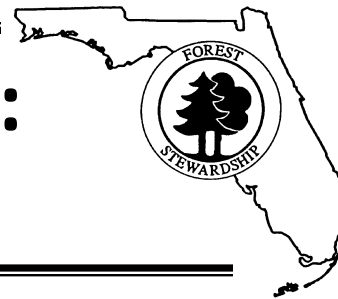

Forest Stewardship Workshop: Integrate Wildlife and Forestry



February 26, 2015; 9:00 am – 3:00 pm ET
Austin Cary Forest Learning Center
10625 NE Waldo Rd, Gainesville, FL 32609

Integrating forestry and wildlife management starts with setting realistic timber, wildlife and economic objectives, and a long-term management plan that addresses the management strategies to meet them. This workshop will cover some of the strategies that can be used to integrate wildlife management and forestry and available assistance programs.



Agenda:

9:00 am	Sign-in, meet & greet
9:15	Welcome & Introduction – Start with Your Plan , <i>Chris Demers, UF/IFAS School of Forest Resources and Conservation</i>
9:45	Manage the Habitat , <i>Joseph Vaughn, Florida Fish and Wildlife Conservation Commission</i>
10:15	Supplemental Feeding , <i>Tim Wilson, UF/IFAS Bradford County Extension Service</i>
10:45	Break
11:00	Forestry and Wildlife – Putting it all Together , <i>Dave Conser, Florida Forest Service</i>
11:30	Conservation Assistance Programs , <i>Monica Jones, USDA Natural Resources Conservation Service</i>
	Florida Best Management Practices for Wildlife , <i>Robin Holland, Florida Forest Service</i>
12:00 pm	Lunch
1:00	Field Tour on Austin Cary Forest , all
2:45	Evaluation, adjourn



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

Table of Contents	Page
Assistance	
Workshop Contacts	3
Florida Forest Stewardship Program Fact Sheet	4
Tree Farm Program Fact Sheet	5
Forestry Wildlife Best Management Practices	6
Got Invasives? Get Assistance.	7
Presentation Notes	
Chris Demers' Presentation Notes: Start with Your Plan	8
Joe Vaughn's Presentation Notes: Manage the Habitat	10
Tim Wilson's Presentation Notes: Forage and Wildlife Food Plots	14
Dave Conser's Presentation Notes: Putting it all Together	21
Monica Jones' Presentation Notes: Conservation Assistance Programs	29
Robin Holland's Presentation Notes: Wildlife Best Management Practices	31
Publications	
Management of Pine Forests for Selected Wildlife in Florida	33
Establishing and Maintaining Wildlife Food Sources	42
Ten Tips for Increasing Wildlife Biodiversity in Your Pine Plantations	47
Dead Wood: Key to Enhancing Wildlife Diversity in Forests	51
Forest Groundcover Restoration	56
Benefits of Prescribed Burning	59
Prescribed Burning Regulations in Florida	62
A Walk on the Wild Side: 2013 Cool-Season Forage Recommendations for Wildlife Food Plots in North Florida	67
Soil Fertility Management for Wildlife Food Plots	71
UF/IFAS Forest Stewardship Publication list	75
Note space	76
Tour Map of Austin Cary Forest	79

Workshop Contacts

David Conser Alachua County Forester Florida Forest Service 5353 NE 39th Avenue Gainesville, FL 32609 (352) 955-2239 Dave.Conser@freshfromflorida.com	Gary Johns Forest Manager – Austin Cary Forest UF/IFAS School of Forest Resources and Conservation PO Box 110410 Gainesville, FL 32611-0410 (352) 371-8041 purina@ufl.edu	Joseph Vaughn Landowner Assistance Biologist Florida Fish and Wildlife Conservation Commission 5353 NE 39th Avenue Gainesville, FL 32609 (352) 955-2241 Joseph.Vaughn@MyFWC.com
Chris Demers Forest Stewardship Coordinator UF/IFAS School of Forest Resources and Conservation PO Box 110410 Gainesville, FL 32611 (352) 846-2375 cdemers@ufl.edu	Monica Jones District Conservationist USDA Natural Resources Conservation Service 5709 NW 13th St Gainesville, FL 32653 (352) 376-7414 ext. 3 Monica.Jones@fl.usda.gov	Tim Wilson County Extension Director UF/IFAS Bradford County Extension 2266 N Temple Ave Starke, FL 32091 (904) 966-6224 timwilson@ufl.edu
	Scott Sager Forester – Austin Cary Forest UF/IFAS School of Forest Resources and Conservation PO Box 110410 Gainesville, FL 32611-0410 (352) 846-0846 sasager@ufl.edu	

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

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

Florida's Forest Stewardship Program

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



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

Eligibility

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

Benefits to Landowners

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

Getting into the Program

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

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



Tree Farm Program

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

Eligibility

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

Benefits to Landowners

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

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

Getting into the Program

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

http://www.floridaforest.org/tree_farm.php



Forestry Wildlife Best Management Practices for State Imperiled Species



- Forestry Wildlife Best Management Practices for State Imperiled Species (WBMPs) were adopted into Florida Administrative Code (Rule 51-8) on October 21, 2014.
- WBMPs were developed through a partnership between the Florida Department of Agriculture and Consumer Services' Florida Forest Service and the Florida Fish and Wildlife Conservation Commission (FWC).
- WBMPs are **voluntary** practices designed as a practical approach for avoiding and minimizing the loss of **State Imperiled Species** due to silviculture operations.
- WBMP practices address the 16 State Imperiled Species which are considered to be potentially vulnerable to silviculture operations including ten aquatic species, two burrowing animals, and four nesting birds.
- WBMPs are designed to supplement the existing water quality-based Silviculture BMPs which already provide many valuable benefits to the conservation and management of fish and wildlife in Florida.
- Landowners and other forestry resource professionals can enroll in the voluntary program by completing a WBMP Notice of Intent. Those who do not wish to enroll will continue to be subject to all current laws and regulations regarding State Imperiled Species.
- Once enrolled, applicants who **properly implement** WBMPs will no longer be required to obtain a permit authorizing the incidental take of State Imperiled Species during bonafide ongoing forestry operations. In addition, they will not be subject to any fines or penalties associated with an incidental take of the State Imperiled Species covered by the WBMP Manual.
- WBMPs are not designed to facilitate wildlife habitat restoration or species recovery and expansion. Also, they do not address any Federally Listed Species. For information on Federally Listed Species, refer to FWC's online "Florida Wildlife Conservation Guide."
- To obtain more information or a copy of the WBMP Manual and Notice of Intent, contact your local Florida Forest Service BMP forester (see below) or a FWC Landowner Assistance Program biologist (850) 488-3831.

Florida Forest Service BMP Foresters

Roy Lima
Panhandle Area
(850) 681-5942



Robin Holland
Peninsula Area
(352) 732-1273

Roy.Lima@FreshFromFlorida.com

Robin.Holland@FreshFromFlorida.com



Got Invasives?

Invasive exotic plant problem? Use the Florida Invasives.org website to find financial and or technical assistance to manage or prevent an infestation.

FloridaInvasives.org is an online resource of management assistance programs to help in your fight against problematic plant species. This resource takes the guesswork out of finding the agencies or organizations offering assistance and will direct you to available programs. It will also provide the requirements for each program, to help you decide if they are a good match for your needs.

Why was FloridaInvasives.org developed?

Public and private land managers have identified the high ecological and economic cost of invasive species as a statewide problem in Florida. The Florida Invasive Species Partnership (FISP) is a collaboration of federal, state and local agencies along with nongovernment organizations in Florida, formed to link efforts at preventing and controlling infestations of invasive exotic plants across agency and property boundaries. FISP has developed an on-line tool of available financial and technical assistance sources to make it easier for landowners and land managers to find them.

How does FloridaInvasives.org help you?

Each year, multiple agencies and organizations provide cost-share programs, grants and/or technical assistance to help landowners and land managers with various agriculture or natural resource management practices. Invasive exotic species management is an important practice covered within many of these programs.

FISP has created a searchable database, accessible at FloridaInvasives.org, that allows you to determine which agency or organization(s) might have an assistance program for your needs. Simply provide your county, target species and other pertinent information into the online tool, and you will retrieve a current list of available programs along with the most up-to-date contact information. FloridaInvasives.org will help provide focus to your search so that you can get the right person at the right program.

FloridaInvasives.org builds community awareness, leverages limited resources through cooperation and may reduce individual land management costs. This resource will be regularly updated with the most current program information to provide you the most up-to-date opportunities. Log on at <http://FloridaInvasives.org> to find assistance with your invasive species problem.

Conclusion

The Florida Invasive Species Partnership has created FloridaInvasives.org to help connect Florida's landowners and land managers with available technical and/or financial assistance programs to prevent or control invasive exotic species problems. These programs have been collected, evaluated and categorized in a single resource, making it easier to find the financial and/or technical assistance available to Florida landowners.

Go to FloridaInvasives.org to find out more.

Florida
Invasive Species
Partnership

Think Locally, Act Neighborly
Invasive exotic species know no boundaries!

Have Land? Get a Plan and Stay Connected

Chris Demers
(352) 846-2375
cdemers@ufl.edu
http://sfrc.ufl.edu/forest_stewardship



When is a management plan a good idea?

Always!

- Your plan is your road map from where you are to where you want to be.
- Could also help demonstrate bona fide timber management for property tax assessment.

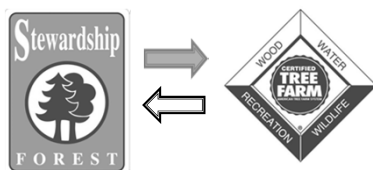
When are management plans required?

- **Cost-share programs**
 - USDA, FWC, other programs
- **Certification / recognition programs**
 - Tree Farm (American Forest Foundation)
 - Sustainable Forestry Initiative
 - Forest Stewardship Council
 - Forest Stewardship Program (FL Forest Service)
- **Demonstrate bona fide timber management?**

What's in a Management Plan?

- Your goal, objectives
- Property location, history
- Resource assessment
- Management recommendations
- Map, activity schedule (usually 5 years)
- Supplemental information
 - Contacts, aerial photos, records, receipts, notes, etc..

Get a Plan



Timber / Wildlife Considerations

• Silvicultural System

- What are your objectives?
 - What tree and wildlife species do you want?
 - Habitat requirements?

- How do you want to regeneration the stand?
 - Plant trees or natural regeneration?

- Markets – what products are in demand?

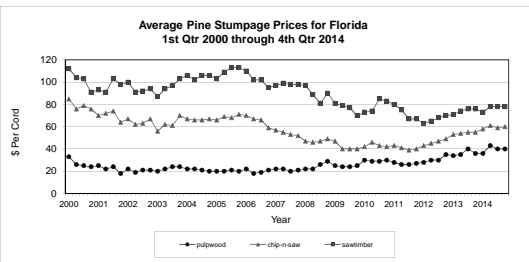
- Pulp/small diameter: GP, GREC, PHI pellet plant, etc..
- Large diameter: Cochran Forest Products, Griffis Lumber, Gilman Building Products, Klausner Lumber One, etc..



