conservation Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date August 3, 2007. Visit the EDIS Web Site at http://edis.ifas.ufl.edu.

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Figure 1. Widely-spaced longleaf pines and an understory consisting of broomsedge and wiregrass facilitate periodic prescribed burning to maintain a relatively stable ecosystem. Credits: Pat Minogue, 2007

from the roots, typically resulting in more numerous stems of smaller diameter. This could potentially be used as an initial treatment by landowners with small properties, or on properties that have only a small hardwood component. However, long-term management will require follow-up treatments of either fire or herbicides to control the sprouts.

Machinery – Bulldozers can be used to clear large trees and underbrush, particularly in larger tracts where the desired groundcover is completely absent and re-planting and re-seeding will need to occur. However, this practice is expensive and consumptive of petroleum fuels, and additional problems include the potential for soil compaction, erosion, and re-sprouting of hardwoods.

Fire – Prescribed burning is a natural and cost-effective means to remove hardwoods from pine stands and promote desirable species in the understory. Burns in the late spring and summer are most effective in top-killing hardwoods (killing above ground portions). During warm seasons hotter burns are obtained and the heat of the fire will penetrate the bark of hardwood trees and shrubs fostering top-kill; however, the hardwood root system will survive and re-sprouting is expected. The bark of pine trees is thicker than hardwoods and thus they are better insulated, but even with a well executed prescribed burn pines can be injured.

Prescribed burning is an integral part of establishment and maintenance of the longleaf pine ecosystem. The first time a stand is burned it is best to do it in winter, under exacting conditions of wind, temperature, and humidity. Subsequent burns during the growing season may be done to control hardwoods. Prescribed fire regimes on a 2-3 year cycle are recommended. There are significant risks in prescribed burning regarding smoke and fire containment. It is best to work with trained and experienced burners and to prepare a burn plan in advance. Many southeastern states have “certified burner” programs through the State Forestry Commission or Division of Forestry. Additional information is available on the IFAS Web site http://www.fireinflorida.com.

Silvicultural Herbicides

Selective herbicides may be used to remove hardwood trees and brush and to promote legumes and native grasses in the under-story (Minogue et al. 1991). Most techniques involve treating individual hardwood trees or brush with hand-held tools and back-pack sprayers. Broadcast applications are used to shift the species composition to desirable vegetation by using selective herbicides—ones that affect some plants more than others.

Hack and Squirt Treatment

A hatchet and squirt bottle may be used to apply small amounts of herbicide directly into the vascular system of undesirable hardwoods. This approach is most appropriate where there are few scattered individuals with diameters greater than 3 inches. Many products are available for this use, but the most popular are Arsenal® Applicators Concentrate (imazapyr) and Garlon® 3A (triclopyr) which are mixed with water or used undiluted. A hatchet is used to cut through the bark in a downward fashion to create a cup in which to place a small amount of herbicide solution, one milliliter or about the amount a typical squirt bottle produces with one pull. Cuts are made around the stem to encircle the stem at a convenient height, and different approaches regarding the distance between cuts and solution concentration to use are described on the product labels. From experience, we know to use a sharp hatchet to ensure

a deep cut past the bark and well into the wood. Place only as much herbicide solution as will remain in the cut. Either imazapyr or triclopyr may be applied throughout the year with good results, except during the period of strong sap flow in the early spring. For imazapyr fall applications are optimum.

Imazapyr is the treatment of choice for most hack-and-squirt applications because of its effectiveness over a broad spectrum of tree and brush species and low use rate. However, imazapyr is soil active, meaning that it may be absorbed from the soil around treated stems by roots of desirable trees and other plants resulting in non-target injury. When applied at labeled use rates imazapyr will not be injurious to southern pines, which are tolerant to the herbicide.

For selective removal of some hardwood stems in mixed pine/hardwood stands, triclopyr is a better choice since it does not have soil activity. Selective removal by herbicide treatment within a species may result in injury to non-treated stems which share a common root system or grafts to treated stems.

