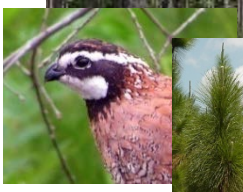
Apalachicola Regional Stewardship Alliance and **Greenwood Plantation**

Present a Workshop:

Longleaf Pine Forest Restoration & Management



June 2nd, 2016, 8:30 am – 3:30 pm Eastern Time

Greenwood Plantation

Thomasville Bypass /Cairo Road, Thomasville GA 31792

Longleaf pine has many favorable characteristics for landowners with long-term, multiple-use land management objectives. Longleaf pine yields a large proportion of high value solid wood products, is adapted to fire and is resistant to many insects and diseases. Longleaf pine forests provide ideal habitat for a diverse array of plants and animals. The goal of the workshop is to educate private landowners about longleaf pine habitat management, restoration efforts and available technical and cost-share assistance.

Agenda (Eastern Time):

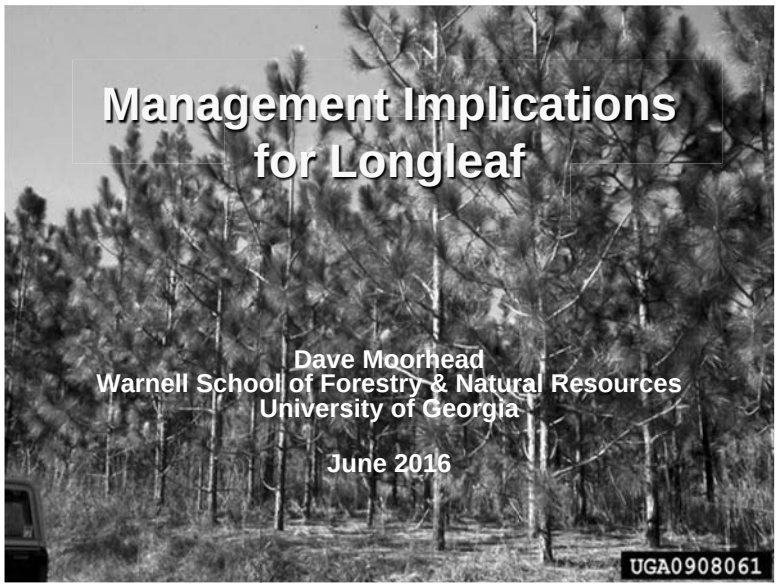
8:30 am	**Sign-in, meet & greet**
9:00	**Welcome, Introduction**
9:15	**Why Longleaf Pine?** *David Moorhead, UGA Extension Forester*
9:45	**Prescribed Fire**, *Shan Cammack, Georgia DNR*
10:15	**Regional Fire Resources,** *David Godwin, Southern Fire Exchange*
10:30	**Groundcover Restoration and monitoring**, *Brian Pelc and Holly Ober, The Nature Conservancy and UF/IFAS Extension Biologist*
11:00	**Managing Wildlife in the Longleaf Forest**, *Phil Spivey, Georgia DNR*
11:30	**Landowner Cost Share Incentives**, *Scott Griffin, Georgia Forestry Commission*
12:00 pm	**Lunch**
1:00	**Field tour**
3:30	**Conclusion, evaluation and adjourn**

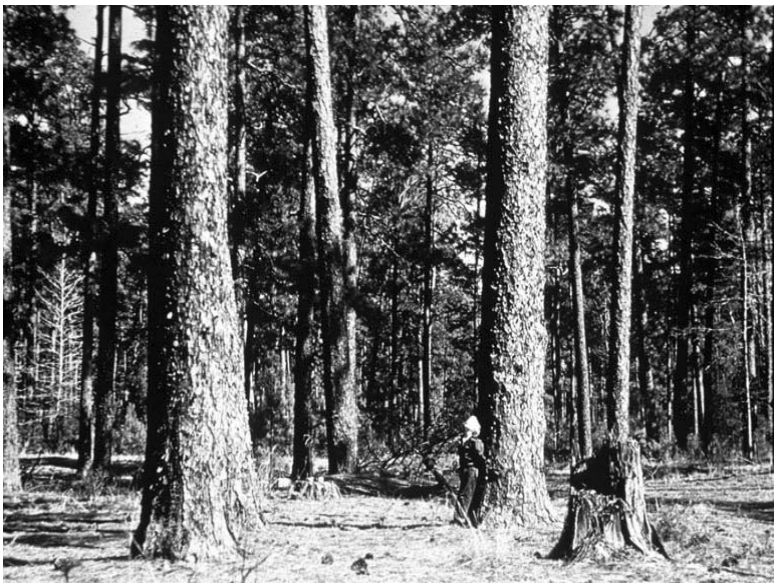
Funding for this workshop is provided by the National Fish and Wildlife Foundation Longleaf Stewardship Fund and the USDA Forest Service through the Florida Department of Agriculture and Consumer Services Florida Forest Service.

Table of Contents

Resource Contacts

Shan Cammack Fire Management Officer Georgia Dept. of Natural Resources 2065 US Hwy 278 SE Social Circle, GA 30025 (770) 519-5022 shan.cammack@dnr.ga.gov	**Scott Griffin** Associate Chief, Forest Management Georgia Forestry Commission 3005 Atlanta Highway Gainesville, GA 30507 (770) 530-3929 sgriffin@gfc.state.ga.us	**Holly Ober** Associate Professor UF/IFAS North Florida Research and Education Center 155 Research Road Quincy, FL 32351 (850) 875-7150 holly.ober@ufl.edu
Chris Demers Extension Program Manager University of Florida IFAS School of Forest Resources and Conservation PO Box 110410 Gainesville, FL 32611 (352) 846-2375 cdemers@ufl.edu	**Ricky Lackey** Regional Biologist National Wild Turkey Federation 998 SW Yorktown Glen Lake City, FL 32025 (229) 378-0003 rlackey@nwtf.net	**Brian Pelc** Restoration Specialist The Nature Conservancy 625 North Adams Street Tallahassee, FL 32301 (850) 222-0199 ext. 103 bpelc@tnc.org
David Godwin Program Coordinator Southern Fire Exchange University of Florida Tallahassee, Florida (850) 893-4153 ext. 261 drg2814@ufl.edu	**David Moorhead** Extension Forester University of Georgia Warnell School of Forestry and Natural Resources 2360 Rainwater Road Tifton, GA 31793 (229) 386-3298 moorhead@uga.edu	**Phil Spivey** Wildlife Biologist Georgia Dept. of Natural Resources (229) 376-1920 phillip.spivey@dnr.ga.gov


Management Implications
for Longleaf
Dave Moorhead
Warnell School of Forestry & Natural Resources
University of Georgia
June 2016
UGA0908061




UGA1146009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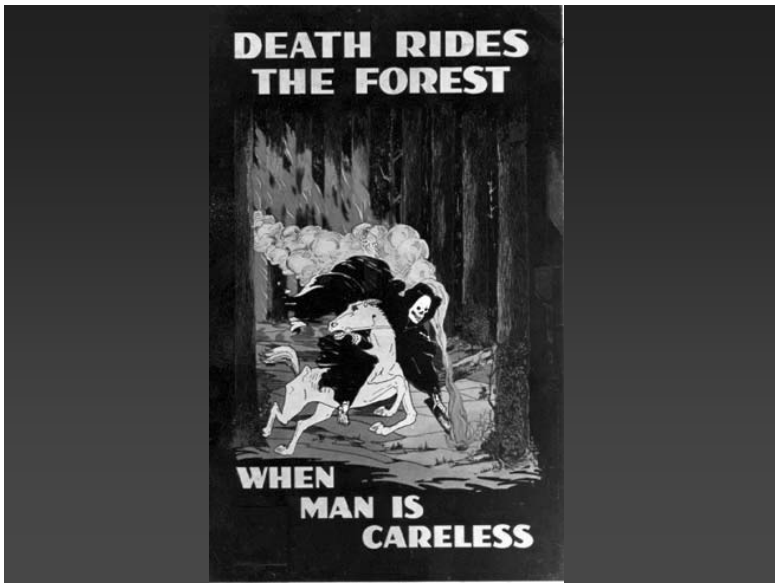
UGA1420094


UGA1420127


UGA1420156


UGA1420046


UGA1420103


DEATH RIDES
THE FOREST
WHEN
MAN IS
CARELESS


SMOKEY SAYS—
Care will prevent
9 out of 10 forest fires!