Timber / Wildlife Considerations

• Timber markets and marketing

- Know what you have to sell and what it's worth



Best Management Practices



• Water

- Minimum standards to protect water quality
- Exceed if you can



• Wildlife

- Voluntary practices to protect State Imperiled Species of wildlife



Get Assistance

- Consultants
- Florida Forest Service
- Florida Fish and Wildlife Conservation Commission
- USDA Natural Resources Conservation Service
- University of Florida / IFAS
- Others: National Wild Turkey Federation, Quality Deer Management Association, Quail Unlimited, Ducks Unlimited, etc...

How to Integrate Wildlife and Forestry

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



What Species are We Managing For?



What are the Issues



Bedding when not needed = loss of groundcover



Not bedded, retained groundcover



So if you want wildlife, protect the groundcover



If this is what your stand looks like,
what can you do?



You Can

- Thin your stand
- Burn your stand
- Manage for longer rotation
- Favor longleaf pine over slash or loblolly, where appropriate
- Leave snags
- Create openings
- Plant at lower densities – 400 to 600 trees/acre



Thin

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

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

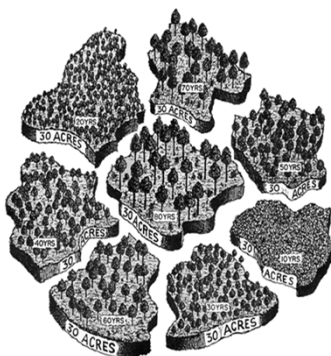
Burn (but why)

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



Rotation

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



Convert

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



Favor LLP over LOB

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



Snags

(You gotta love 'um)

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



Snags (that we love) come in many forms



Snags

(what's not to love)

- Cabbage palm that has become a wildlife condo



Create Openings

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



Maintain your Openings

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



Planting Density

- 726 tpa = great for silviculture, ok for some species wildlife
- 600 tpa = good for silviculture, good for many species of wildlife
- 400 tpa = ok for silviculture, great for most species of wildlife
- Less than 400 tpa = not considered as silviculture but outstanding for wildlife
- What is the right choice, it is your land, it is your goals, it is the landowners call!



Thank You!

Questions?



"A Walk on the Wild Side"

Forage and Wildlife Food Plot Demonstrations

Tim Wilson

UF/IFAS Bradford Extension

UF IFAS Extension
UNIVERSITY OF FLORIDA

Introduction

- ▶ Hunting and/or wildlife attraction is an important activity of many residents in Northeast Florida.
- ▶ Many food plot mixes available to wildlife enthusiasts may or may not work in our environment or in our sandy soils.

UF IFAS Extension
UNIVERSITY OF FLORIDA

Introduction

- ▶ Goal - Provide a well-designed, variety demonstration is the best way to show these clientele how different varieties grow in Northeast Florida.

UF IFAS Extension
UNIVERSITY OF FLORIDA

Material and Methods

- ▶ Soil tests - October 30, 2012
- ▶ Soil preparations included mowing and rototilling (6 inches), followed by lime at 1 ton/acre and N-P-K (19-9-19) at 250 lbs./acre.
- ▶ Lime and fertilizer were spread separately then rototilled to incorporate into the soil.

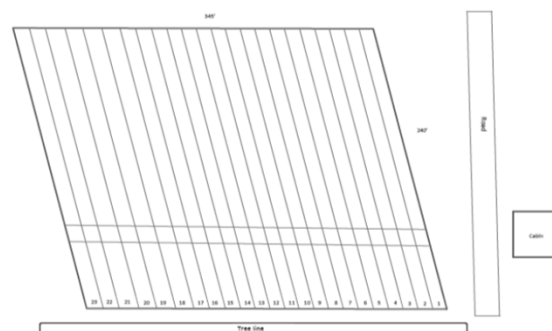
UF IFAS Extension
UNIVERSITY OF FLORIDA

Material and Methods

- ▶ Twenty-three varieties were broadcast planted in approximately 1/10th acre plots at on November 9, 2012 then were packed with a roller.
- ▶ Plots were designed so that a five foot wide wildlife exclusion hotwire could be installed to prevent unwanted grazing. All plots were fertilized again on February 4th at a rate of 50 lbs. of Nitrogen per acre.

UF IFAS Extension
UNIVERSITY OF FLORIDA

2012 - 2013 Bradford County Wildlife Food Plots



UF IFAS Extension
UNIVERSITY OF FLORIDA

Applying Lime



UF IFAS Extension
UNIVERSITY OF FLORIDA

Broadcasting Seed



UF IFAS Extension
UNIVERSITY OF FLORIDA

Describing Outcomes



UF IFAS Extension
UNIVERSITY OF FLORIDA

Five Foot-Wide Exclusion Cage



UF IFAS Extension
UNIVERSITY OF FLORIDA

Results



UF IFAS Extension
UNIVERSITY OF FLORIDA

Results



UF IFAS Extension
UNIVERSITY OF FLORIDA

Plots as of February 21, 2013



UF IFAS Extension
UNIVERSITY OF FLORIDA

Conclusion

- ▶ Due to the lack of rain and an unusually warm weather pattern, all plots seemed to be delayed in growth.
- ▶ Rain events in January followed by typical cooler weather stimulated growth followed by the second application of fertilizer in February.

UF IFAS Extension
UNIVERSITY OF FLORIDA

Conclusion

- ▶ This demonstration has provided a hands-on evaluation for clientele and the information they obtain from this project will help them make informed decisions as they prepare for next season.

UF IFAS Extension
UNIVERSITY OF FLORIDA

Acknowledgements

- ▶ A. Blount², C. Mackowiak², B. Bactawar³, M. Davis⁴, D. Barber⁵, B. Wilder⁶, and W. Oden⁷
- ▶ ²UF/IFAS North Florida Research and Education Center - Marianna, ³UF/IFAS Union County Extension, ⁴UF/IFAS Baker County Extension, ⁵UF/IFAS Columbia County Extension, ⁶UF/IFAS Alachua County Extension, ⁷Clayno Hunt Club (N 29.95790 W -82.26232)

UF IFAS Extension
UNIVERSITY OF FLORIDA

2013 - 2014 Synchronized
On-Farm Demonstrations

Bradford County Layout

1	6	RAM LA 99016 Oat	120 lbs	12 lbs	1	1	Trical 342 Triticale	120 lbs	12 lbs
2	5	AGS 2040 Wheat	120 lbs	12 lbs	2	7	FL 0567-L1 Oat	120 lbs	12 lbs
3	1	Trical 342 Triticale	120 lbs	12 lbs	3	8	Coker 227 Oat	120 lbs	12 lbs
4	14	Earlyploid Ryegrass	25 lbs	2.5 lbs	4	15	Jumbo Ryegrass	25 lbs	2.5 lbs
5	9	FI 401 Rye	120 lbs	12 lbs	5	17	Marshall Ryegrass	25 lbs	2.5 lbs
6	13	Gore Wheat	120 lbs	12 lbs	6	2	Monarch Triticale	120 lbs	12 lbs
7	3	Flo 1143 Triticale	120 lbs	12 lbs	7	13	Gore Wheat	120 lbs	12 lbs
8	18	Common Gulf Ryegrass	25 lbs	2.5 lbs	8	16	Prine Ryegrass	25 lbs	2.5 lbs
9	16	Prine Ryegrass	25 lbs	2.5 lbs	9	9	FI 401 Rye	120 lbs	12 lbs
10	17	Marshall Ryegrass	25 lbs	2.5 lbs	11	10	Wrens Abruzzi Rye	120 lbs	12 lbs
11	12	Blend (Trical 342/FLO567-LI)	120 lbs	12 lbs	10	14	Earlyploid Ryegrass	25 lbs	2.5 lbs
12	11	AGS 104 Rye	120 lbs	12 lbs	12	18	Common Gulf Ryegrass	25 lbs	2.5 lbs
13	15	Jumbo Ryegrass	25 lbs	2.5 lbs	13	12	Blend (Trical 342/FLO567-LI)	120 lbs	12 lbs
14	2	Monarch Triticale	120 lbs	12 lbs	14	6	RAM LA 99016 Oat	120 lbs	12 lbs
15	10	Wrens Abruzzi Rye	120 lbs	12 lbs	15	5	AGS 2040 Wheat	120 lbs	12 lbs
16	7	FL 0567-L1 Oat	120 lbs	12 lbs	16	4	Horizon 201 Oat	120 lbs	12 lbs
17	4	Horizon 201 Oat	120 lbs	12 lbs	17	3	Flo 1143 Triticale	120 lbs	12 lbs
18	8	Coker 227 Oat	120 lbs	12 lbs	18	11	AGS 104 Rye	120 lbs	12 lbs

TRT 1

TRT 2

UF IFAS Extension
UNIVERSITY OF FLORIDA

2013 WILDLIFE FOOD PLOT DEMONSTRATION Allison Farm, Lake City, Florida

Material	Rate/lbs per Ac	Rate/lbs per 1/10 Ac
1 Plotspike (LA99016) oat	120	12
2 Horizon 201 oat	120	12
3 Coker 227 oat	120	12
4 FL 0567 oat	120	12
5 Buck Forage (LA99017) oat	120	12
6 Tall Tines Tuber Turnip	6	0.6
7 Barkart Turnip	10	1.0
8 Austrian/Whistle Winterpea	60	6.0
9 Daikon Radish	10	1.0
10 Monarch Triticale	120	12
11 Trical 342 Tritical	120	12
12 FL01143 Triticale	120	12
13 Imperial Whitetail Clover	8	0.8
14 Imperial Whitetail Chicory	3	0.3
15 Plotspike Forage Feast	80	8.0
16 Forb Feast Chicory	3	0.3
17 New Zealand Clover Plus	9	0.9
18 New Zealand Maximum	9	0.9
19 UF Triple Treat (crimson, white, red)	23	2
20 Imperial Alfa Rack	13.2	1.32
21 Gore Wheat	120	12

Plot = 130 ft. x 300 ft. = 39,000 sq. ft. = .90 ac

Seeding rate is at 1/10 ac. Plots were seeded at double rate suggested.

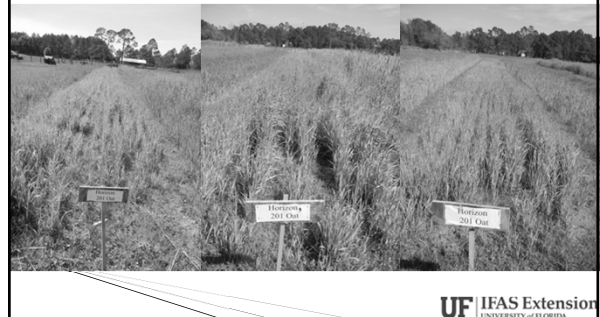
Planted on November 22, 2013, seeds were hand broadcast and rolled.