Back-Pack Directed Foliar Sprays

Where sapling size hardwoods less than head tall are to be controlled, backpack sprayers can be used to direct herbicide spray to the foliage of undesirable brush and sapling trees. Many herbicide products are available for this use, but combinations of Accord XRT® (glyphosate) and Arsenal® Applicators Concentrate or Chopper® (imazapyr) are most cost-effective across a wide range of brush species. A common mixture is 2% Accord XRT plus either 0.5% Arsenal or 1% Chopper in water. Add 1% methylated seed oil surfactant to improve control, particularly when treating oaks and other species with a thick cuticle (leaf covering). The oil improves penetration into the leaves and fosters good control. Apply this mixture to at least 2/3 of the crown with light coverage; there is no need to wet the foliage. Late summer to the beginning of fall coloration is the ideal timing. Refer to “directed foliar sprays” on the product labels for additional information.

Basal Stem Treatments

Where undesirable hardwood crowns are too tall to reach with a backpack sprayer, or where very numerous sapling size stems are present, consider using a basal stem treatment with Garlon® 4 (triclopyr). There are several approaches described on the product label, but essentially a mixture of herbicide in oil is applied to the basal (lower) portion of the stem. It is best to treat the “root collar”, the base of the trunk where it goes into the soil up for about 12 inches. The approach is most effective on stems less than six inches in diameter, and is suggested for stems less than three inches. Diesel fuel, vegetable oil, or various mineral oils can be used as a carrier for the herbicides. The carrier type has little effect on hardwood crown-reduction during the dormant season. However, when the trees are growing, better results were provided by triclopyr mixed with vegetable oil (Williams and Yeiser 1995). The hack-and-squirt method discussed above is typically used for larger diameter stems. Basal stem treatments may be done anytime of year, including winter. Applications are made using a “straight-stream” sprayer such as the Gunjet® applicator.

Soil Spot Applications

Velpar® L (hexazinone) may be applied directly to the soil surface to control susceptible species either by treating the soil at the base of individual stems, or when brush is dense, by making applications in a grid pattern (e.g., 3 X 3 ft spacing of spots). When labeled rates are applied, pines are tolerant to this herbicide. The amounts of product will depend on the hardwood species, stem diameter, and soil texture; see the product label for details. Undiluted product may be applied with a squirt bottle or by more durable equipment such as a MeterJet®. Optimum timing is from spring bud break to early summer. Rainfall is needed to foster root uptake. This material is particularly effective for controlling oaks.

Broadcast Treatment

Several herbicides may be broadcast by ground or aerial equipment to selectively remove hardwood trees and brush in southern pine stands. The most common materials are Arsenal Applicators Concentrate (imazapyr) and various formulations of hexazinone (Velpar L, Velpar® ULW, and Pronone® 10 G). Imazapyr is applied in the late summer and early fall as a foliar spray and is effective on a wide range of hardwood species with some notable exceptions including winged elm and redbud. Imazapyr is tolerated by leguminous plants which may proliferate after broadcast applications (Minogue and Quicke 1999). Hexazinone products are applied from spring bud break to early summer and very effective in controlling oaks, particularly on the sandy soils characteristic of longleaf sites. In part due to the removal of the hardwood overstory and in part due to selectivity of the herbicide at low rates, hexazinone applications tend to promote native grasses such as broomsedge, wiregrass, and other graminoids, as well as forbs (Hurst and Warren 1986; Brockway et al. 1998; Hay-Smith and Tanner 1999). In comparing hexazinone broadcast to spot applications, Brockway concluded that spot applications provided better tolerance for native grasses, which were favored by the removal of a turkey oak overstory.

Summary

Longleaf pine ecosystems require some management activity to maintain the favorable grassy understory. Left alone, the longleaf pine stand will develop a dense hardwood understory that will shade out desirable grasses, shrubs, and forbs. Lasting treatments must include either mechanical treatments where feasible, prescribed fire, herbicides or a combination of these options to keep undesirable hardwood under control.

Table 1. Herbicide treatment approaches for controlling hardwoods and shrubs in longleaf pine restoration and management of established stands

Undesirable Vegetation	Recommended Approach	Herbicide to Apply
Few scattered hardwoods, stem diameters greater than 3 inches	Hack and squirt (cut stem application)	Imazapyr Triclopyr
Shrubs, brush, sapling hardwoods less than head tall	Back-pack directed spray	Glyphosate plus Imazapyr
Numerous sapling hardwoods greater than head tall	Basal stem treatment	Triclopyr
Numerous or scattered oaks of various sizes, sandy soils	Soil spot application	Hexazinone
Large hardwoods, saplings, brush, and shrubs	Broadcast application	Hexazinone Imazapyr

References

Brockway, D. G., K. W. Outcalt, and R. N. Wilkins. 1998. Restoring longleaf pine wiregrass ecoystems: plant cover, diversity and biomass following low-rate hexazinone application on Florida sandhills. *Forest Ecology and Management* 103:159-175.