UGA1


UGA1420111

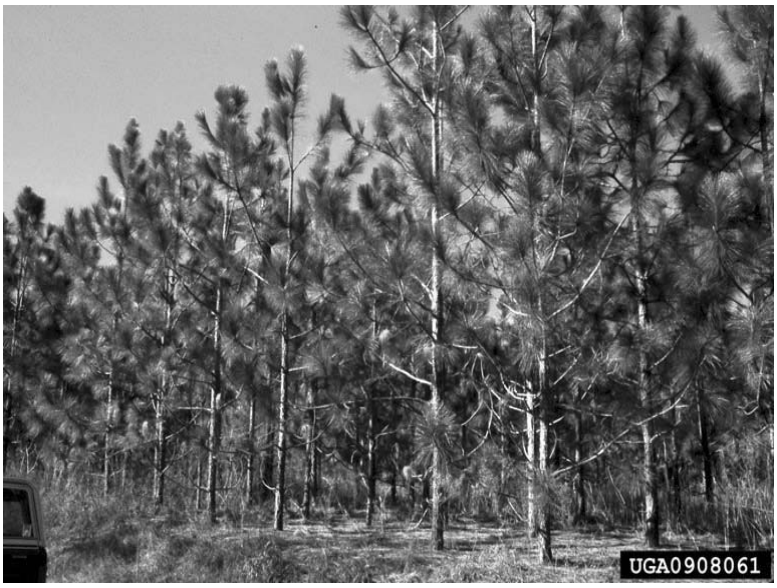

5433058


UGA1


UGA1420043

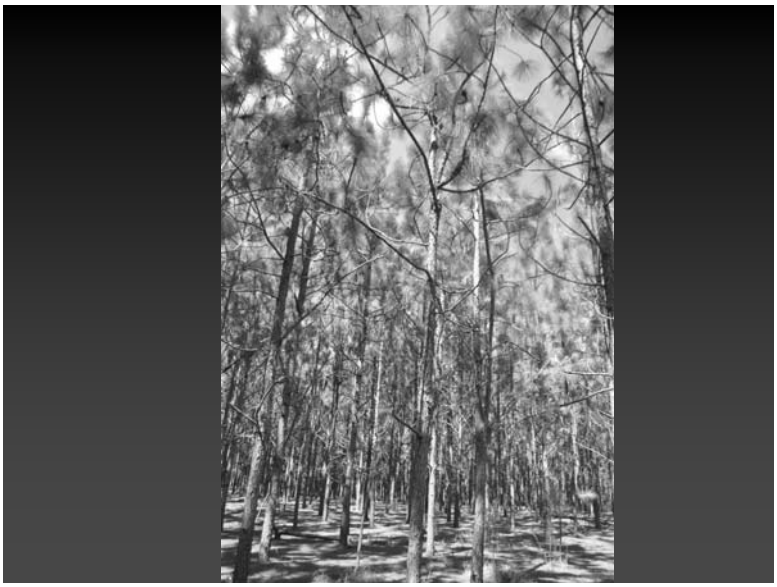

UGA1146009


Age 3
UGA1403040


UGA0908061


UGA0908071


Age 10



The ability to burn longleaf early and often, creates rich understory communities and good wildlife habitat throughout the early life of the stand. ***John P. McGuire, Longleaf Alliance***


Photo by Gifford Pinchot 1897 Baldwin Co., AL


LONGLEAF PINE: THE FIRE FOREST
Shan Cammack, Fire Management Officer
Georgia Department of Natural Resources
Wildlife Resources Division
Nongame Conservation Section


The Importance in a Fire Forest
• Reduce competition for longleaf
• Stimulate groundcover diversity
• Reduce fuels to prevent catastrophic wildfires
1/30/2001


General Management Objectives Achieved by Fire
Reduce hazardous fuels
Prepare seedbeds
Suppress woody vegetation
Recycle nutrients
Increase forage
Increase herbaceous diversity
Enhance wildlife habitat
Enhance threatened and endangered species habitat
Remove litter and debris
Promote fire adapted species
Control exotic species
Control disease


RX fire helps keep fuel loads low.

Prepare a Burn Plan

Author/Burn Boss (*name and contact info*)

Important Contacts (*GFC, LE, medical, fire*)

Purpose of Burn (*ecological, fuel reduction*)

Unit Description (***fuel types and loading***, *hazards, surrounding fuels*)

Previous Burning Events (*RX and wildfire*)

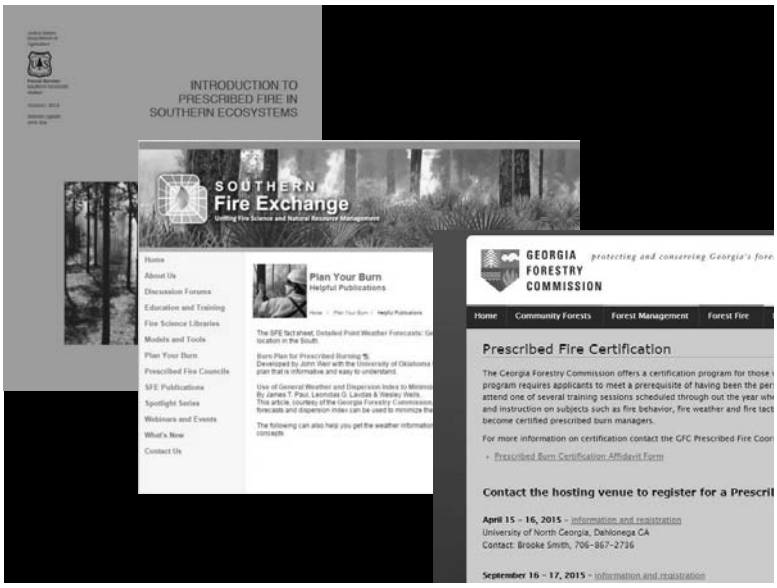
Weather Parameters (*winds, temp, rH, mixing height*)

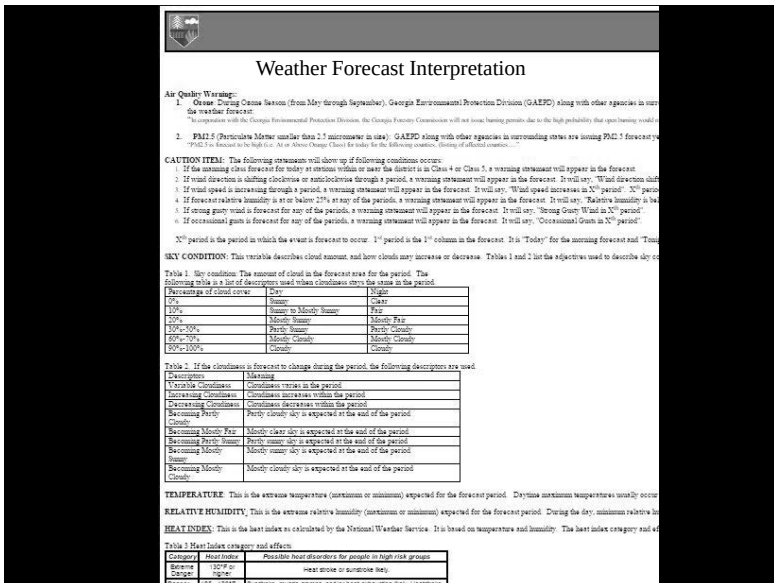
Smoke Management Plan (*sensitive areas and distance, down-drainage*)

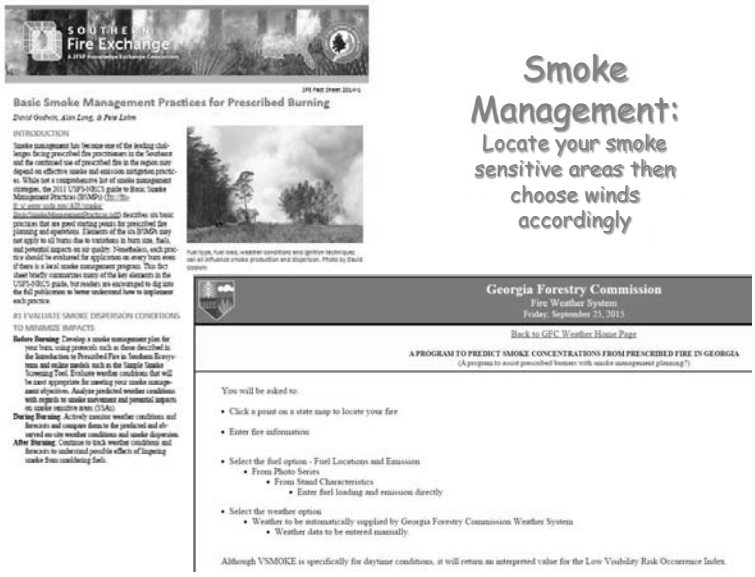
Burn Management (*firebreaks, ignition, holding, mop-up, map*)

Contingencies (*escape routes, secondary control lines*)

Post Burn Monitoring (*objectives met, consumption, problems*)