UF IFAS Extension
UNIVERSITY OF FLORIDA

Ram Oat



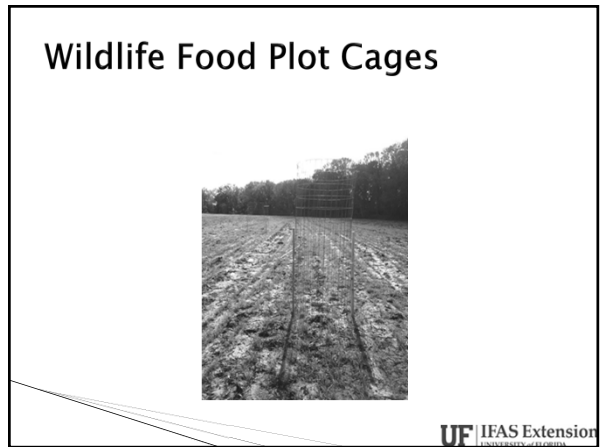
Horizon 201 Oat



Crown Rust on Horizon Oats



Wildlife Food Plot Cages



Trical 342 Triticale



FL 0567-L1 Oat



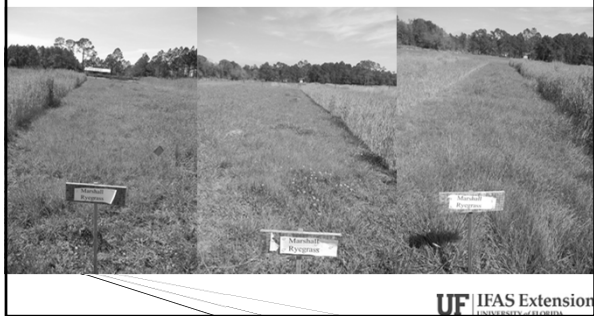
Blend
(Trical 342/FL 0567-L1 Oat)



Jumbo Ryegrass



Marshall Ryegrass



Prine Ryegrass



Earlyploid Ryegrass



Common Gulf Ryegrass



AGS 2040 Wheat



Gore Wheat



Putting it All Together

Integrating Forestry and Wildlife

Provided by Dave Conser, Florida Forest Service

One of the initial goals of the Stewardship Program was to educate landowners that doing no forest management is poor wildlife management in most cases; and certain forest management is extremely helpful to wildlife, over “leave as is”, except in rare cases.

In general, forest management activities can create habitat diversity, through more open conditions, better species and species diversity, soil disturbance, food, shelter, etc.

It is impossible to maximize timber revenue and wildlife habitat on any particular acre of land. Your objectives determine the mix of timber, wildlife habitat, aesthetics, restoration, and/or grazing that is best for you and your land. Sometimes landowners know their objectives, and in other cases they need education about what is possible on their land so they can decide on their reasonable objectives.

So what are some forest management practices that integrate with wildlife habitat management? How do they mix together? The following are some examples. While it would be time consuming to go into all the nuts and bolts of every practice, we can focus on how each practice integrates forest management and wildlife management. The recommendations here are not limited to, but often specific to north central Florida.

Planting Trees

Planting trees, primarily pines, establishes a forest that is conducive to wildlife. Pines are a fire adapted species, so that the multiple benefits of fire are realized. Planting pines by necessity means we are initially creating an opening with much light and therefore a food source. We need to realize that wildlife find tremendous value in sunny, open areas with a diverse growth of grasses and herbaceous plants, or browse. A park-like setting of large oaks may provide acorns for 2-3 months out of the year, but other than that, a young pine forest is much better wildlife habitat, since relatively little is growing in the understory of that park-like hardwood forest.

Species selection is important for your objectives and for integrating forest management and wildlife. Longleaf pine is a better wildlife species than the other southern pines in our area. It lets more light penetrate its canopy, reaching the forest floor and therefore providing better forage. It tolerates fire better and therefore allows for the wildlife benefits of earlier prescribed burning. Slash pine has its place, depending on your property and objectives. If you have a wet flatwoods site with a heavy coverage of lyonia and gallberry, you may be better off with slash pine. Slash pine, properly managed with fire and periodic partial harvests, can also provide good wildlife habitat. Your

financial objectives come into play. In my experience, longleaf produces 20% less revenue in 20-25 year rotations than slash pine, on a good site. On dry sites longleaf will outperform slash or loblolly. I would not plant loblolly due to its proclivity to fall prey to the Southern Pine Beetle, and its inherently worse tree form. In 30+ year rotations on a good site longleaf can surpass the economic return of the other pines due to the production of our highest value wood product, poles. I have measured 50-70% future pole production after thinning in longleaf pine plantations. Neither slash nor loblolly will come close to this figure.

Get recommendations from your forester for Tree Planting contractors who can properly plant your trees, especially if you're planting longleaf pine. The following is a link to the Longleaf Alliance's website, regarding restoring longleaf pine and planting recommendations for both cutover sites and pasture/old fields: <http://www.longleafalliance.org/restoring-and-managing/restoration> The Longleaf Alliance is a good source of information for all things longleaf. Here's the link to their main page: <http://www.longleafalliance.org/>

How many trees per acre should you plant? This is highly dependent on your mix of objectives. You should consult your natural resource professionals and discuss your objectives, look at your property together, and make the decision that's best for you. To a point, lower stocking rates (trees per acre) favor wildlife habitat since more light reaches the forest floor longer. To a point, higher stocking rates favor higher financial returns. I say "to a point" because you could have so few pines that you can't get a good burn on your property, and you could plant so many trees per acre that all you get are toothpicks.

I personally like about 400 to 500 surviving seedlings per acre, after one year. Assuming 75-90% survival this would require planting about 500 to 600 containerized longleaf per acre. For bareroot longleaf, I would bump the planting rate up about 20% to account for likely greater mortality. Late planting, or planting in extremely rough conditions, also warrants bumping up the planting rate to account for greater mortality. For slash pine, to achieve 400 to 500 surviving seedlings per acre usually requires planting about 450 to 600 per acre, adjusting up for late planting, rough conditions, or hand planting.

In my opinion, these stocking rates allow for an excellent mix of revenue from timber and enhancement of wildlife habitat. A partial harvest (thinning) at mid-rotation will be necessary to enhance both timber and wildlife as the trees get bigger. At a certain point the trees start growing slower due to competition with each other, and start shading out the browse. When the one year old survival rate of pine seedlings falls below about 275 trees per acre, problems arise. The trees become "limby" for many years, creating knots that preclude the use of your pines for the more valuable solid wood products, unless you are willing to wait 30-50 years. And even then, for longleaf, the proportion of trees making poles will be much reduced. However, if your objectives highly favor wildlife (or restoration) over timber revenue, then the stocking rates suggested above can be lower. Just remember, having decent timber revenue can finance your land management, including wildlife habitat management.

When we look at 100 year old natural longleaf forests with 20-60 trees per acre we need to remember that it took 100 years to look like that. Also, it's most likely a sandhill site with lower fertility. For poor sites fewer trees are appropriate, since low fertility sites can't support as many trees per acre.

When to plant? Containerized longleaf: mid October – January, and the rainy summer months; Bareroot longleaf: December – January; Slash (nearly always bareroot): December – January. Planting in February is ok, but not optimal.

Site Preparation

Site preparation is almost always necessary prior to planting trees. Pines abhor competition, so competing vegetation, such as pasture grass, brush and hardwood trees need to be dealt with. I recommend scalping pastures and idle cropland. This peels back the sod about 4" deep and about 2.5' wide, exposing mineral soil, leveling the planting surface, and pushing back grass and weed competition long enough for the pines to get established. A level planting surface is extremely helpful in planting longleaf, since proper planting depth is critical. Do not scalp sandhill sites with native groundcover. Do not scalp the wet portion of a pasture where it's so wet that wetland plants are growing instead of pasture grass.

For replanting a cutover site most always we will have a problem with hardwood competition if we don't properly prepare the site. After a clearcut it can look like most of the hardwood is gone. It's not gone. It's crushed down, pushed down – but the root systems are still there with plenty of stored reserves. You will plant your pines and then watch the hardwood outgrow the pine seedlings. Have an Herbicide Contractor apply an approved forestry herbicide – safe to the environment but heck on hardwood trees. It is critically important to leave the site alone for at least one full growing season, and preferably two, before applying herbicide. This allows the hardwoods to resprout, grow, and absorb enough herbicide to be killed. Otherwise you just wasted your money. Also, truly let the site sit unmolested. I can't tell you how many of my landowners want to bulldoze the site clean, mow it, burn it, etc. This won't get rid of hardwood competition, only set the clock back regarding when an herbicide treatment will be effective. Burn if possible after the herbicide has acted for long enough. V-blade planting is the way to replant most of these sites. A V-blade tractor has a v-shaped blade on the front which pushes back the dead hardwood and logging debris, and pulls a tree planting machine behind. This is much cheaper and better than bulldozing the entire site. Hand planting can substitute for V-blade planting. Even cutover flatwoods sites are most often better prepared by herbicide, burning and V-blade (or hand) planting, although old school mechanical site preparation, such as chopping, burning and root raking may have their occasional use in a cutover flatwoods site. I do not like bedding unless the drainage of the soil is rated as "Poorly drained". Bedding churns up at least half of any native groundcover in each row, severely reducing it.

Proper preparation treatments help to temporarily create an opening. The associated soil disturbance causes regrowth of annual and perennial weeds. Herbicide prevents hardwoods from

shading out browse. Prescribed burning for site preparation generates the values associated with fire.

Prescribed Burning

No forestry practice doubles as a wildlife management practice more than prescribed burning. Prescribed means we have a “prescription”, not unlike a doctor’s prescription, for how the fire will behave and how we’ll pull that off. Prescribed burning rejuvenates browse, enhances fire dependent vegetation, promotes the restoration of native habitat, reduces hardwood encroachment, reduces the hazard of uncontrolled wildfire, plus other things. Combined with thinning (selective harvest) no two other forestry practices better enhance wildlife habitat. Thin and burn, burn and thin.

Seasonality of burning is important. Ultimately this means switching from easier, traditional wintertime burning to burning in the growing season, May-August. For the restoration of native groundcover grasses, May and June is best. For herbaceous plants (wildflowers), August is best. Growing season burning controls hardwood, and excessive palmetto, much better than wintertime burning. In winter, competing vegetation has stored food reserves in its root system. So the hardwood reprints relatively well after a wintertime burn. Conversely, in the growing season, especially in May and June, hardwoods have expended their reserves in growing new leaves, and fire removes those leaves, depleting the reserves. However, on most properties the first one or two burns should be wintertime (dormant season) to reduce fuel loadings, so that the following growing season burn won’t get too hot. Switching back and forth between dormant season and growing season burning is not a bad idea. Studies have shown the greatest calcium content in bird eggshells from sites that were burned alternatively in winter and spring. The vegetation may be the most diverse in this case, contain more nutrients, and supply those nutrients to insects and birds.

Longleaf pine can be burned earlier than slash pine. The young grass-stage seedlings are fire resistant when robust (about 1 year old). The saplings are fairly resistant to fire after achieving 6’ of height, and sometimes before. Burn slash pine when it achieves about 4” ground caliper (diameter) or later.

Most forests should be burned on a two to three year burning interval. Every year is too often, since many critters and plants need a break from fire to do their thing. For instance, blackberries fruit in their second year of growth, and naturally regenerated longleaf seedlings need time to become robust enough to survive fire.