Hay-Smith, Leslie and G.W. Tanner. 1999. *Restoring* L*ongleaf Pine Sandhill Communities with an Herbicide*. Wildlife Ecology and Conservation Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, The University of Florida, Publication WEC-131, 4 Pp.

Hurst, G. A. and R. C. Warren. 1986. Deer forage on pine plantations after a herbicide application for pine release. *Proc. Southern Weed Sci*. Soc. 39:238.

Landers, J. L. 1991. Disturbance influences on pine traits in the southeastern United States. In: *Proc. Tall Timbers Fire Ecol. Conf.*, Tall Timbers Research Station. Tallahassee, Florida. 17:61-98.

Minogue, P. J., H. C. Griswold, and R. L. Cantrell. 1991. Vegetation management after plantation establishment. Chapter 19. In *Forest Regeneration Manual*. M. Duryea and P. Dougherty, eds. Kluwer Academic Publishers. Dordrecht, Netherlands. Pp 335-358.

Minogue, P. J. and H. E. Quicke. 1999. Early-season forest site preparation with imazapyr and combinations of imazapyr and glyphosate or triclopyr in oil emulsion carrier: second-year response for planted pines and associated woody and herbaceous vegetation. *Proc. Tenth Biennial Southern Silvicultural Research Conference*. USDA Forest Service Gen. Tech. Rpt. SRS-30. Pp 307-311.

Noss, R. F. 1989. Longleaf pine and wiregrass: Keystone components of an endangered ecosystem. *Nat. Areas J*. 9: 211-213.

Platt, W. J., G. W. Evans, S. L. Rathbun. 1988. The population dynamics of a long-lived conifer (*Pinus palustrius*). *Am. Naturalist* 131: 491-525.

Williams, R. A. and J. L. Yeiser. 1995. Efficacy of vegetable oil as a triclopyr carrier for basal bark treatment of selected hardwoods. *Proceedings of the Southern Weed Science Society, 48th Annual Meeting: Herbicide Resistant Crops: A Bitter or Better Harvest?* Memphis, TN. Pp 131-137.

For additional information see also:

The University of Florida, Institute for Food and Agric. Sciences http:/edis.ifas.ufl.edu

The Longleaf Alliance http://www.longleafalliance.org

PLEASE, READ AND FOLLOW ALL HERBICIDE LABEL DIRECTIONS

UF UNIVERSITY of FLORIDA
IFAS Extension

WEC269

Forest Groundcover Restoration[1]

Holly K. Ober and Jennifer L. Trusty[2]

Restoration is the process of assisting the recovery of an area that has been degraded, damaged, or destroyed because of human activities. Groundcover restoration involves working to reestablish the herbaceous (nonwoody) species that occurred at a site before it was damaged. People may start groundcover restoration projects for a wide variety of motivations. Some common reasons are to enhance habitat for wildlife, to increase biodiversity, to restore ecosystem services (processes that take place in the natural world that provide benefits to humans), to increase natural beauty, or simply to take personal enjoyment in recreating the natural conditions that occurred historically.

Traditionally, restoration in forested areas focused on the trees, while groundcover received little attention. Recently, however, interest in restoring groundcover plants in the Southeast has increased as appreciation of their beauty and understanding of their importance to the health of ecosystems has grown. Due to the newness of the interest in this topic, no handbook yet exists to guide someone new to the field through the restoration process. Here we provide some suggestions for individuals interested in restoring groundcover.

Planning a Restoration Project

Ultimately, the goal of most vegetation restoration projects is to recreate the community of species that were previously present at the site. The following seven steps will get you on a path towards success in a groundcover restoration project.

1. Identify the factors that caused degradation of the site.

Before investing time and money in activities that could rebuild the groundcover at a site, determine what degraded the groundcover in the first place. Common problems include fire suppression, changes to the water table, or invasive species. Once you have pinpointed the causes of the damage, determine whether or not you can remove or at least mitigate the harmful conditions. If not, your restoration efforts are unlikely to succeed. For example, if fire suppression has changed the groundcover at the site and prescribed burning will never be possible there, simply reintroducing the missing species is unlikely to keep the site restored over time. In cases where factors that caused degradation can't be changed, restoration activities should not be started; effort should instead be shifted to a different location. In areas where the sources of degradation can be changed, restoration should begin only after these factors have been addressed. For example, in an area where bedding was used to change the water table to favor the growth of pine trees, many native groundcover plant species would not grow well because of the changes in water availability. Restorationists would need to remove the bedding and restore the hydrology (the water cycle) before attempting to reintroduce the native groundcover.