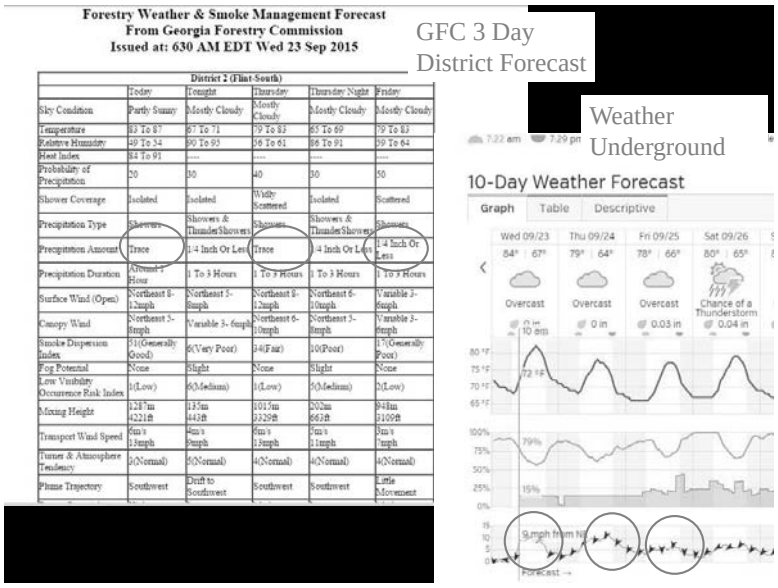






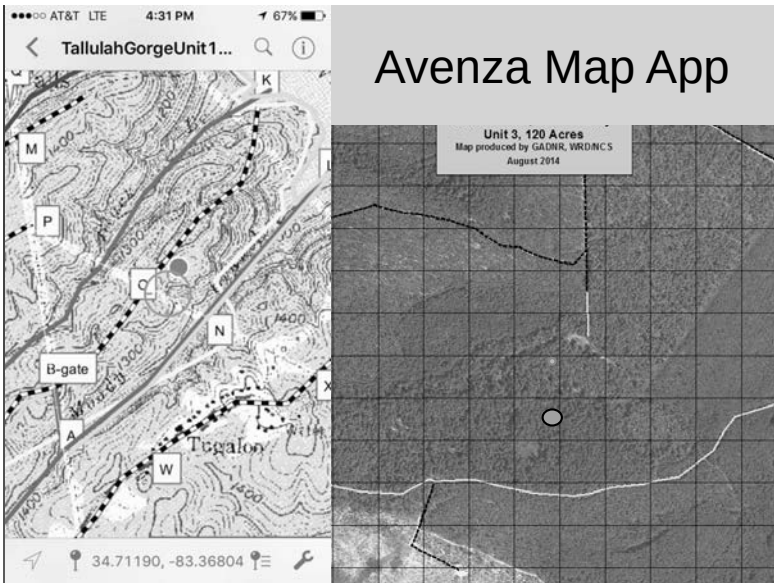
Smoke Management:

Locate your smoke sensitive areas then choose winds accordingly

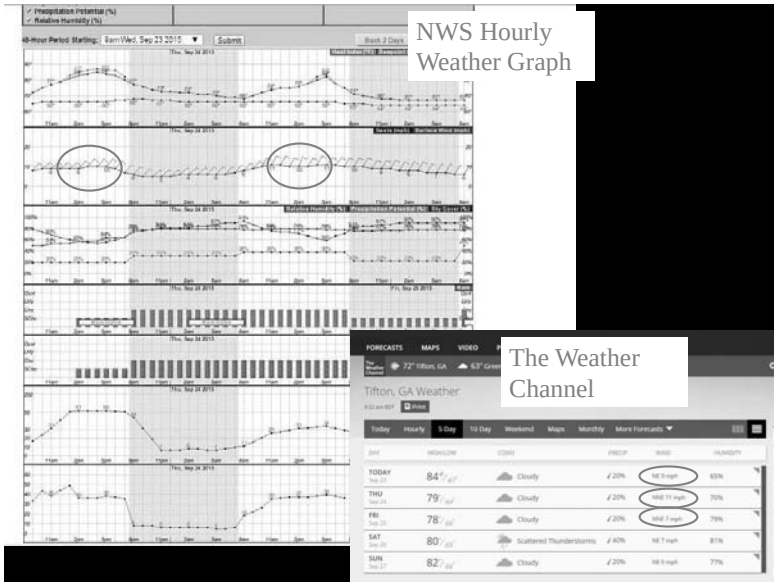


GFC 3 Day District Forecast

Weather Underground

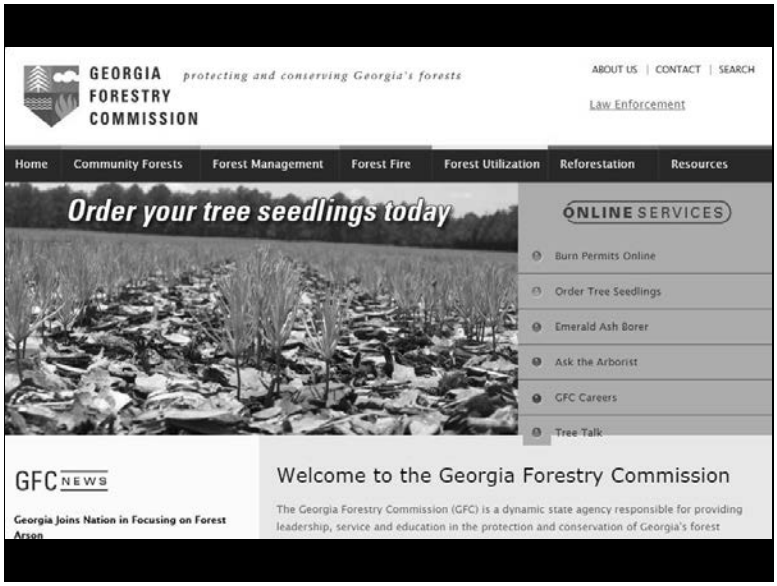


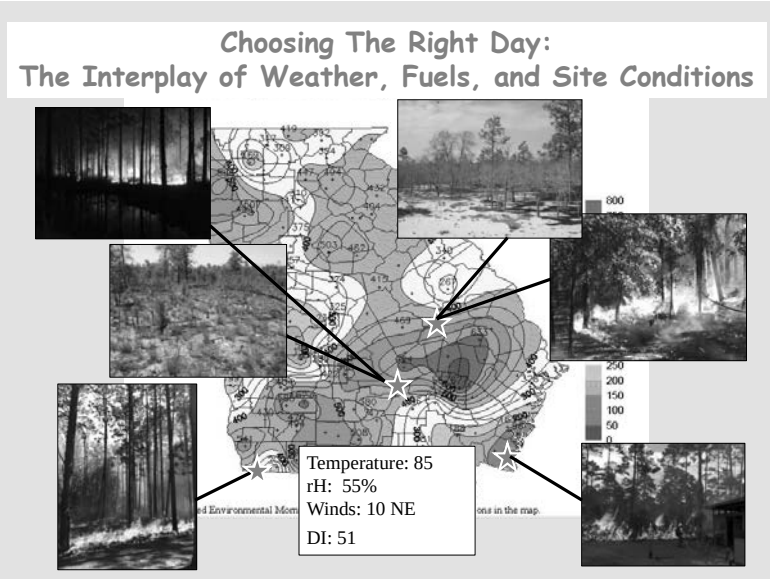
Avenza Map App



NWS Hourly Weather Graph

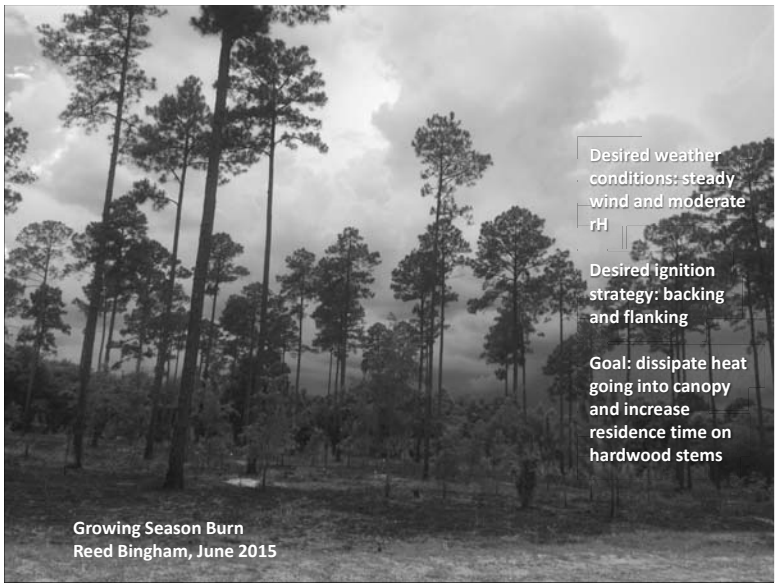
The Weather Channel

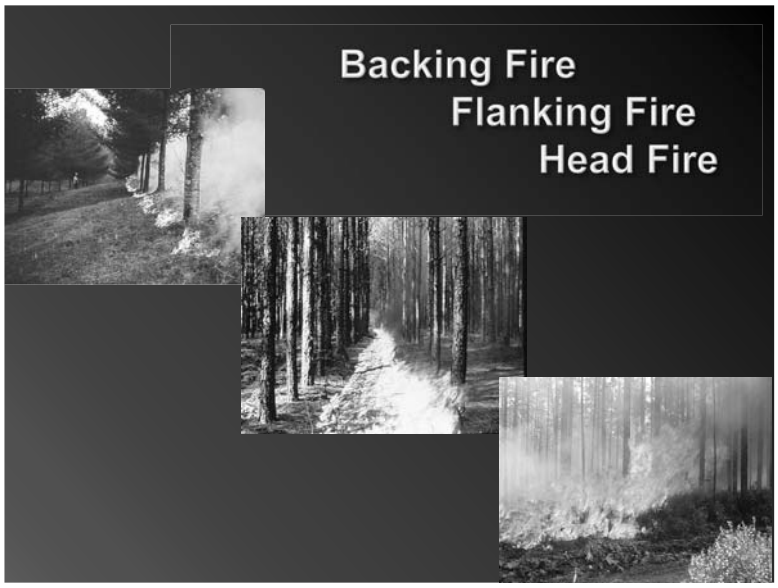


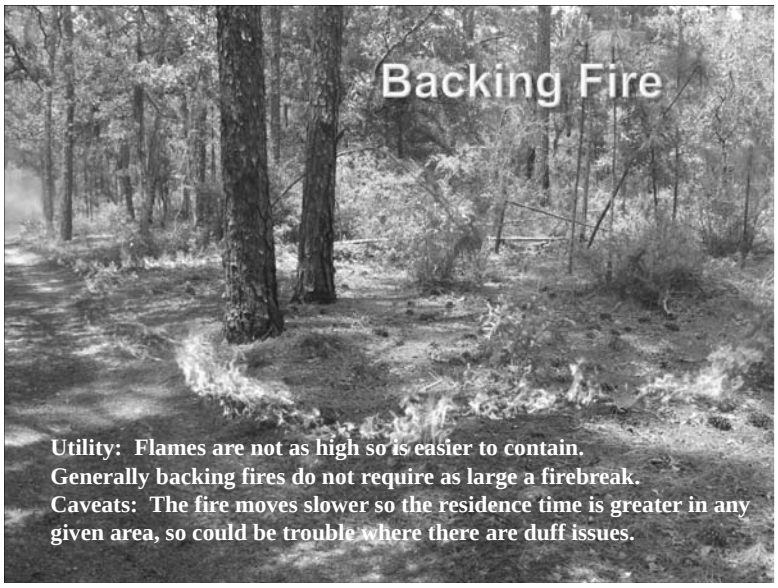

Choosing The Right Day:
The Interplay of Weather, Fuels, and Site Conditions
Temperature: 85
rH: 55%
Winds: 10 NE
DI: 51

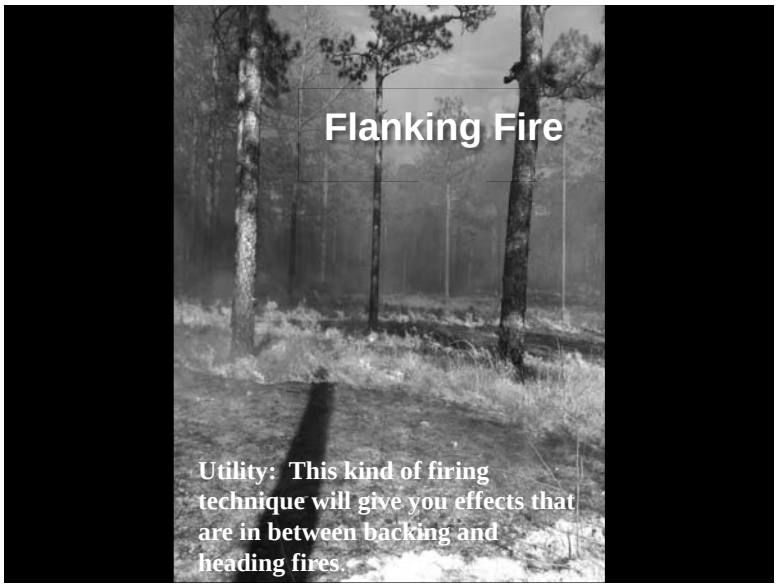

Burn Objectives Drive
Ignition Strategies

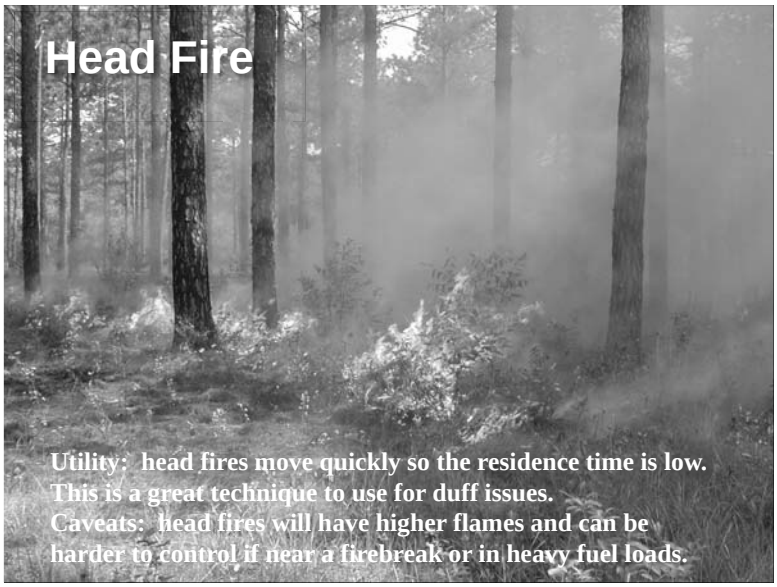

Light
Assess
Adapt

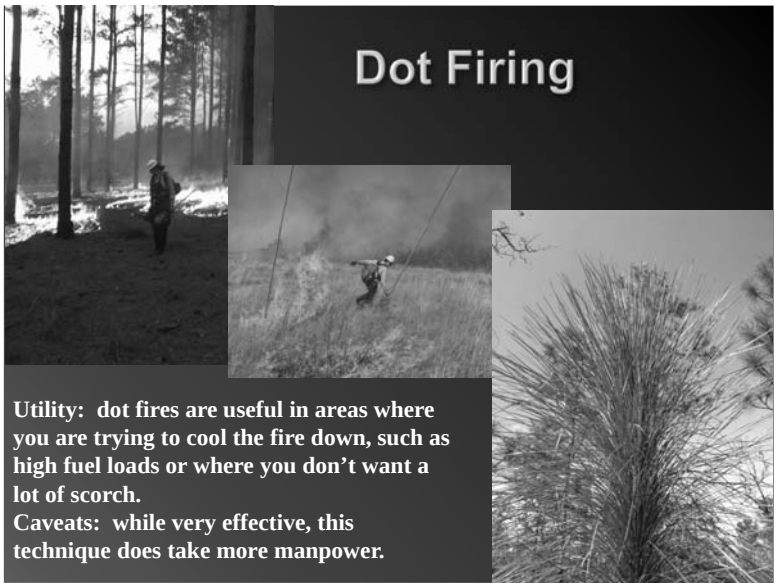

Desired weather conditions: steady wind and moderate rH
Desired ignition strategy: backing and flanking
Goal: dissipate heat going into canopy and increase residence time on hardwood stems
Growing Season Burn
Reed Bingham, June 2015


Backing Fire
Flanking Fire
Head Fire

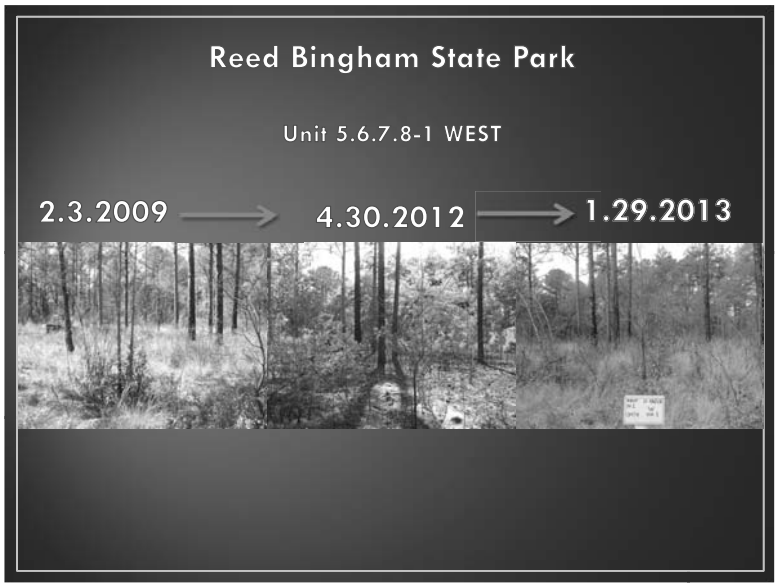

Backing Fire
Utility: Flames are not as high so is easier to contain.
Generally backing fires do not require as large a firebreak.
Caveats: The fire moves slower so the residence time is greater in any given area, so could be trouble where there are duff issues.


Flanking Fire
Utility: This kind of firing technique will give you effects that are in between backing and heading fires.


Head Fire
Utility: head fires move quickly so the residence time is low. This is a great technique to use for duff issues.
Caveats: head fires will have higher flames and can be harder to control if near a firebreak or in heavy fuel loads.