Rotational Mowing

Rotational mowing is the wintertime mowing between the rows of young pines in an alternating fashion, creating vegetative diversity. Initially, mow between all the rows in the cold of winter, taking steps to not mow down your pines. The next winter, mow every third row only. The winter after that move over one row and mow every third row. And so on. What you accomplish is

the establishment of three levels of vegetation, supplying a diversity of fresh browse, seed and soft mast production, and cover. From a forestry standpoint, you will prevent hardwood encroachment and possibly accelerate the growth of your trees. If your pines were planted into a pasture, consider light disking instead of mowing. Mowing only helps domestic grasses. If you have native groundcover, don't mow it, burn it instead.

Firelines

We should protect our pine forest from wildfire originating off our property. Firelines or firebreaks do this by creating a mineral soil strip of a certain width that will not burn. The best time to install firelines is November or December, before a hard freeze increases the danger of wildfires. Wintertime soil disturbance is also the best time for promoting wildlife friendly vegetation, particularly legumes. Legumes supply nitrogen, the nutrient most often critically in short supply for critters. Firelines can double as wildlife openings if we widen them a bit. Instead of 10-12 feet wide, consider widening your firelines to 20-30 feet. This will allow more light for "weedy" vegetation to regrow. "Weeds" are good for wildlife, and believe it or not, they don't burn real well when they're green and regrowing. Wider firelines will better protect a stand from wildfire.

Thinning

Combined with burning, thinning and burning are two of your best forest management tools to promote wildlife. Thinning means the selective harvest of the poorer quality trees so that your best trees can continue to grow well. Stand at the end of the rows of pines, between two rows, and look up at the tops down the rows. Are the branches intermingling, touching across the rows? If so, your stand of pines has achieved "crown closure". The trees just started growing slower, and the forest floor is shaded and unable to grow as much browse for wildlife. For many stands on decent sites crown closure occurs about age 12 to 15. For both the trees and the wildlife, the best thing you could do now is thin your stand. You should have a private consulting forester mark the poor quality trees for a timber sale, leaving the best trees. If you let a logger decide which trees to remove, even if he has your best interest at heart, he can't study the tops of the trees, and whether a tree is diseased, like a man on the ground. Thinning is an investment in growing more valuable solid wood products in the future, such as chip-n-saw, sawtimber and poles. It's also one of the best investments you can make to enhance wildlife habitat in that stand. The best time to thin is the cold of winter. The second best time is the rainy summer months, as long as your stand isn't poorly drained and saturated in the summer. Loading decks used to load the timber and transport it can be turned into wildlife openings. Additionally, as long as the logger is there, this is your opportunity to "daylight" your roads and edges of your stand. Let your consultant know that you want to widen these areas by cutting just a little more timber there. Then more light will be available for browse.

Burning combines with thinning in a wonderful way. Since more light is now available in the stand, more browse will grow. Burning rejuvenates that browse, plus hinders hardwood encroachment. This is a critical point: Without burning, hardwoods will take over the understory

over time, shading out the browse, and possibly reducing pine growth. You have an approximately one to three year window to start burning after thinning. After that, the hardwoods begin to achieve a size more difficult to control with fire. The very best strategy for most stands would be to thin in the winter, then burn two winters later.

Have a professional forester evaluate your stand for the need for thinning. After the first thinning you have the choice to thin the stand again in 6-10 years or clearcut in about 8-12 years. A second thinning is also a great idea, in my opinion, as wildlife habitat is further improved, aesthetics go through the roof, and you are producing the most valuable timber of all, sawtimber and poles.

TSI

Timber Stand Improvement (TSI) means the removal of competing vegetation, primarily hardwood trees. Burning can do this if the hardwood is small enough. Otherwise an herbicide treatment is the best TSI option. Heavy duty mowing is an option also, but the hardwoods just regrow. It's better to not get into a TSI situation, by means of proper herbicide site preparation, rotational mowing and burning. The removal of competing hardwoods enhances wildlife habitat.

Harvests / Biomass

I was at my friend's house one Saturday morning and I couldn't help but overhear his son Josh watching Captain Planet, who was crusading against some nasty tree killers. I asked him, "Josh, is it *always* wrong to cut a tree down?" He replied emphatically, "Oh yes!" His dad was shocked. And we had a discussion.

At some point it may be appropriate and necessary to clearcut harvest a forest. Or you may have acquired a clearcut forest. Most of the public (including Captain Planet) probably see this as a travesty. Wildlife see it differently. A clearcut is an opening. Now if the clearcut is huge, then it's not so good because some of the wildlife will only use the edges. However, most of your clearcuts are going to be excellent wildlife habitat. Maximum sunlight is hitting the ground and maximum growth of wildlife friendly plants is taking place. And hopefully you have plans to replant into pines, initiate burning, mowing and other practices that will continue to enhance wildlife habitat.

Biomass harvesting is a new tool for you as forest landowner. Currently biomass harvesting in this area is removing non-merchantable (non sellable) hardwood and low quality pine and sending it to be burned at a power plant. If you have such an area, and you want to restore it a longleaf pine forest (or slash pine), now you have the option to get the area cleared off for free, or nearly so. As the hardwood resprouts, an herbicide treatment and planting will be necessary, but much more efficient than when you were dealing with a hardwood thicket. An article in the Winter/Spring 2014 Forest Land Steward newsletter, titled "Biomass Harvesting as a Restoration Tool" gives more details.

Uneven Age Management

Uneven Age Management in this area generally refers to managing a longleaf stand for multiple age classes of trees. Large, sawtimber size trees, medium size pulpwood and chip-n-saw size trees, saplings and seedlings, all constitute a proportion of the trees in the stand. The management can be complicated, but rewarding. Partial harvests are made on a periodic basis, removing a certain proportion of tree sizes, so that the uneven age structure is created and perpetuated. Since large, valuable trees are produced and harvested, this system can compete economically with an even age, clearcut-every-so-often system. Proper prescribed burning is important in the uneven age management system. Proper marking and harvesting, using a fairly sophisticated technique, is also critical. Again, a private consulting forester is necessary. Excellent wildlife habitat results from uneven age management. If you have an uneven age longleaf forest then you have a rare and wonderful thing, something I would recommend you continue with. Otherwise, to get to an uneven stand will take a long time, involving planting, natural regeneration and harvesting over 50-100 years.

Snags

Snags are dead standing trees. Forests used to get older than they do today, and therefore there used to be a lot more snags. Many cavity nesters rely on snags, so if a snag is not a hazard, I would recommend leaving it. That's money, time and effort you don't have to expend. There's also wildlife value in dead and down material. Some landowners fret if their land isn't neat and tidy. Neat and tidy is poor wildlife management. And it's less work, forest management wise, to leave snags, plus dead and down material.

Brush Piles

The same is true of brush piles. Brush piles are great refuges for many wildlife species. After a harvest we are often left with a number of logging piles. Have you ever calculated how much area they take up? Not much. For instance, a 40' x 40' logging pile is about 0.04 acres. Additionally, burning logging piles creates two problems. First, smoke from burning logging piles can linger over a smoke sensitive area, like a highway, especially if there's dirt in the piles. Secondly, the ground under a burned out brush pile is now covered with so much alkaline ash that it will difficult to get anything to grow well there. And again, less money, time and effort from a forest management aspect. Neat and tidy is not good.

Invasive Control

An invasive is a non-native plant that harms an ecosystem by its presence. We should control invasives because the invasive is having a deleterious effect on native flora and fauna. And in many cases invasives aren't good for proper forest management either. A good example would be cogongrass, which shades out almost all other groundcover, and can burn your pine forest to a crisp.

Openings

We already mentioned openings when we discussed firelines, harvesting, loading decks and daylighting roads. Wildlife like openings for the new growth of grasses and herbaceous plants. Maintain openings by annual soil disturbance in the wintertime, by mowing, disking or burning.

Pine Straw Harvesting

Pine straw harvesting is poor wildlife management in the area where it occurs. The pine straw harvester in most cases is going to use a broad spectrum herbicide to kill the groundcover and understory, in order to get clean straw. What's left to eat? The only way this even begins to make sense from a wildlife management standpoint is this: I have my pine stands where I rake pine straw, making money, funding my efforts at enhancing wildlife habitat in other stands on my property. In other words, having a mix of conservation areas and financial return areas across a property.

Native Groundcover

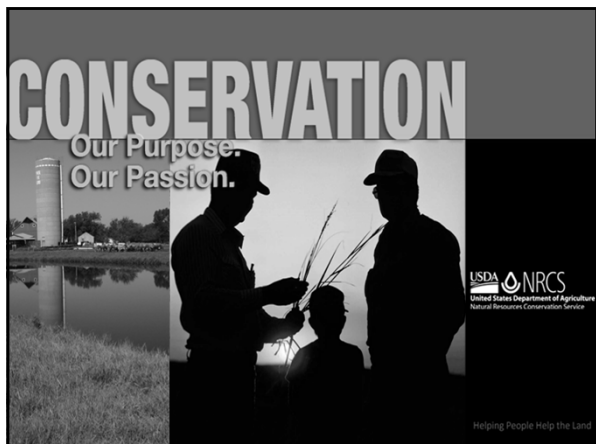
Native groundcover in our area usually includes wiregrass and its associated species. Some have maintained that the longleaf pine – wiregrass ecosystem is the second most diverse terrestrial ecosystem on Earth, only behind tropical rain forest. If you've got native groundcover – don't lose it! To restore native groundcover is extremely difficult and expensive, on the order of thousands of dollars per acre. To promote and enhance native groundcover, burn in the growing season on a 2-3 year rotation. Unfortunately what we are most often left with are what I call “agronomic” weeds – those herbaceous plants and domestic grasses left over after farming.

Conclusion

Nearly every forestry management practice has an effect on wildlife habitat. Most of us would like that effect to be positive. Forest management that benefits wildlife does so by creating habitat diversity, more open conditions, better species and species diversity, soil disturbance, food and shelter. Hopefully, the practices outlined here can assist you in enhancing both your forest management and wildlife habitat.

CONSERVATION

Our Purpose.
Our Passion.




USDA NRCS
United States Department of Agriculture
Natural Resource Conservation Service

Helping People Help the Land.

CONSERVATION

Our Purpose.
Our Passion.

WORKING LANDS FOR WILDLIFE



BACKGROUND:

- HISTORICALLY MORE THAN 90 MILLION ACRES OF THE SOUTHEASTERN US WERE COVERED BY LONGLEAF PINE
- TODAY, ONLY 3.4 MILLION
- LONGLEAF PINE FORESTS PROVIDE CRITICAL HABITAT FOR 29 THREATENED & ENDANGERED SPECIES, INCLUDING GOPHER TORTOISE.

USDA NRCS
United States Department of Agriculture
Natural Resource Conservation Service

Helping People Help the Land.

CONSERVATION

Our Purpose.
Our Passion.

WORKING LANDS FOR WILDLIFE



GOALS/OBJECTIVES:

- ASSIST LANDOWNERS TO VOLUNTARILY CREATE, RESTORE OR ENHANCE GOPHER TORTOISE HABITAT
- INCREASE HABITAT CONNECTIVITY
- IMPROVE WEED AND INVASIVE SPECIES MANAGEMENT
- PROMOTE GOVERNMENT PROGRAMS THAT PROVIDE INCENTIVES FOR DEVELOPMENT OR RESTORATION OF HABITAT

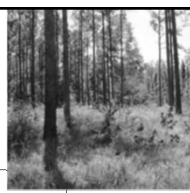
USDA NRCS
United States Department of Agriculture
Natural Resource Conservation Service

Helping People Help the Land.