2. Define your goals and objectives in very specific terms.

No single groundcover restoration plan would work at all sites. This is because restoration efforts must be tailored to address the unique problems that exist at each site. Before

1. This document is WEC269, one of a series of the Wildlife Ecology and Conservation Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date November 2009. Reviewed March 2013. Visit the EDIS website at http://edis.ifas.ufl.edu.

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beginning to plan a timeline of activities for restoring groundcover, it is important to identify the target conditions you are aiming for. The goals of a restoration project should be broad statements of what you hope to achieve. For example, the restoration goal of your site may be to establish native groundcover species in an area that was converted to a pasture of nonnative grasses. Within this goal should be more specific objectives, which are more detailed statements describing the results you want to achieve. An example of an objective for restoring a pasture might include reducing the cover of non-native species to 10% within the next 5 years. By deciding in the beginning exactly what you are trying to achieve, you'll have a much clearer idea of when you've achieved it!

3. Carefully consider how realistic your goals and objectives are.

Finances should be one of your most important considerations when planning for groundcover restoration. It's important to realize that the costs of the long-term maintenance may be more than the costs of the initial restoration activities. Many restoration efforts fail in the long run because not all expenses were included during planning.

Before starting any restoration activities, ensure reliable, continuing access to funding, labor, equipment, and seeds or transplants of the species you want to reintroduce. If any of these resources are limited or uncertain, it is best to delay the start of the project.

The costs that should be budgeted for a groundcover restoration project are:

- Assessment of both the site to be restored and the reference sites (discussed below)
- Purchase or rental of mechanical equipment
- Mechanical preparation and maintenance of the site (disking, mowing, roller-chopping, etc.)
- Chemical preparation and maintenance of the site (spraying herbicides)
- Pyric preparation and maintenance of the site (prescribed burning)
- Purchasing or growing plants and/or seeds to reintroduce to the site
- Seeding and planting of desired groundcover
- Monitoring

If labor is limited, try contacting county agricultural Extension agents, local plant societies, botanical gardens, high schools, and colleges. These organizations may have volunteers willing to donate their time and effort to assist with restoration.

4. Identify the reference community for your site.

The goal of most restoration projects is to restore the ecosystem that existed at that site before it was damaged. Unfortunately, a description of the conditions at the site to be restored is often unavailable. When historical descriptions cannot be found and there is no intact habitat on your site to compare to, you can use off-site locations (known as "reference sites") as models. Carefully matched reference sites can help you define your restoration objectives by giving you a standard to imitate. Agency biologists or extension agents working in your area may be able to help you find a suitable reference site for your restoration project.

5. Determine which restoration activities will be needed to reach the restoration goals you set for your site.

Conduct a "site assessment" at your reference sites and at the site you want to restore to inventory the characteristics of each site. This will allow you to compare the sites and develop a list of problems that need to be addressed to make your site more like the reference sites.

The specific activities that will be needed to restore the groundcover at your site can be determined using information in the references listed at the end of this document or by contacting specialists who have been restoring similar habitats in your region. Specific restoration activities you may want to consider are listed in Table 1.

Each of these techniques can be used alone or in combination with others.

6. Develop a detailed project schedule, but be prepared to change it.

Successful restoration requires planning for both the short and long term. Restoration is a long, complicated process that should involve planning, site assessment, selection of reference sites, careful consideration of potential restoration activities, and monitoring. A detailed timeline of what you will do each season of each year will help keep you on track.

However, it is also important to be willing to change your carefully laid plans. "Adaptive management" is an approach to restoration that involves monitoring the effects of your activities as you go so you can change tactics if your actions are not bringing about the results you want. This flexibility increases your chances of success in the long run. It allows you to learn from your mistakes and not repeat them again.

7. Monitor.

The best way to determine if your groundcover restoration project is successful is through periodic sampling of the groundcover. Measure such characteristics as percent cover (the amount of area covered by plants) and species richness (the number of species of plants present) and compare them to the same characteristics at your reference sites. This will help determine how effective your restoration efforts have been. Monitoring is the only way you can identify which restoration activities are producing the results you want and which are not.