Dot Firing
Utility: dot fires are useful in areas where you are trying to cool the fire down, such as high fuel loads or where you don't want a lot of scorch.
Caveats: while very effective, this technique does take more manpower.


AVOIDANCE FIRING


Reed Bingham State Park
Unit 5.6.7.8-1 WEST
2.3.2009
4.30.2012
1.29.2013

SOUTHERN Fire Exchange

JOINT FIRE SCIENCE PROGRAM

Fire Science Resources

Tools for developing plans and addressing management questions

June 2016| Longleaf Pine Forest Restoration and Management Workshop
David Godwin
Program Coordinator

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

www.SouthernFireExchange.org

- Southern fire news and science information
- All SFE fact sheets and newsletters
- Workshops and webinars
- Presentation recordings and archives
- Links to funding opportunities and grants
- Prescribed Fire Council meeting notices
- Tools for fire planning (weather / models / plans)
- Links to many other resources

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A JFSP Knowledge Exchange Consortium

SFE Resources

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

SFE Fire Science Fact Sheets :

- *Cypress Mortality Following Wildfires*
- *Nests Under Fire: Effect of Season of Burn*
- *Accessing FRAMES and the Southern Fire Portal*
- *Accessing Joint Fire Science FireScience.gov*
- *Searching the Tall Timbers Fire Ecology Database*
- *Economic Impacts of Wildfire*
- *Effects of Prescribed Fire and Wildfire in NC*
- *Effects of Prescribed Fire and Wildfire in FL*
- *Health Effects of Wildland Fire Smoke*
- *Accessing Detailed Point Weather Forecasts*
- *Predicting Smoke Movement with Computer Models*
- *Nighttime Smoke and Fog on Prescribed Fires*
- *Smoke Prediction with VSMOKE*
- *Wildfire Ignitions in the Southeast*
- *Mechanical Treatments in Pine Flatwoods*

Recent Fact Sheets :

- **Using the Fire Effects Information System (FEIS)**
- **GPS Enabled Maps on a Mobile Device**
- **Fire Science Continuing Education**

Over 25 different fact sheets covering a wide range of topics!

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

Accessible Fire Science for Resource and Fire Managers

- SFE is one of 15 JFSP regional Fire Exchanges serving fire managers and science providers
- SFE Started 2010
- Goal: enhance fire science delivery and adoption

JOINT FIRE SCIENCE PROGRAM

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

***"Fire Lines"* Digital Newsletter**

- Southern Fire Science News
- Research Briefs
- Lessons Learned Reports
- Management Discussions
- Training Opportunities
- Events / Conferences

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

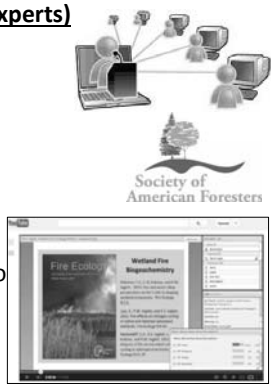
Webinars (w/ Scientists, Researchers, and Experts)

-Many count towards SAF CFE credit

-Free and last about an hour

-Topics Include:

- Wildlife Management
- GIS / Mapping
- Prescribed Fire Techniques
- Smoke Management and Smoke Mo
- Fire Weather
- Invasive Species



http://www.youtube.com/user/SouthernFireExch

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

Fire Effects Information System (FEIS)

- Reviews of scientific literature for select individual species, including:
  - Life History / General Ecology
  - Fire Ecology and Effects
  - Management Considerations
- FEIS includes over 1,100 plant and animal species!

http://www.feis-crs.org/beta/

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

SFE Field Workshops:

Past Locations: GA, FL, SC, MS, TX, VA, LA, AR

Topics have included:

- Longleaf Pine Restoration
- WUI RxFire Programs
- Groundcover Restoration
- Mechanical Treatments
- Wetland Restoration

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Fire Effects Information System (FEIS)

- Many ways to search:
  - Common or Scientific Name
  - Life Form (tree, grass, shrub, bird mammal, etc.)
  - Native vs. Nonnative
  - Federal Legal Status
  - State / Location (Online Map)
  - Plant Community

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Fire Effects Information System

SOUTHERN Fire Exchange
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Some FEIS Results

- Fire Ecology and Adaptations
- Post Fire Regeneration
- Associated Fire Regimes / FRI
- Immediate Fire Effects
- Fire Management Considerations
- Scientific Publication Citations

  (For example: 48 for slash pine)

SPECIES: Pinus elliottii

FIRE ECOLOGY OR ADAPTATIONS :
Young slash pine is susceptible to fire, but mature trees are fire resistant [6]. Thick bark and high, open crowns allow individuals to survive fire. Slash pine, however, is less fire resistant than longleaf or sand pine [27]. Seedlings grow fast, and in 10 to 12 years slash pine is resistant to fire that does not crown [40].

Estimates of the natural fire frequency of slash pine flatwoods range from 3 to 15 fires per century [8,21]. A fire interval of at least 5 to 6 years allows young trees to develop some fire resistance. Fires are ignited by lightning in late spring and summer [10,61]. Ample soil moisture and seasonally wet depressions and drainages of slash pine habitat impede fire entry. Occasional fire serves to reduce hardwood competition and expose mineral soil which enhances germination [21,24].

The bark structure of slash pine is important to its fire resistance. Outer bark layers overlap and protect grooves where the bark is thinner [6]. The platy bark flakes off to dissipate heat [21].

The South florida variety is more fire resistant than the typical variety because seedlings and saplings have thicker bark [1,2,24,62]. The estimated natural fire frequency of South florida slash pine communities is 25 fires per century [21]. Crown fires are rare because frequent fires reduce fuel build-up, trees self-prune well, and stands are open [1]. In addition to adaptations of the typical slash pine variety, the South florida variety is fire resistant in the seedling grass stage. A dense tuft of needles protects the terminal bud. If top-killed by fire, the grass-stage seedling may sprout from the root collar [65]. See the longleaf pine review for further information on grass-stage seedlings.

…And more!

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A JFSP Knowledge Exchange Consortium

Fire Effects Information System (FEIS) Resources

FEIS Online Available at:

- http://www.feis-crs.org/beta/

SFE 3 page fact sheet with instructions and tips available at:

- http://www.southernfireexchange.org
- **(Search 'FEIS')**

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

E.V. Komarek Fire Ecology Database

- Over 30,000 citations
- Founded in 1987 by Tall Timbers Research Station
- Curated by Tall Timbers librarian
- Funded by SFE, TTRS, JFSP
- New citations added yearly

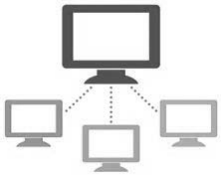
http://talltimbers.org/fire-ecology-database/

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

Learn more about FEIS though a live webinar!

"Finding the Best Science Available on Fire Ecology and Fire Regimes in Southeastern Ecosystems."

Wed. 1 PM ET August 31, 2016



Look for registration later this summer at:
http://www.southernfireexchange.org

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

Database Resources

- Journal articles
- Books and government documents (federal & state)
- Conference proceedings (including all Proceedings of the TTRS Fire Ecology Conferences, with abstracts)
- Theses and dissertations
- Interesting Old Stuff You Won't Find Anywhere Else

http://talltimbers.org/fire-ecology-database/

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

Tall Timbers Fire Ecology Database

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

Fire Ecology Database Pros & Cons

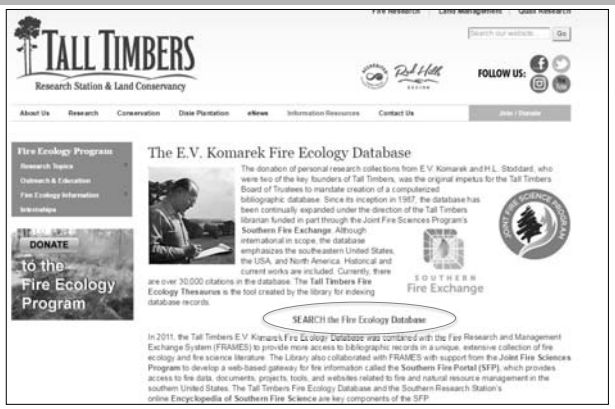
Pros:

- Over 30,000 citations
- Older and obscure citations
- Organized using fire specific search terms

Cons:

- Very few links to actual documents
- Updates are once or twice per year
- Content not directly searchable but based on assigned search terms

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium



http://talltimbers.org/fire-ecology-database/

SOUTHERN Fire Exchange
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USFS TreeSearch

- Contains 46,000 publications from USFS research personnel
- Easy to use interface like Google for all USFS research publications
- All publications are free with direct links to .pdf files
- New resources added yearly
- Publications are peer-reviewed

Example: Searching “longleaf pine” pulls up a list of 649 publications!