CONSERVATION

Our Purpose.
Our Passion.

WORKING LANDS FOR WILDLIFE



OUTCOMES/IMPACTS

- COMPLEMENT THE EXISTING LONGLEAF PINE INITIATIVE BY PROVIDING TARGETED FUNDING TO HELP ENHANCE, RESTORE AND PROTECT GOPHER TORTOISE HABITAT
- INCREASE LANDOWNER CONFIDENCE THAT THE CONSERVATION PRACTICES IMPLEMENTED WILL NOT HARM THE SPECIES OR HABITAT


USDA NRCS
United States Department of Agriculture
Natural Resource Conservation Service

Helping People Help the Land.

CONSERVATION

Our Purpose.
Our Passion.

WORKING LANDS FOR WILDLIFE



CORE PRACTICES:

- RESTORATION AND MANAGEMENT OF RARE AND DECLINING HABITATS (643)
- UPLAND WILDLIFE HABITAT MANAGEMENT (645)
- EARLY SUCCESSIONAL HABITAT DEVELOPMENT AND MANAGEMENT (647)


USDA NRCS
United States Department of Agriculture
Natural Resource Conservation Service

Helping People Help the Land.

CONSERVATION

Our Purpose.
Our Passion.



WORKING LANDS FOR WILDLIFE



INTERESTED????

USDA NRCS
United States Department of Agriculture
Natural Resource Conservation Service

Helping People Help the Land.

CONSERVATION Our Purpose. Our Passion.	2008 Farm Bill 
<ul style="list-style-type: none"> • MONICA JONES DISTRICT CONSERVATIONIST 5709 NW 13TH ST., SUITE B GAINESVILLE, FL 32653 352-376-7414 X3 • monica.jones@fl.usda.gov 	 <small>United States Department of Agriculture National Resource Conservation Service</small> <small>Helping People Help the Land.</small>

Equal Opportunity Employer and Provider

"The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer."



Forestry Wildlife Best Management Practices



Presented by: Robin Holland
Florida Forest Service BMP Forester
Robin.Holland@FreshFromFlorida.com
(352) 732-1273

Florida's Forestry WBMPs

- In 2013 the Silviculture BMP Technical Advisory Committee (TAC) Began the Process of Developing the FL Forestry Wildlife Best Management Practices for State Imperiled Species.
- The TAC Consists of 22 Members Who Are Appointed by the Commissioner of Agriculture.
 - U.S.D.A. Forest Service
 - US Fish and Wildlife Service
 - FL Department of Environmental Protection
 - FL Fish and Wildlife Conservation Commission
 - Florida Forest Service
 - FL Water Management District
 - FL Regional Councils Association
 - University of Florida
 - 1000 Friends of Florida
 - Sierra Club
 - The Nature Conservancy
 - Florida Audubon
 - Florida Wildlife Federation
 - Forest Industry
 - Florida Forestry Association
 - Forestry Consultants
 - Private Forest Landowners

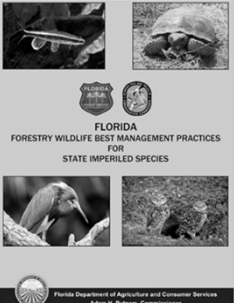
ADAM H. PUTNAM, COMMISSIONER




DEPARTMENT OF AGRICULTURE & CONSUMER SERVICES

Florida's Forestry WBMPs

- Rule 5I-8 F.A.C.** Was Officially Adopted by the Department of State on October 21, 2014. It included:
 - Florida Forestry Wildlife Best Management Practices for State Imperiled Species Manual
 - Forestry WBMP Notice of Intent (NOI)
- WBMPs for Agriculture are Currently Under Development.



ADAM H. PUTNAM, COMMISSIONER



DEPARTMENT OF AGRICULTURE & CONSUMER SERVICES

Florida's Forestry WBMPs

- The WBMPs Only Address STATE IMPERILED SPECIES. They DO NOT Address Any Federally Listed Species.
- Forestry WBMPs Are NOT Designed to Facilitate Wildlife Habitat Restoration or Species Recovery and Expansion.
- WBMPs Are Designed as a Practical Approach for Avoiding and Minimizing the Loss of State Imperiled Species.
- Florida Forestry Wildlife Best Management Practices are VOLUNTARY!

ADAM H. PUTNAM, COMMISSIONER




DEPARTMENT OF AGRICULTURE & CONSUMER SERVICES

Florida's Forestry WBMPs


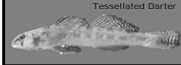

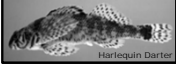
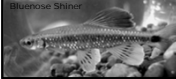

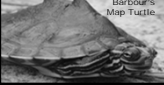


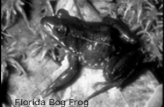
- The WBMPs Cover 16 of the 64 State Imperiled Species.
- These 16 Were Determined to have the Potential to Be Impacted by Agriculture or Silviculture Operations.
 - State Imperiled Aquatic Species (10)
 - State Imperiled Burrowing Animals (2)
 - State Imperiled Nesting Birds (4)

ADAM H. PUTNAM, COMMISSIONER



DEPARTMENT OF AGRICULTURE & CONSUMER SERVICES

State Imperiled Aquatic Species

State Imperiled Burrowing Animals



Gopher
Tortoise

Burrowing
Owl



State Imperiled Nesting Birds



Southeastern
American
Kestrel



Florida
Sandhill
Crane



Tricolored Heron



Little
Blue
Heron

Florida's Forestry WBMPs

- Those Who Do NOT Wish to Enroll in the WBMP Program will Continue to be Subject to All Current Rules, Laws, Regulations, etc. Regarding State Imperiled Species.
- Benefits to Florida Forest Landowners who Enroll In and Correctly Implement the WBMP Program are:
 - Not Subject to Incidental Take Permitting from FWC
 - Not Subject to Fines/Penalties, etc. Associated with an Incidental Take of WBMP Species

ADAM H. PUTNAM, COMMISSIONER



DEPARTMENT OF AGRICULTURE & CONSUMER SERVICES

Florida's Forestry WBMPs

- Landowners and Other Forestry Professionals Who Want to Enroll in the WBMP Program Will Need to:
 - 1) Submit a Notice of Intent (see me later for copies)
 - 2) Implement All Applicable Florida Forestry Wildlife Best Management Practices
 - 3) Maintain Documentation to Very WBMP Implementation for Forestry Practices that are Not Physically Observable (such as fertilization, etc.)
- Applicants Should Be Prepared for On-Site Inspections by FFS & FWC to Verify WBMP Implementation

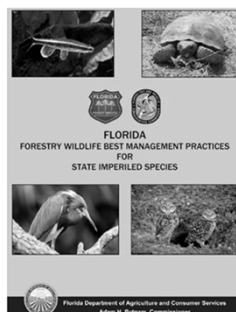
ADAM H. PUTNAM, COMMISSIONER



DEPARTMENT OF AGRICULTURE & CONSUMER SERVICES

Forestry Wildlife Best Management Practices

Robin Holland
Florida Forest Service
BMP Forester
Robin.Holland@FreshFromFlorida.com
(352) 732-1273



Management of Pine Forests for Selected Wildlife in Florida¹

Wayne R. Marion, George W. Tanner, Holly K. Ober, and Matthew Werner²

Pine forests are common in the southeastern Coastal Plain and extensive in Florida. Many of these forests are managed for timber production. As the total number of forested acres in Florida diminishes, the demand for forest products continues to increase. Other resource needs must be satisfied as well--habitat for wildlife species directly dependent upon forests is an excellent example. The need for forest products such as timber and the provisioning of habitat for wildlife are frequently seen as being in competition. This is because forest management activities that enhance timber production are not necessarily good for all wildlife, and activities that enhance wildlife are not necessarily best for timber production. However, it is possible for a forest to sustain both wildlife and successful forest products industries. Most forest management practices will have an effect on wildlife habitat and therefore result in changes in some part of the wildlife community, but with careful management, habitat used for timber production can sustain healthy wildlife populations.

Pine flatwoods (Figure 1) are the forest type that is typically most intensively managed for commercial purposes in Florida, and for this reason, management options favoring wildlife in pine flatwoods will be emphasized in this publication. We will attempt to illustrate ways in which timber and wildlife management can be successfully combined using an integrated approach to fulfill multiple resource objectives.

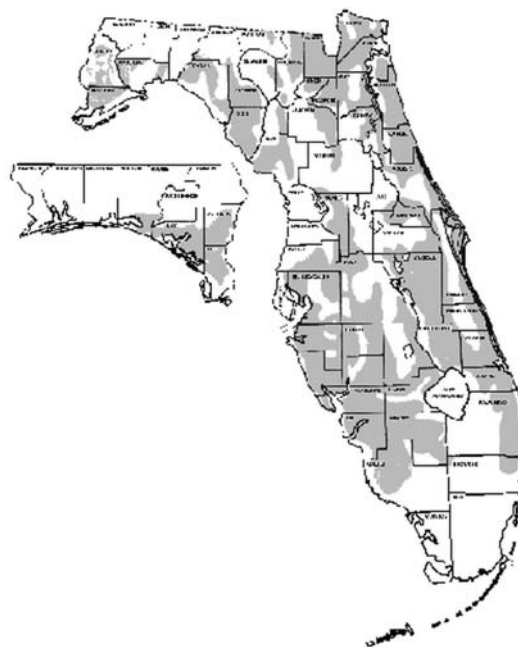


Figure 1. Pine flatwood forests are common throughout Florida.

What Are Pine Flatwoods?

Flatwoods are typically found on poorly drained, sandy soils intermediate in moisture content between wetter bottomlands and drier uplands. Overstory of these woodlands consists mainly of longleaf, slash, and loblolly pines, although pond pine and shortleaf pine do occur in localized areas. Intermixed with the flatwoods are small bayheads, cypress domes, prairies, marshes, and hardwood swamps.

1. This document is CIR706, one of a series of the Wildlife Ecology and Conservation Department, UF/IFAS Extension. Original publication date October 1986. Revised August 2011. Reviewed October 2014. Visit the EDIS website at <http://edis.ifas.ufl.edu>.
2. Wayne R. Marion, former associate professor; George W. Tanner, emeritus professor; and Holly K. Ober, associate professor and extension specialist, Department of Wildlife Ecology and Conservation, UF/IFAS Extension, Gainesville, FL 32611. Matthew Werner, former graduate research assistant, State University of New York, College of Environmental Science and Forestry, Syracuse, NY 13210.

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Opportunity Institution authorized to provide research, educational information and other services only to individuals and institutions that function with non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations. For more information on obtaining other UF/IFAS Extension publications, contact your county's UF/IFAS Extension office.

U.S. Department of Agriculture, UF/IFAS Extension Service, University of Florida, IFAS, Florida A & M University Cooperative Extension Program, and Boards of County Commissioners Cooperating. Nick T. Place, dean for UF/IFAS Extension.