Keeping a photographic record is a good way to guage your progress. Set up photostations so that you can take pictures at the same locations looking in the same directions at regular intervals over time. Making use of photostations is an efficient and simple method to observe changes in vegetation. Along with photographs, conduct regular plant sampling to determine which groundcover species are thriving, and how close you are to restoration success.

Important Considerations for Groundcover Establishment

The number of decisions that must be made in a groundcover restoration project can be overwhelming. You need to decide which site conditions to change, select techniques to make these changes, determine if invasive species need to be controlled and if so which techniques would be best for this, decide whether to rely on nature to bring in desired species or to use direct seeding or outplanting of seedlings/tubelings, decide where and how to obtain seeds or seedlings/tubelings, determine what equipment you will need to do the planting, and decide whether prescribed burning would be appropriate, and if so, how often. Furthermore, the time of year that each of these activities takes place and the ordering of activities will affect your restoration success. There is a lot to consider!

Due to the newness of the interest in groundcover restoration, many of the restorationists who have conducted successful projects have not yet written descriptions of their successes. Much of the valuable information they have learned is impossible for others to access.

To help people interested in groundcover restoration to learn from one another, we have created a map of recent groundcover restoration projects. Figure 1 shows the location of over 150 groundcover restoration sites throughout Florida. We recommend contacting individuals working on groundcover restoration in your area for additional assistance. For more information on who is conducting groundcover restoration, see the groundcover restoration manual at http://www.sfrc.ufl.edu/cfeor/Short%20Term%202008.htm.

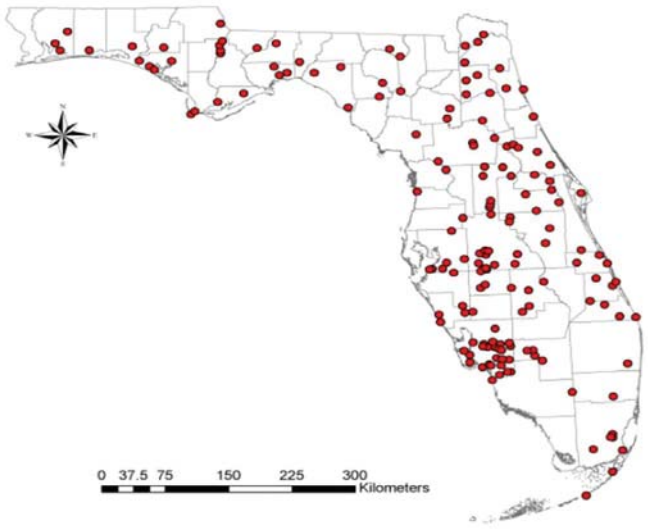

Figure 1. Map of restoration sites.

Additional information

Brockway, D. G., K. W. Outcalt, D. J. Tomczak, and E. E. Johnson. 2005. Restoration of longleaf pine ecosystems. USDA Forest Service GTR-SRS-083. Southern Research Station, Asheville, NC.

Gordon, D. 1994. Translocation of species into conservation areas: a key for natural resource managers. Natural Areas Journal 14: 31-37.

Tanner, G. W., W. R. Marion, and J. J. Mullahey. 1991. Understanding fire: nature's land management tool. University of Florida, IFAS Extension document CIR 1018. http://edis.ifas.ufl.edu/UW124.

Trusty, J. L., and H. K. Ober. 2009. Groundcover restoration in forests of the Southeastern United States. Available at http://www.sfrc.ufl.edu/cfeor/Short%20Term%202008.htm.

USDA Natural Resources Conservation Service. 2008. Range planting: Conservation practice standard 550 guidance. Field office technical guide, section 4. http://efotg.sc.egov.usda.gov/references/public/NE/NE550.pdf [1 June 2012].

Walker, J. L. and A. M. Silletti (2006). Restoring the ground layer of longleaf pine ecosystems. Pp. 297-333 in S. Jose, E. J. Jokela, and D. L. Miller (editors). The Longleaf Pine Ecosystem. New York, NY: Springer.