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

Fire Ecology Database Links

E.V. Komarek Fire Ecology Database available at:

- http://talltimbers.org/fire-ecology-database/

SFE fact sheet with instructions and tips available at:

- http://www.southernfireexchange.org
- (Search “Fire Ecology Database”)

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

http://www.treesearch.fs.fed.us/

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

USFS TreeSearch

SOUTHERN Fire Exchange
A JFSP Knowledge Exchange Consortium

Connect with us!

www.SouthernFireExchange.org

contactus@southernfireexchange.org

@SEFireScience

facebook.com/sefirescience

www.linkedin.com/company/southern-fire-exchange

https://www.youtube.com/user/SouthernFireExch

http://www.flickr.com/photos/105057014@N02/

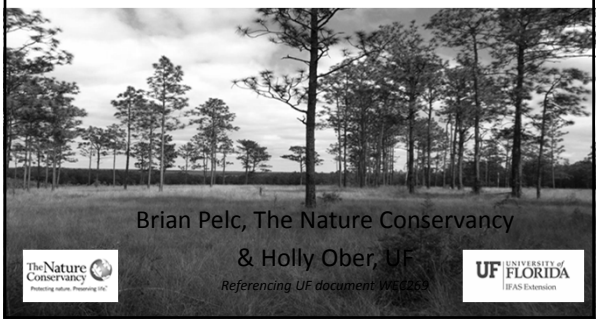
Accessible Fire Science for Resource and Fire Managers

Questions?

Thank you!

David Godwin
Program Coordinator
Southern Fire Exchange
drg2814@ufl.edu

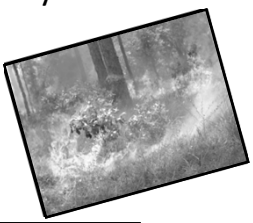
Longleaf Pine Forest Groundcover Restoration



Brian Pelc, The Nature Conservancy
& Holly Ober, UF

Referencing UF document WEC269

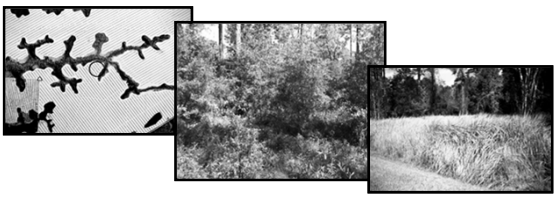
Why do we restore groundcover?



- For management
- For wildlife
- For biodiversity
- For sense of place

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

- Previous land use like bedding or windrowing
- Fire suppression and canopy closure
- Invasive species



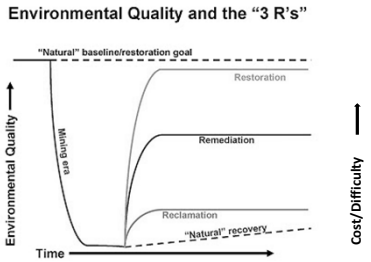
2. Define your goals and objectives in very specific terms

- "I want to have a nice place to walk"

⇩ {Longleaf Forest Threshold} ⇩

- "I want to encourage better fuels"
- "I want more wildlife"
- "I want to recreate historic conditions"

3. Carefully consider how realistic your goals and objectives are



Carefully consider your costs

Calculate not just initial costs, but also maintenance costs

- Labor and time
  - Assess the site to be restored
  - Assess the reference site
  - Mechanical treatments (roller-chopping, mowing, disking)
  - Herbicide application
  - Prescribed burning
  - Growing plants from seed?
  - Planting seeds or plugs
  - Monitoring

- Equipment
  - Purchase or rent all large equipment for roller-chopping, mowing, disking
  - Purchase herbicides, and purchase or borrow tanks, sprayers, ATVs
  - Arrange for safety equipment to be on hand for prescribed burns
  - Purchase plants and/or seeds of desired plants

4. Identify the reference community for your site

- Agency contacts can help with this

Sandhill Site

Flatwoods Site

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

- *Agency contacts can help with this also*
- *Based on land history, available resources and desired future condition*

Timber harvest and prescribed fire

Bare mineral soil moonscape

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

How we do it?

- Site Prep
  - Canopy mods (thinning, clear cut, replant)
  - Midstory mods (roller chop, gyrotrac, mow, chainsaw)
  - Understory mods (collect and sow native seed mix)

Seed mix collection

- Equipment: simple to complex
- Storage: depends on how soon it will be sown
- Cleaning: depends on how it will be sown
- Testing: can be helpful in estimating outcomes

Collection and Sowing Equipment

- *Contractors are available for this work…but there's room for more!!*

Seed collector : flail-vac by AgRenewal

Seed drill by Grasslander

7. Monitor

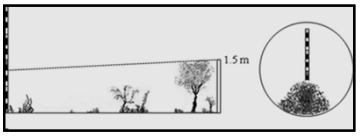
- Periodically characterize the groundcover at your site to tell if your efforts are paying off
- Simple approach: photo-monitoring

7. Monitor

- More complex approach: measure plants

Canopy Cover: cheap method requires an empty paper towel cardboard tube. Estimate what % of view is obstructed by leaves & branches

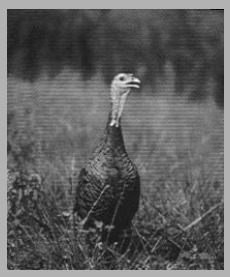
Ground Cover Structure: make a 'cover board' or 'cover pole' with alternating black & white bands. Stand a standard distance away and record which zones are obstructed



Pretty Pictures

Habitat

A combination of resources (food, cover, space, and water) and environmental conditions a particular species needs for survival and successful reproduction.



Example: Wild Turkey Habitat

Nesting Cover
Brood-rearing Cover
Year-round Foraging Areas
Roosting Sites
Display Areas
Loafing/Dusting Sites

It is important to remember that each species has its own unique habitat requirements.

Longleaf-wiregrass ecosystem

Habitat

- Vertical Structure
  - Groundcover
  - Understory
  - Midstory
  - Canopy
- Horizontal Structure
  - Landscape

Flatwoods

- **Because each species has its own unique habitat requirements (niche), some forestry activities may negatively impact some species while benefiting others, or even have no noticeable impact.**

Sandhills

Wetlands:
(seeps, bogs, savannas, ponds, bays)

Fire Suppression

- **Over 80% of Georgia's RT&E species are listed due to a lack of natural and prescribed fire across the landscape**

Early Successional Habitat

29 species listed as special concern, rare, threatened or endangered are associated with open pine savanna

Why the Concern?

- **Lack of knowledge**
- **Habitat loss/Conversion**
- **Development**
- **Pollution**
- **Fire suppression**

Red-Cockaded Woodpecker (RCW)

E

- Decline has paralleled longleaf decline
- Dependent on frequently burned, mature pine stands, usually longleaf
- Cannot tolerate midstory
- Only woodpecker to excavate cavities in living trees

Flatwoods Salamander

T

- Primarily live in burrows just under soil surface
- Migrate to breed in dry basins that eventually fill with rain
- Declined along with longleaf, fire suppression, flatwoods drainage, and mechanical soil disturbance

Gopher Tortoise

T

- Official GA state reptile
- Keystone burrower in coastal plain longleaf community
- Burrows important for many other species

Wood Stork

T

- Storks roost and nest communally in SE GA
- May have several nests in one tree, but tree must be in standing water
- Feeds in tidal creeks, wetlands, sloughs

Gopher Frog

R

- Found near gopher tortoise burrows and stump holes
- Need fishless, isolated wetlands for breeding
- Nocturnal

Eastern Indigo Snake

T

- Longest snake in North America (up to 8.6 ft)
- Highly dependent on gopher tortoise burrows in winter
- Eat venomous snakes, birds, frogs, lizards
- Declined along with longleaf, gopher tortoises, and because of “gassing” tortoise holes.

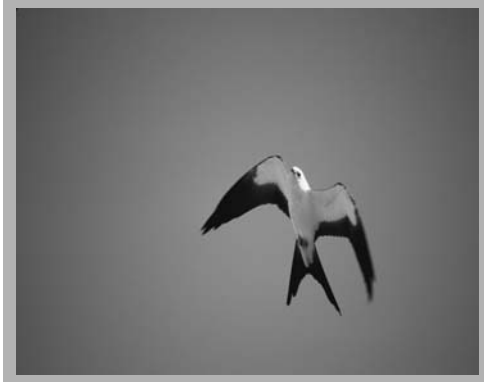
Bachman’s Sparrow

R

- Dependent on open, grassy woods and young clearcuts
- Ground nesters, eat insects and seeds
- Regular fire (1-3 yrs) vital to maintain habitat and grass component

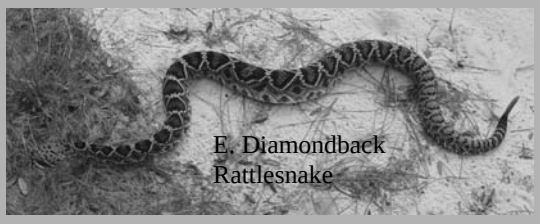
Swallow-tailed Kite

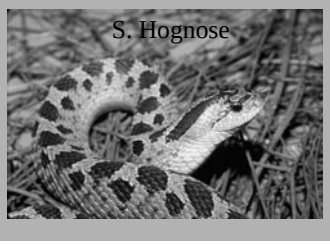
R



- Nests in SE US primarily near rivers
- Very tall pine/cypress trees for nesting
- Bottomland hardwoods, pine flatwoods, marshes, open areas