Fire originally played a major role in determining the overstory composition of flatwoods, since longleaf pines are relatively fire-tolerant and slash pines are not. Purposeful fire suppression has greatly altered the balance of ecological forces and caused obvious changes in natural vegetative communities. So, too, has the switch from natural, lightning-caused fires (which traditionally occurred during the summer) to prescribed fire during the dormant season (late winter to early spring). Conversion of natural longleaf, slash pine, and hardwood forests to slash and loblolly plantations throughout the southeastern Coastal Plain has further altered natural vegetative patterns.

The shrub layer of flatwoods forests often includes blackberry, dwarf huckleberry, fetterbush, gallberry, saw palmetto, and wax myrtle. These evergreens produce fruits and berries that are important wildlife foods. Grasses on the flatwoods forest floor often include broom-sedge, chalky bluestem, Indian grass, panicum, paspalum, and wiregrass. Associated herbs can include beggarweed, deer tongue, grassleaf gold aster, partridge pea, and rabbit tobacco. A variety of wildlife species and sometimes domestic livestock graze in Florida flatwoods.

Flatwoods Wildlife

The term wildlife includes all of the free-ranging, wild vertebrate species inhabiting an area. In the Southeast, there are about 400 resident species of mammals, birds, amphibians, and reptiles. Of course, no one parcel of land can support all 400 species. In fact, each species, and sometimes each life stage of a species, requires a unique set of habitat conditions. Consequently, different management techniques favor different wildlife species. Not all wildlife species in an area will react in the same way to a particular management practice. There are a wide range of responses to each practice, depending on the species being considered. In general, the larger a parcel of land and the greater the variety of habitat types present, the greater the variety of wildlife species that can be supported there.

There are many reasons for managing wildlife. One reason is to provide habitat for rare species. Preservation of endangered species, such as the red-cockaded woodpecker, requires careful management of specific habitat types to provide features suited to those species. Another reason to manage wildlife is for recreational activities, such as hunting and wildlife observation. Throughout the Southeast, approximately 10 percent of resident birds and 20 percent of resident mammals are considered game species suitable for hunting. Leasing of hunting rights on private forestlands is becoming a more typical means of gaining access to

game. Hunting leases can provide substantial annual income for the owner of well-managed forests.



Figure 2. Red-cockaded woodpeckers are endangered.

Nationally, only about 20 percent of wildlife-related recreational activity involves hunting. Americans involved in wildlife observation (e.g., bird watching) outnumber Americans involved in hunting by more than two to one. In addition to resident wildlife species, the forests of the southeastern United States support a massive influx of migratory bird species between the fall and spring each year. These are but a few of the worthwhile reasons to manage forests to favor wildlife.

Changing Forest Structure for Wildlife

The ability to produce timber and pulpwood in southern pine forests is continually improving. Examples of new techniques include genetic stock improvement, planting of superior seedlings, and use of various herbicides and insecticides. These developments help foresters meet growing demands for pulp and timber. But how do these developments affect wildlife?

Diversity

Diversity is a technical term used to describe **variety**. The techniques and developments listed above tend to reduce vegetative diversity in flatwoods. As the structural diversity (differences in vegetation in terms of height and spatial arrangement of the plants) of forests is reduced, so is their capability to support various and abundant wildlife species. Forest structural diversity is considered to be the main determinant of the number and abundance of wildlife species. Every species has a unique set of habitat requirements (food, cover, water, and space). Maintenance or enhancement of structural diversity, both within and among forest

stands, maintains or increases the types of habitats available for wildlife.

Within-Stand Diversity

Establishment of even-aged plantations, while facilitating timber production and harvest, has greatly reduced within-stand structural diversity. Low- and mid-story vegetation are often poorly developed in such stands, especially after closure of the pine canopy. Because each tree species has a unique growth form, forest stands with many species have high structural diversity; in contrast, stands with only one or two species have low structural diversity.

Temporal diversity is created when many different species of plants are available to provide wildlife with year-round sources of food and cover. A variety of sources of food or cover also assures that if one species fails, another will likely thrive. Additional information on providing food for forest wildlife is available at <http://edis.ifas.ufl.edu/pdffiles/FR/FR06200.pdf>.

Snags and cavity trees are another component of forest structural diversity important as wildlife habitat. A snag is a standing dead or dying tree that provides perching and nesting sites for many different animals. Snags also are rich in the insects many wildlife species eat. It is useful to leave a few snags standing both in the forest and in more open areas. Additional information on the importance of snags and cavity trees is available at <http://edis.ifas.ufl.edu/pdffiles/UW/UW27700.pdf>.

Among-Stand Diversity

Usually, managing a multiple-use forest to increase among-stand diversity is the most efficient way to enhance wildlife populations. Even-aged stands of trees tend to have low within-stand diversity, but select wildlife can thrive on a plantation if horizontal, or landscape, diversity is maintained through the intermingling of stands of different ages and types.

Landscape characteristics such as topography, soil type, and related physical and biological features should dictate the design of multiple-use forests. The boundaries of a management block should be defined on an ecological basis, such as watersheds and drainages, rather than on historical boundaries. Additionally, the site should dictate which tree species are managed. For instance, hardwood trees should be left or planted in areas normally not suitable or productive for pines, such as swamps, bottomlands, and pond edges. Hardwood forests normally produce and support two or more times the wildlife populations of coniferous

forests. They are a highly desirable feature of among-stand forest structural diversity.

Consider the life-cycle requirements of larger wildlife species when planning the locations of habitat units. Units large enough to provide for breeding territories and home ranges of the species you want to foster will be most useful. Also, because it is common for wildlife species to use different habitats at different times of day or during different seasons, it is essential to provide habitat corridors and travel lanes to allow animals to move between habitat units and across open areas. These habitat corridors will also encourage animals to recolonize isolated patches.

Edge

An important concept in ecology worthy of consideration when managing wildlife is that of **edge**. Edge occurs in the zone where two different habitats meet—sometimes called the ecotone. Both habitats contribute plant and animal species to the edge, and the combination of both in close proximity makes the edge more valuable to wildlife than either habitat alone.

Create good-quality edge habitat by placing two dramatically different habitats side by side for an extended period—at least several years. For example, a clearcut area next to a mature stand might create quality edge for only one year if the following year the adjacent stand is also cut. A higher quality edge will occur if a clearcut area is placed next to a mid-rotation stand. Long or irregularly shaped clearcut areas (C and D in Figure 3) will create more edge than square or circular clearcut areas (A and B in Figure 3). If the edges of the cut follow irregular contours, the benefits of the edge will be even greater. Finally, **coverts** are formed when three or more habitat types meet at one point. Coverts provide additional advantages to edge zones for some wildlife species because they provide an even greater array of resources in close proximity.

Access roads, powerlines, and firelanes also are habitat features that can be managed to greatly enhance landscape diversity. High-nutrient forage plants can be seeded in these areas to provide quality food for wildlife. Mowing of existing weedy vegetation along roadsides can renew forages for many wildlife species. Irregular roads provide greater quantities of valuable forage than straight roads because they provide more edge zone. Open areas like these also are excellent insect habitats. Limiting access of people to these areas will encourage their use by wildlife.

In summary, a mixture of relatively small, even-aged pine stands at various stages of growth, intermingled with each other and with natural communities (streams, hardwoods, cypress domes, etc.) will provide edge and increase among-stand forest structural diversity.

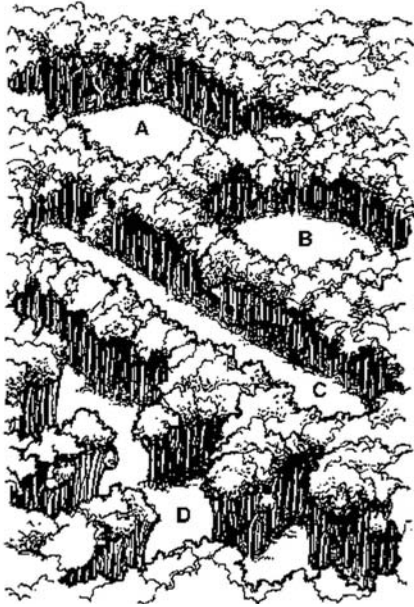


Figure 3. Varying amounts of edge are created by clearcuts of different sizes and shapes.

Developing a Management Plan

The forest is constantly changing. Many changes are subtle and gradual, such as the replacement of plant and animal species by other species. You may not notice these changes, but they are always occurring in a process known as ecological succession.

Forest management intended to benefit wildlife often involves changing the natural course of plant succession to produce habitat conditions that meet the needs of the wildlife species desired. In essence, management practices allow you to somewhat control which native wildlife species will be present on a forestland. A carefully thought-out management plan helps to do this most effectively. For more information on forest management plans, see <http://edis.ifas.ufl.edu/pdffiles/FR/FR12600.pdf>.

A management plan requires several essential steps. First, identify your needs and interests, and your short- and long-term objectives. How often do you want to harvest trees? What types of wildlife do you want to encourage? How intensive will your management input be?

Next, inventory the habitats on your land so that you know what you have to work with. Create management blocks based on the habitat types you identify.

Third, learn about the habitat requirements of desired wildlife species. This step may require further reading, or contacting the Cooperative Extension Service or the Florida Fish and Wildlife Conservation Commission. Be sensitive to wildlife needs for cover, food, and water, and arrange these resources effectively to provide ready access to animals. Many animals depend on insects as food sources, so choose insecticides carefully and apply them judiciously so as not to suppress insect populations in areas not devoted to production. Whenever possible, protect animals' natural sources of water by keeping streams well vegetated and by using procedures to prevent soil erosion during harvesting and other operations.

When you have determined your objectives, choose among the following silvicultural (forest management) practices to achieve them.

Silvicultural Practices and Their Effects on Wildlife

In general, intensified forest management reduces within-stand structural diversity and results in the loss of several habitat characteristics of importance to wildlife. Among-stand diversity can provide partial compensation for the loss of within-stand diversity, however, and will allow for the development of habitat conditions suitable for a wide array of wildlife. Understanding common timber management practices and their effects on forest structural diversity and wildlife will assist in the management of forestlands for wildlife (see Table 1).

Site Conversion

The conversion of natural forests to slash or loblolly pine plantations has drastic effects on wildlife populations. Site conversion typically results in the loss of both the naturally diverse characteristics of the original forest type and the among-stand features created by the intermixing of different forest types. Natural longleaf pine forests in the southeastern Coastal Plain seem to be superior as wildlife habitats because they support a greater variety of herbaceous species and insects, making them more attractive to both plant- and insect-eating wildlife.

By leaving most tree species and natural plant communities intact, you can usually retain valuable diversity over broad areas. The more a stand has been changed from its natural condition, the more management efforts will be required to put it back into its previous condition. Wet areas not suitable for pine growth--such as cypress domes, bayheads, swamps, and marshes--provide important wildlife habitats

and refuges. Draining wetlands and converting them to conditions suitable for pine growth is detrimental to native wildlife and should be avoided if your objective is to promote wildlife.