Table 1. Activities that can help establish native groundcover

Restoration activities	What they will accomplish
Harvesting or thinning canopy trees	
Mechanical treatment of shrubs (i.e., disking, roller-chopping, mowing)	
Chemical treatment of invasive species (i.e., spraying herbicides)	
Pyric treatment (i.e., prescribed burning)	
Outplanting or direct seeding	

More Resources and Links

University of Florida / IFAS Extension Publications:

Considerations for Developing Effective Herbicide Prescriptions for Forest Vegetation Management, https://edis.ifas.ufl.edu/fr335

Herbicides Registered for Pine Management in Florida, https://edis.ifas.ufl.edu/fr158

Herbicide Application Techniques for Woody Plant Control, https://edis.ifas.ufl.edu/ag245

Opportunities for Uneven-Aged Management in Second Growth Longleaf Pine Stands in Florida, https://edis.ifas.ufl.edu/fr132

Gopher Frogs, Burrows, and Fire: Interactions in the Longleaf Pine Ecosystem, https://edis.ifas.ufl.edu/uw295

Groundcover Restoration in Forests of the Southeastern United States, http://sfrc.ufl.edu/CFEOR/index.html

Resources from Partner Organizations:

The Longleaf Alliance is the “Go-To Resource for all things Longleaf", www.longleafalliance.org

Longleaf Alliance restoration and management keys, http://www.longleafalliance.org/restoring-and-managing/restoration

Longleaf Alliance List of seed sources, http://www.longleafalliance.org/resources/contractor%20list.pdf

Groundcover Restoration Implementation Guidebook (FL Fish and Wildlife Conservation Commision), http://www.floridainvasives.org/central/GCRGuidebook.pdf

Joseph W. Jones Ecological Research Center Outreach Publications, http://www.jonesctr.org/products/outreach/

Florida Wildflowers Growers Cooperative, http://www.floridawildflowers.com/

Andrews Nursery, Florida Forest Service, http://www.freshfromflorida.com/Divisions-Offices/Florida-Forest-Service/For-Landowners/Programs/Bare-Root-Tree-Seedlings-For-Sale/Andrews-Nursery

The Natives, Inc., http://www.thenatives.net/

Florida Association of Native Nurseries, http://www.floridanativenurseries.org/

Forest Plants of the Southeast and their Wildlife Uses, James H. Miller and Karl V. Miller, University of Georgia Press. (for sale) http://www.ugapress.org/index.php/books/forest_plants_of_southeast

UF/IFAS Forest Management and Stewardship Extension Publications on EDIS:

http://edis.ifas.ufl.edu/TOPIC_Forest_Management_and_Stewardship

- Assessing the Economic Feasibility of Short-Rotation Woody Crops in Florida
- Assessment and Management of Hurricane Damaged Timberland
- Beyond the Trees: A Systems Approach to Understanding Forest Health in the Southeastern United States
- Cooperation and Communication: Benefits for Non-Industrial Private Forest Landowners
- Dead Wood: Key to Enhancing Wildlife Diversity in Forests
- Florida Forest Landowner Preferences for Carbon Offset Program Characteristics
- Forest Management in the Interface: Forest Health
- Forest Management in the Interface: Practicing Visible Stewardship
- Forest Resource Information on the Internet: Connecting to Today's Online Resources
- Improving, Restoring, and Managing Natural Resources on Rural Properties in Florida: Sources of Financial Assistance
- Improving, Restoring, and Managing Wildlife Habitat in Florida: Sources of Technical Assistance for Rural Landowners
- Longleaf Pine Regeneration
- Making the Most of Your Mast
- Management Practices to Support Increased Biodiversity in Managed Loblolly Pine Plantations
- Opportunities for Uneven-Aged Management in Second Growth Longleaf Pine Stands in Florida
- An Overview of Carbon Markets for Florida Forest Landowners
- Ownership Succession: Plan Now for the Future of Your Land
- Selecting a Consulting Forester
- Steps to Marketing Timber
- Stewardship Ecosystem Services Study Series: Assessing Forest Water Yield and Purification Ecosystem Services in the Lower Suwannee River Watershed, Florida
- Stewardship Ecosystem Services Study: Carbon Stores on Florida Forest Stewardship Program Lands
- Ten Tips for Encouraging the Use of Your Pine Plantations By Game Species
- Ten Tips for Increasing Wildlife Biodiversity in Your Pine Plantations
- Thinning Southern Pines - A Key to Greater Returns
- Tips for Integrating Land and Wildlife Management: Deer in Forests
- Tips for Integrating Land and Wildlife Management: Quail and Timber
- Using Soils to Guide Fertilizer Recommendations for Southern Pines
- What is in a Natural Resource Management Plan?
- What to Expect in a Forest Inventory

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