Snakes





Henslow's Sparrow

R

- Winters in SE US- grassland bird
- Depend on longleaf pine savanna, wet pine flatwoods, overgrown fields
- Paulks Pasture WMA/Plum Creek

Management Considerations

- Gopher tortoises
  - 20-25' buffer around burrow,
  - Flag active burrows
  - Thin heavy, burn often
- Red-cockaded woodpecker
  - Flag cavity trees
  - Manage for mature, open longleaf
- Flatwoods salamander
  - Manage for open stands and follow BMP's
  - Avoid bedding of pine rows

Loggerhead Shrike

- Also known as "Butcherbirds" because the impale prey
- Inhabit open fields, pastures, open pine woods
- In decline throughout range, GA does annual survey

Management Considerations

- Rare plants
  - Note plant locations
  - Avoid damaging with heavy machinery
  - Protect from herbicide or release treatments
- Native pine understory
  - Adequate thinning
  - Prescribed fire regime
  - Control of woody understory

Forest Management Incentive Programs

Scott Griffin
Associate Chief, Forest Management
Georgia Forestry Commission

Incentive Programs

- Conservation Reserve Program (CRP)
- Emergency Forest Restoration Program (EFRP)

Sign up through FSA

- Environmental Quality Incentives Program (EQIP)
- Conservation Stewardship Program (CSP)

Sign up through NRCS

- Southern Pine Beetle PRS Program
- Invasive Plant Control Program

Sign up through GFC

- Partners for Fish and Wildlife Program

Sign up through USF&W

Get to know your local agency representatives!

GFC Involvement

- GFC
  - 32 field foresters & 31 technicians
  - Administer and serve as TSP
  - Develop plans - Resource Management Plan
    - Part of overall conservation plan
  - Verify performance
  - www.gatrees.org – overview of programs

UGA1342052

Incentive Programs

Conservation Reserve Program (CRP)

- Currently 25.6 million acres enrolled nationwide
- Currently 307k acres enrolled in GA – mostly trees
- 2 kinds of signups – Continuous & General
- Continuous signup has been announced (CP36 & CP38C)

  Available acres:
  CP36 (longleaf pine est.)- 8,000 acres
  CP38 (pine savannah est.)- 640 (3000 requested)
- CRP General Sign-up 12/1/2015 – 2/26/16 (CP3 & CP3A)

Eligibility for Farm Bill Programs

- An official tax ID (Social Security number or an employer ID)
- A property deed or lease agreement to show you have control of the property; and
- A farm tract number
  - FSA this this up
- Complete certificate regarding highly erodible land and wetlands (AD-1026)
- Average adjusted gross income can't exceed $900,000 (3 year average)

Incentive Programs

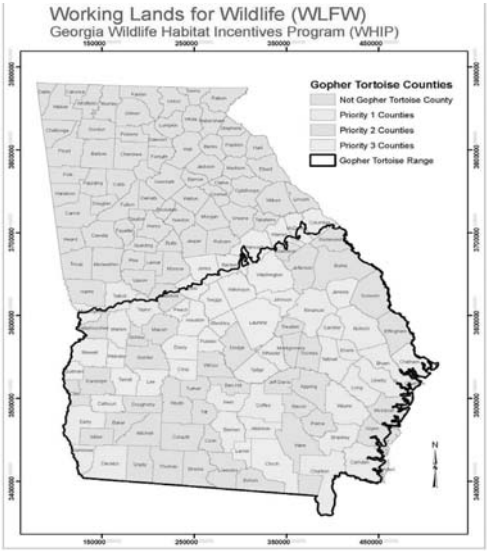
Emergency Forest Restoration Program (EFRP)

- Restores forest after natural disaster
- Excludes drought & insect infestation
- Ice Storm 2014 / Spring 2011 tornadoes
- Appropriated by Congress
- Softwood or hardwood restoration
- $1500 minimum - $500K max.
- Contact FSA when there is damage in the county!

Incentive Programs

Environmental Quality Incentives Program (EQIP)

- Farm Bill combined EQIP & WHIP
- Continuous signup / Competitive ranking process
  - Local resource concerns
- Eligible practices include: prescribed burning, pre-commercial & commercial thinning, site preparation and tree planting, brush management, herbaceous weed control, road/trail stabilization, invasive plant control, wildlife opening management and NWSG planting and management
- 5% to wildlife practices



Incentive Programs

Environmental Quality Incentives Program (EQIP)

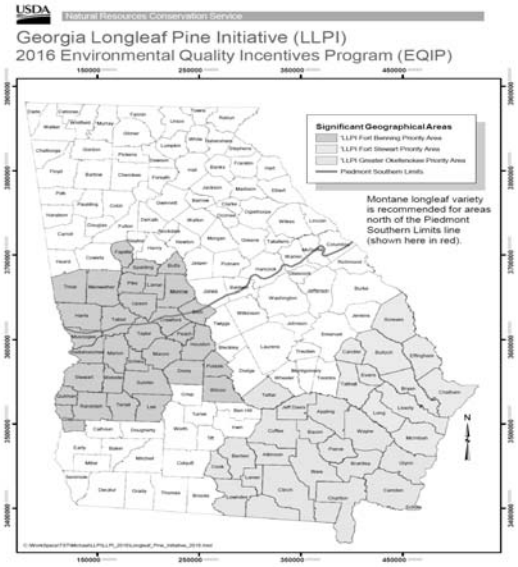
FY 2016

- Signup deadline was December 18, 2015
- Applications received after deadline considered for FY 17
- Streamlined signup process – one visit
- General Sign-up & Initiatives
- Longleaf Pine Initiative & WLFW were funded – changes year to year

Incentive Programs

Conservation Stewardship Program (CSP)

- Continuous signup
- Reward for good management
- Annual payment for installing new conservation practices and maintaining existing activities
- Around $6/acre/year for NIPFL
- Self-screening checklist- cropland, pastureland, NIPFL
- CRP & WRP lands ineligible
- 5 year contract
- At least 1 new enhancement



Plant Enhancement Activity – PLT17 – Creating forest openings to improve hardwood stands

Enhancement Description

Creating forest openings or patches is a silvicultural practice used to naturally regenerate over-mature and/or degraded hardwood stands while providing added cover and browse for several game and non- game species of wildlife

Nonindustrial Private Forest Land – CSP Self Screening Checklist

Forest/woodland is "green certified" by one of the following recognized programs: Tree Farm System, Green Tag, Smart Wood, Forest Stewardship Council, or Sustainable Forestry Initiative.

One or more improvements have been made to your forest/woodland in the past 10 years according to a written forest management or stewardship plan that was prepared with assistance from a certified/licensed natural resource professional. Examples of improvements may include prescribe thinning, tree planting, establishing a firebreak, etc.

There is no apparent erosion on harvested or burned areas, roads, skid trails and landings.

Native trees are appropriately stocked on the property (except temporarily for areas being
reforested) and wildfire risk (in wildfire-prone areas) is minimized by strategically placed narrow firebreaks and wider fuel breaks (which may include roads, streams, riparian areas, and other areas managed to slow fire spread).

Practices - Release

- Loblolly or shortleaf stands
- 1/3+ stems are hardwood
- Chemical or mechanical/chemical
- Pine stand must be of commercial density – 60+ BA or 350+ TPA
- $40/acre

Incentive Programs

SPB Cost Share Program - 2016

Prevention practices: pre-commercial thinning ($70), pine release ($40) & prescribed burning ($5)

- Loblolly/shortleaf only, except burning young longleaf

Restoration practices: pine and hardwood planting ($80 - $115)

Suppression practices: cut or push buffer

- Any active spb infestation

- 10 acre practice minimum
- $2000 maximum per landowner

Sign-up process

- Sign up period just announced, deadline May 27th
- Applications are ranked based on spb hazard ranking for county, practice type, etc.)
- Active pots of money after the sign-up

Practices – Prescribed Burning

1. Maintenance burning - Loblolly or shortleaf stands
- 60 – 110 sq. ft. BA
- Purpose is to reduce competition
- Winter & Spring burning authorized -no scorch

2. Establishment burning – Longleaf stands
- 10 years old or less
- Purpose is to control competition or brown spot needle blight
- Avoid burning during height growth stage

$5 per acre

Practices – Pre-commercial thinning

- 700+ stems/acre of loblolly or shortleaf
- Must thin stands with 700 to 1000 stems per acre to 450 & stands with 1000+ to 550
- Can't receive gain from the thinning (money or in-kind)
- $70/acre

Practices – Restoration

- Offered for 2016
- Must prepare and plant by March 2017
- Pines - Loblolly, slash, shortleaf or white
- Pines (550 - 605 TPA), longleaf pines (550- 726 TPA) and hardwoods (250 TPA min)
- Pine - $80/acre
- Longleaf pine & hardwood - $105 to $115/acre
- No partial payments

Incentive Programs

Invasive Plant Control Program (IPSC)

- Funding exhausted currently
- Target species: privet spp., Japanese climbing fern, Chinese tallow tree, olive spp., chinaberrry and multiflora rose
- Available to NIPF lands and those of local governments
- $50/acre flat rate
- $3500 maximum – 70 acres
- Minimum 3 acre practice size
- Annual funding from USFS

GFC Services

Management Plans and Advice
Forest Health, Timber Selling, Reforestation, Forestry BMP's, Forest Stewardship Plans, Cost Share, etc.