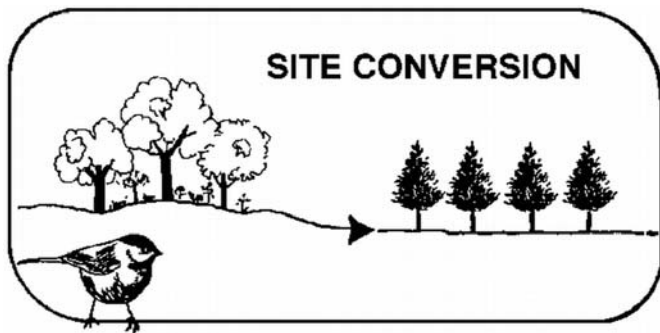


Figure 4. Site conversion changes the dominant species of trees in a forest stand.

To understand the long-term effects of site conversion, consider pine plantations that have been planted on “old-field” sites. Old-field sites are locations converted to fields for agricultural cultivation. In general, old-field sites yield greater pine growth and less understory growth than previously non-cultivated sites. The lack of understory vegetation typical of old-field plantations results from the lack of seeds in the soil. Studies show that there is a steady decrease in understory deer browse as old-field plantations grow older. In contrast, the peak browse value of plantations on previously forested sites occurs in 5- to 10-year-old stands. The lack of structural diversity of vegetative layers in old-field plantations makes them less attractive to wildlife than plantations on previously forested sites. Consider carefully before embarking upon a site conversion that could destroy natural attributes such as the seed legacy in the soil and permanently alter the habitat to the detriment of the wildlife you hope to encourage.

Clearcutting

Clearcutting is the harvesting of all commercially valuable trees in an area. In the southeastern Coastal Plain, clearcutting is the most common timber harvest technique. No other management practice has more immediate and dramatic effects on animals and their habitats. For example, clearcutting typically excludes from a site all birds and mammals that feed and nest in tree crowns. The degree of impact depends on the age of the trees, the plant species present, stocking density, and the size and shape of the stands removed. In northern Florida, approximately 40 percent of breeding forest bird species are cavity-nesters, and clearcutting has drastic effects on local populations of these birds. Competition among animals for nesting cavities is intense; thus, clearcut, short-rotational management systems may limit abundance of these species. Leave snags

and trees with cavities standing whenever possible to fulfill the requirements of cavity-dwelling species of wildlife.



Figure 5. Clearcutting is the most common timber harvest technique in the southeastern Coastal Plain.

Clearcutting is favorable for some species and unfavorable for others. Removal of the shading effects of the forest overstory allows an increased growth of understory vegetation, which may significantly benefit ground-level feeders, such as white-tailed deer, northern bobwhite quail, eastern meadowlarks, cottontails, and wild turkeys. These species require open conditions and early successional plant communities. Production of ground-level fruits available for consumption by wildlife is greatest during the first few years following clearcutting. Studies of Florida flatwoods demonstrate that clearcuts and edges of clearcuts are also important habitats for wintering bird species.

The size and shape of a clearcut site determine the degree of impact on wildlife. Most animals with small home ranges will not use large square or circular cuts of more than 250 acres, and few species will use the centers of large clearings. Large animals, such as deer, use only the outermost 100 yards of large clearcuts, where forest cover is nearby. Smaller, elongated clearcut areas of less than 100 acres are more favorable for most species, since they allow greater use of the food sources within clearings and create more edges. Long, narrow clearcut areas can include territories and home ranges of more animals, allowing more individuals to benefit from the close proximity of food and cover (see Figure 3).

Several alternative regeneration methods may be used instead of clearcutting followed by replanting with seedlings. The two-cut regeneration system, or shelterwood, is an inexpensive, natural way to establish young pines before harvesting all mature trees. Make the first cut a few years before the final harvest, and use prescribed burns to prepare the site for seedling establishment. Thin the stand heavily, leaving only the best-formed trees to provide seed for regeneration. Harvest the remaining trees after a uniform growth of young pines has appeared. The seed tree regeneration system is similar to the shelterwood system, except that it leaves fewer trees standing. The main disadvantage is that the small volume of timber left may be

difficult to sell. Both of these systems are valuable in that they generally increase habitat and wildlife diversity. They produce abundant ground level forage and frequently support substantial bird populations. However, germination, spacing, and survival of seedlings are unpredictable.

Clearcutting usually is followed by a number of treatments that prepare the site for the planting of tree seedlings. These treatments may include any combination of the following: burning or chopping of debris and piling it in windrows with a K-G blade, stump removal, herbicide use, harrowing, bedding, and ditching. The combination and intensity of these site preparation techniques determine their impact on wildlife. Very intensive site preparation practically eliminates the existing plant communities from the site, and establishment of desirable wildlife foods and cover is consequently delayed.

Site Preparation

The length of time required for growing pines to dominate a site also depends on the intensity of site preparation. This is an extremely important point in determining the species of wildlife that will be supported. When the pines are young and the sparse crowns allow sunlight through, wildlife species that prefer open conditions (early successional habitats) will use the site. These include northern bobwhite quail, cottontail rabbits, cotton rats, and sparrows. Young forests also supply abundant food for deer and turkeys. These habitats and animals decline as the pine stand approaches crown closure. After closure and before thinning or burning occurs, a pine plantation provides few food plants and little more than escape and nesting cover for many wildlife species.



Figure 6. Site preparation activities influence which wildlife species a stand will support.

In general, high-intensity site preparation hastens development of the canopy, and in so doing diminishes wildlife habitat. A study comparing high-intensity with low-intensity site preparation demonstrated that, after nine years, low-intensity sites had a well-developed grass/saw palmetto understory and little growth of other woody shrubs. The understory supported a large number of insects, which in turn sustained a variety of insect-feeding

animals, including opossums, armadillos, and shrews. In comparison, high-intensity site preparation had a greater degree of crown closure and a more developed shrub layer. This greatly reduced the amount of ground forage.

Although site preparation techniques such as cultivation and fertilization may reduce the total understory, researchers have found that the proportion of desirable understory forage plants is sometimes greatly increased. After 12 years, prepared sites provided better deer habitat than non-prepared sites. The researchers concluded that intensive pine culture can be compatible with maintaining deer habitat. Other site preparation techniques can help wildlife also. Burning in Florida flatwoods is often beneficial. Also, the piling of debris to form windrows provides cover for deer, bobwhites, and cottontails, but may have long-lasting negative impacts on native groundcover vegetation that serves as food for these species. In general, when considering a variety of wildlife species, less intensive levels of site preparation are more favorable than more intensive levels. However, certain game species, particularly white-tailed deer, are helped in some cases by higher intensity site preparation.

Controlled use of fire in Florida flatwoods is a valuable management tool. Pine forestlands can be burned to accomplish the following goals: 1) to dispose of debris from timber harvesting operations and to prepare the site for planting, 2) to reduce understory and litter to prevent catastrophic wildfires, 3) to control insect pests and diseases, 4) to increase the quantity and quality of edible plants for cattle and/or wildlife, 5) to recycle nutrients bound up in plant litter and debris back into the soil, and 6) to alter or improve the structural aspects of wildlife habitats.

Native plants and animals of Florida flatwoods have evolved in the presence of frequent burning in many pine forest types. Shrubs such as saw palmetto, pawpaw, yaupon, sweetleaf, sumac, and blackberry all respond vigorously to periodic burning. Other species are limited by fire. Exclusion of fire for the first 10 or 15 years in pine plantations may, therefore, have drastic effects on the development of the forest understory, which in turn affects the suitability of these areas for wildlife.

Prescribed Burning

Burning schedules are extremely important to the development of habitat conditions favorable for various wildlife species. A one- to two-year burning schedule keeps the understory open and creates habitat favorable for northern bobwhite quail. A three- to five-year burning schedule

allows for development of browse and cover plants, thereby favoring deer and turkeys. A three- to five-year schedule also allows the accumulation of sufficient fuel to support the next prescribed burn, and is most compatible with timber production in pine flatwoods.



Figure 7. Prescribed burning in pine flatwoods improves habitat for many species of wildlife.

When planning a prescribed burn, seek the advice of a professional forester or technician. A planned burn carried out in a careful and knowledgeable manner can be a safe and effective management tool. Burns are often conducted in the winter shortly after a rain, although there is some evidence that summer burns were historically more common and may be better for wildlife because of their “patchy” nature. A day with a slow, steady wind is desirable. Keeping the blocks of land to be burned relatively small will allow you to stop the burn any time conditions become dangerous. The areas to be burned should be surrounded by natural barriers or plowed fire breaks.

Set your prescribed fire on the downwind side of the site so that the fire will burn slowly back into the wind. Such a fire is considered safe, provided the wind does not change direction. The upper surface layer of pine needles and grass will fuel the fire, but the lower organic layer should be moist enough to resist burning. A slow, steady wind will help to spread the heat before it rises into the tree crowns, and will facilitate a backfire. After burning, always make follow-up observations to prevent flare-ups from smoldering stumps or logs.

Forest Fertilization

Florida pine flatwoods are often lacking in certain nutrients, especially phosphorus. Fertilization, therefore, can influence the growth rate of pines and the quality of flatwoods habitats for wildlife. Soils that are lacking in phosphorus produce poor-quality deer browse that cannot support large populations. The body weights and general condition of deer can actually be predicted through knowledge of the phosphorus levels in the soil.

If phosphorus is applied to the forest before crown closure or if thinning is accompanied by fertilization, then understory plants of superior quality result in enhanced forage for

deer. Sometimes deer damage to pines in young plantations can become a major concern. One suggestion is to create an alternative food source by fertilizing native plants a short distance away from the affected stand. Thinning is the process of removing lesser quality trees from the forest. Thinning in pine stands reduces light competition among pines and improves both the form and growth of trees left standing. The first thinnings usually produce pulpwood that is used in the manufacture of paper products. Later thinnings will produce pines with 8-inch diameters at breast height (DBH) or greater diameter chip-and-saw trees large enough to permit the production of chips and boards from the same tree. Prices for chip-and-saw trees may be much greater than those for pulpwood.



Figure 8. Fertilization can increase the rate of growth of pines.

Thinning

Without thinning and burning, the lack of light penetration through the pine crowns, the root competition for water and nutrients, and the heavy accumulations of organic litter that ties up nutrients all inhibit the development of understory vegetation. Thinning is a timber stand improvement practice (TSI) that opens up the pine canopy of plantations, promoting development of the understory and midstory vegetation that is extremely important for many wildlife species. In general, thinning as early in plantation development and as often as possible is favorable both for wildlife and for forest health and productivity. Alternatively, wider spacing of seedlings can benefit wildlife by delaying canopy closure, although this may have negative effects on timber production.

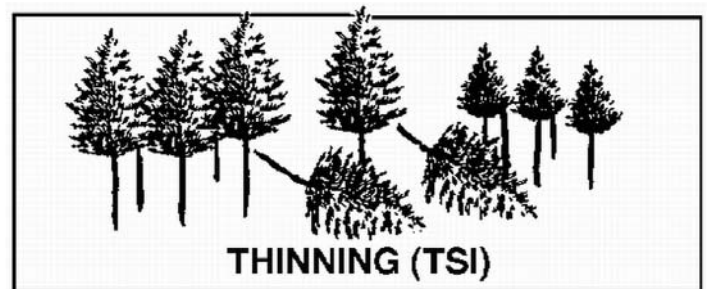


Figure 9. Thinning reduces canopy cover, improving growing conditions for groundcover and the understory.