Pre-suppression Firebreak Plowing & Prescribed Burning
The GFC provides the service of plowing pre-suppression firebreaks and assisting with the burn

Tree Seedlings
Pine and hardwood bare root seedlings for sale

Directories
Consulting Foresters, Forestry Service Contractors, Master Timber Buyers, Timber Harvest Notification Ordinances, Certified Arborists, Christmas Tree and Pine Straw Producers

Questions?

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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.

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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.

FOR 70

Benefits of Prescribed Burning[1]

Alan J. Long[2]

History of Fire in Florida

Fire has been a frequent visitor to Florida's forests for thousands of years. During spring and fall dry seasons, and even during periods of summer rain, fires ignited in grass, dry leaves, and brush at the base of lightning-struck trees. Native Americans also set fires to reduce vegetation, improve wildlife or grazing habitat, and create space for crops. Across much of historic Florida, these natural and human-caused fires maintained open park-like landscapes dominated by longleaf and other pines. Wildlife were nourished by the diversity of plants that thrived in these regular fire regimes. The short intervals between fires undoubtedly kept most fires far less intense than those of the 1998 fire season.

During much of the 20th century, intensified fire suppression and prevention activities decreased the frequency of wildfires and the area they covered. This brought about changes in forest ecosystems. Understory brush and hardwoods became more dense and both live and dead vegetation accumulated, increasing the risk of large and damaging wildfires.

In the last 40 to 50 years these changes in Florida's forests have prompted a return to using fire, under carefully controlled conditions, to accomplish many of the same benefits that were historically provided by natural fires. Today, approximately 1.5 to 2 million acres are prescribed burned each year for forest management, agriculture, grazing, and ecological restoration. At the same time, problems associated with smoke in populated areas and on highways have become more prominent. For the continued use of prescribed fire, landowners and the public alike must understand the value of fire for accomplishing various management goals as well as the constraints that limit its use.

Reasons We Burn

Just as with natural and human-ignited fires in the past, prescribed burning today accomplishes many important ecological functions and landowner objectives.

Reduction of Hazardous Fuels

Prescribed burning removes accumulated fuels and therefore the risk of intense fires. Arson, human carelessness, and lightning will inevitably ignite fires

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in Florida. The rate of spread and damage caused by the resulting fires are directly related to fuel types and volumes. Fire intensity is much lower in grasses and small shrubs than in a 10-year-old growth of saw palmetto and wax myrtle. Fuel reduction would not have significantly decreased the number of fires in Florida in 1998, but would have reduced their severity. Prescribed burning must be repeated at regular intervals to maintain the protective effect of reduced vegetative fuels. In the long growing seasons of the Southeast, it takes only four to five years for fuels to return to hazardous levels.

Altering Vegetative Communities

Many public agencies and some private landowners conduct prescribed burns to restore or improve natural forest conditions. Longleaf pine forests are commonly burned, but so are ecosystems as diverse as sandhill scrub and wet sawgrass or pondcypress prairies. Fire intensities vary by plant community in temperature, from very low to extremely hot, and in frequency, from one to 40 years. In these natural forests, burning promotes seed germination, flowering, or resprouting of fire-adapted native plants and generally improves wildlife habitat.

Prescribed burning also changes the composition and density of existing vegetation. In forestry operations, fire at three- to five-year intervals reduces competing vegetation under forest stands over 10 years old. In pasture and range systems, fire is used at two- to three-year intervals to reduce encroachment of shrubs and invasive exotic weeds.

Improving Wildlife and Livestock Habitat

Regular burning of rangelands and understory plants improves forage quality and quantity for wildlife and livestock. New shrub, herb, and grass sprouts capture the quick flush of nutrients into the soil after a fire and are often more nutritious and palatable than older plants. Fires promote flower, seed, and fruit production, thus increasing available nuts and fruits for wildlife. Insects also increase rapidly after most fires. Burning different areas at different intervals and in different seasons produces a diversity of landscapes, animal food, and cover sources. Prescribed fire intervals of two to four years are generally used to promote this diversity.

Controlling Pest Problems

Prescribed burning has been used to control several different pest problems:

- needle disease on longleaf pine seedlings;
- bark beetles in infested trees that are cut and piled;
- root rot fungi;
- spittle bugs in pastures; and
- ticks and red bugs (chiggers).

Improving Access

By reducing dead fuels, harvest residues, and dense understory shrubs, prescribed fires can increase:

- openings for tree planting or natural regeneration;
- visibility within a stand for recreation or hunting;
- openings for wildlife feeding, travel, and display;
- access for hiking and other recreational activities.

Concerns about Prescribed Burning

Although the benefits of prescribed burning are clear, there are also notable concerns. Two of the most important are the possibilities of fire spreading to adjacent properties and smoke intrusions in populated areas. Good management can reduce these concerns. Fires are generally not permitted by the Division of Forestry when hot, dry weather conditions or high fuel loads increase the likelihood that the fire could spread to other property. Similarly, fires should be ignited only when wind directions are predicted to carry smoke away from nearby smoke sensitive areas.

These restrictions may limit the opportunities to burn to just a few days each year. Given these limitations, many forest landowners do not have the staff or capability to burn all their land; they rely on

other management tools to reduce dense shrub and understory vegetation. Proper herbicide applications may require less frequent retreatment than would be necessary with fire. Mowers, choppers, chain saws, and grazing are also used to reduce dense brush and grasses, especially on small land ownerships. However, shrubs grow back quickly after these mechanical treatments.

Another concern with prescribed burning, especially in plantations grown for timber production, is the potential for mortality or growth loss in trees. Even with older longleaf pines, long-term studies have demonstrated that repeated fires will reduce stand volume. The reductions are the result of individual trees killed by fires as well as productivity and growth losses due to needle scorch.

Fire may also negatively affect individual animals. For example, slow moving animals may not be able to escape even low intensity fire fronts. Although ground nests may be lost in certain seasons, adult birds usually renest and benefit from the abundance of insects that follow a fire. Small animals that find cover in burrows or under logs, plants, or stumps may be much easier prey for predators, who truly benefit from fires.

Conclusion

Vegetation management in Florida is critical to retain desired native ecosystems, to reduce the threat of wildfire, and to meet other management objectives. Strategies for effective management may include fire, chemical, mechanical, or grazing technologies. Each method has benefits and problems associated with it. Carefully applied prescribed burning maintains or restores important ecosystem functions and structures, and is a cost effective method to fulfill a variety of landowner objectives. When burning conditions and risks are appropriate, it is usually the preferred strategy in forest management plans.

FOR125

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

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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

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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

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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

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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.

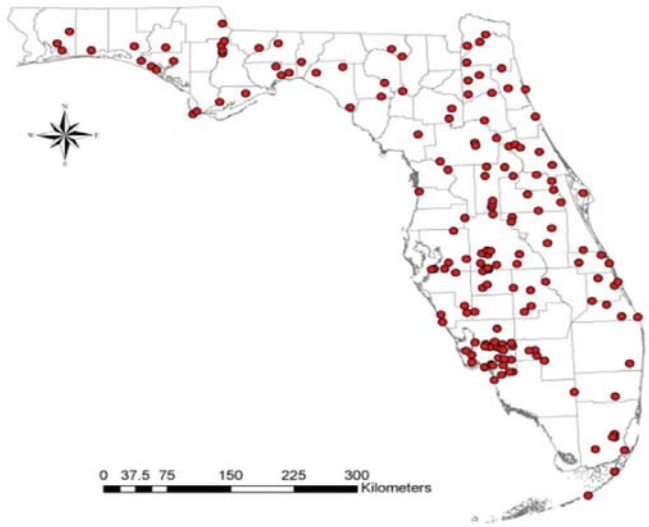

Figure 1. Map of restoration sites.

Additional information

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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

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

Groundcover Restoration in Forests of the Southeastern United States, available at http://sfrc.ufl.edu/cfeor/publications/handbooks/

Groundcover Restoration Implementation Guidebook (Florida FWC), http://bugwoodcloud.org/CDN/floridainvasives/GCRGuidebook.pdf

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

Georgia Forestry Commission Nursery, http://www.gfc.state.ga.us/reforestation/

Andrews Nursery, Florida Department of Agriculture & Consumer Services, 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/

University of Florida IFAS Extension Publications, http://edis.ifas.ufl.edu/

University of Georgia Extension Publications, http://extension.uga.edu/publications/

Forest Plants of the Southeast and their Wildlife Uses, James H. Miller and Karl V. Miller, University of Georgia Press.

Field Guide to Common Legume species of the Longleaf Pine Ecosystem. H. Norden & K. Kirkman. Joseph W. Jones Ecological Research Center Ichauway, http://www.jonesctr.org/; call the center at (229) 734-4706