Conclusions

Managing forested land can be a profitable and rewarding experience. It can provide a satisfying livelihood or a pleasurable pastime. But managing a multiple-use resource always involves trade-offs when making decisions. Defining priorities and making long-term plans based upon sound knowledge and experience can result in intelligent decisions.

It is as difficult to generalize about management of all wildlife as it is to generalize about all combinations of forest management. Some forest management practices are more favorable than others for some wildlife species. The key to management for favoring many wildlife species is in trying to maintain or enhance the variety of vegetation (wildlife habitats) found in an area. Generally, the greater the variety of vegetation, the greater the use of the area by wildlife. If you desire additional information on managing forests to promote wildlife, contact Extension Specialists in the Department of Wildlife Ecology and Conservation, your County Cooperative Extension, Division of Forestry, or Florida Fish and Wildlife Conservation Commission offices.

Sources of Additional Information

Demers, C. 1999. Establishing and maintaining wildlife food sources. University of Florida/IFAS Extension document SSFOR12. <http://edis.ifas.ufl.edu/pdffiles/FR/FR06200.pdf>.

Long, A. J. Environmentally sound forest harvesting. University of Florida/IFAS Extension document SSFOR6. <http://edis.ifas.ufl.edu/pdffiles/FR/FR04200.pdf>.

Ober, H. K., S. Rosenthal, and W. Sheftall. 2009. Ten tips for encouraging the use of your pine plantations by game species. University of Florida/IFAS Extension document WEC 273. <http://edis.ifas.ufl.edu/pdffiles/UW/UW31800.pdf>.

Ober, H. K., S. Rosenthal, and W. Sheftall. 2009. Ten tips for increasing wildlife diversity in pine plantations. University of Florida/IFAS Extension document WEC 274. <http://edis.ifas.ufl.edu/pdffiles/UW/UW31900.pdf>.

Schaefer, J. Helping cavity-nesters in Florida. University of Florida/IFAS Extension document SSWIS901. <http://edis.ifas.ufl.edu/pdffiles/UW/UW05800.pdf>.

Table 1. General impacts of intensive management of pine plantations on selected wildlife as determined from a thorough literature review.

SPECIES	CLEARCUT STAGE						PLANTATION STAGE				
	Clearcut size		Site Preparation				Fertilization	Burn		Thin	Hardwood & Snag Removal
	<100 Acres	>100 Acres	Snag Removal	Burn	Chop	Windrow		1-2 year	3-5 year		
White-tailed Deer	+	-		+	+	+	+		++	++	--
Turkey	+	-						+	++		--
Gray Squirrel	-	-		-	-						--
Bobwhite	++	+		++	+	++		++		++	
Wild Hog											--
Mourning Dove	++	++	-								
Cottontail Rabbit	++	++		+	+	+					
Fox Squirrel	-	-									--
KEY: ++ = Very beneficial; + = Beneficial; Unknown effect [Blank space]; -= Detrimental; -- = Very Detrimental											

Establishing and Maintaining Wildlife Food Sources¹

Chris Demers, Alan Long, Chris Latt, and Emma Willcox²

As human populations in the southeastern United States have grown, so have recreational demands for game and nongame wildlife. Fortunately, southern forests have the potential to be productive wildlife areas, well-suited to meet the growing recreational demands. To take advantage of potential economic opportunities or simply for personal enjoyment, many landowners now include wildlife in their forest management objectives.

Landowners who adopt wildlife management strategies must recognize that each wildlife species requires a specific set of habitat conditions. In other words, animals will frequent your property depending on the condition, type, and variety of food and cover that are present. Although proper wildlife management requires both habitat and population considerations, this publication focuses on methods of increasing the abundance and variety of wildlife food sources on and next to forestlands. Both “consumptive” uses (hunting) and “nonconsumptive” activities (bird watching, wildlife viewing, photography) will benefit from your careful attention to these methods.

Food Sources

Food requirements vary widely among wildlife species and it is beyond the scope of this publication to include all of them. Mast—the seeds and fruits of trees and shrubs—is probably one of the most important naturally occurring seasonal wildlife food sources on your property. Mast is often separated into two categories: hard mast and soft mast. Hard mast includes hard-shelled seeds such as acorns,

hickory nuts, chestnuts, beechnuts, walnuts, pecans, and pine nuts. These seeds, commonly produced in fall and winter, are long-lived and typically high in fat, carbohydrates, and protein. As a result, they provide an energy-rich food source important to many wildlife species during colder months when other forms of nutrition are scarce. Soft mast is comprised of soft, fleshy, perishable fruits such as blackberries, cherries, pawpaws, and persimmons. These fruits are often high in sugar, vitamins, and carbohydrates and also provide an important food and energy source for wildlife. Unlike the seeds that comprise hard mast, soft mast fruits are not normally present during the winter. However, their occurrence during spring, summer, and fall is essential to many migrating and reproducing wildlife species.

Acorns are an especially important source of hard mast in many forests because of their substantial contribution to the total wildlife food base. In autumn, the diets of white-tailed deer and wild turkey can be comprised of up to 70% acorns. Acorn production varies by locality, season, year, oak species, and between individual oaks of the same species. Oaks can be divided into two types, “white oaks” and “red oaks,” based on the length of time it takes them to produce mature acorns. The acorns of white oaks mature in one growing season, while those of red oaks take two growing seasons to mature, resulting in different species having different seasonal and yearly acorn yields. Even within a particular oak species, acorn production can fluctuate greatly from year to year. In good mast years, acorns are abundant and available to wildlife well into the winter season, but in bad

1. This document is SS-FOR-12, one of a series of the School of Forest Resources and Conservation Department, UF/IFAS Extension. Original publication date July 1999. Revised February 2008 and May 2011. Reviewed May 2014. Visit the EDIS website at <http://edis.ifas.ufl.edu>.

2. Chris Demers, Forest Stewardship Coordinator; Alan Long and Chris Latt, former faculty; Emma Willcox, regional specialized agent; Department of Wildlife Ecology and Conservation, UF/IFAS Extension, Gainesville, FL 32611.

years supplies are consumed much earlier. Much of this fluctuation is the result of a natural cycle in oaks called “masting.” Most years, oaks produce low or moderate acorn crops. However, every 2 to 5 years they produce an abundant crop. Acorn yield during an abundant crop year may be 80% higher than in a low-production year.

Like oaks, most other hard and soft mast producers have varying seasonal and yearly yields. It is important to have a variety of hard and soft mast-producing species on your property so that wildlife food is available in each season and to compensate for years when certain individuals or species have low production. In addition to variety, the distribution of these trees across your property will also influence wildlife usage. For more information see the following extension publications on mast and increasing mast production:

- Making the Most of Your Mast (<http://edis.ifas.ufl.edu/fr036>)
- Managing Oaks to Provide Food for Wildlife (<http://edis.ifas.ufl.edu/uw293>)
- The Value of Oaks to Wildlife (<http://edis.ifas.ufl.edu/uw292>)

Although animals will tend to favor mast whenever it is available, herbage and browse (leaves, twigs and buds) provide a second major food source. As with mast, it is better to provide a variety of forage types than to rely on a single species or a few species. You can keep these foods palatable and nutritious through forest management practices such as prescribed burning, timber thinning, and harvest.

Openings and Plantings for Wildlife

A variety of wildlife species benefit from open spaces and supplemental plantings. Good examples of these habitat components include managed forest openings, edge plantings, food plots, and fruit and nut plantations.

Forest Openings

Many wildlife species require and/or benefit from open spaces. These areas provide a variety of foods and cover types that may not occur on forested sites—grasses, herbaceous plants, various insects, berries, small mammals, nesting habitat, and sites for territorial displays and watching for predators. Properly planned openings not only provide important wildlife habitat, but also can add to the attractiveness of your property, serve as firebreaks, and increase internal access. Openings may be located along

roads, right-of-ways, and fence lines, on old log decks, and in strips between different aged plantations. You can plan to scatter several irregular small openings throughout your forest or leave entire old fallow fields unplanted. Two rules of thumb for leaving openings when planting pines on your property are:

- When planting areas of five to ten acres, leave openings approximately 77 feet wide between the newly planted area and existing forest.
- For areas of greater than ten acres, leave numerous small openings scattered throughout the new plantation.

Various low-cost operations encourage the establishment and maintenance of herb and grass cover in these open areas. Disk or rotovate to break up compact soils, such as on log decks or old fire lines. Where grass cover is missing, seed clover or grass. Mow regularly to prevent the intrusion of shrubs and trees. Use rotational mowing (mow different areas at different times of the year) to encourage a wider variety of plants and available mast. Disk established ground covers periodically to enhance species and mast diversity. To avoid the disturbance of ground nesting species such as turkey and quail, and to promote the growth of important wildlife foods such as partridge pea, ragweed, and beggarweed, mow and disk during the winter months (December–February).

Landowners planning to create and maintain forest openings for wildlife may be eligible to receive cost-share funding for these operations under the Wildlife Habitat Incentive Program (WHIP). Wildlife plantings also fulfill requirements for enrollment in the Conservation Reserve Program (CRP). Contact your local U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) office for more information about these programs. See <http://offices.sc.egov.usda.gov/locator/app> to find your USDA Service Center.

Edge Plantings

Other food sources include edge plantings, food plots, and fruit/nut plantations. An edge is a place where two or more different habitat types come together. Wildlife abundance and diversity is typically greatest along edges because they contain food and cover resources common to multiple habitat types. Borders between field and forest or forest stands of different ages or species create edge and are valuable to wildlife because they typically contain a diversity of species from each of the adjacent plant communities. Edge can be further enhanced by planting shrubs, vines, and other herbaceous plants or by managing existing vegetation

to benefit wildlife adjacent to fields, plantations, roads, water bodies, or other openings. Besides wildlife foods, these plants can provide shade, nesting areas, and hiding cover for many wildlife species and, in some cases, may improve the aesthetics of the property. Additional wildlife food and benefits can be provided by leaving several crop rows surrounding harvested agricultural fields.

Edge plantings should be at least 20 feet wide and usually contain taller plants than adjacent open areas. Sometimes the only action needed to establish a stand of shrubs, vines, and other wildlife food plants in an edge is to cut existing trees and let succession run its course. If this method fails to produce the plant community you want, it may be necessary to plant. A clever and inexpensive way to seed these areas is to plow the strip, then stretch a wire or cord between poles along its center. Birds resting on the wire will drop seeds to revegetate the strip. Be advised, however, that this may introduce unwanted or invasive weeds.

If you want more control over your edge plantings, transplanting from elsewhere on the property is a relatively inexpensive solution. A more costly alternative is to order nursery stock. Wax-myrtle, native hollies, hawthorn, crabapple, dogwood, wild plum, bicolor lespedeza, sumac, persimmon, cherries, blackberries, honeysuckle, greenbriar, and blueberries are some of the species suitable for edge plantings. You can allow these to grow into solid thickets, which will provide both food and cover. If you remove trees to provide sufficient light to the strips, cut the trees with the least wildlife value. Trees such as cherries, oaks, and other fruit- and nut-producers have high food value, and should be retained scattered throughout the edge strip.

Food Plots

Food plots are an effective, albeit relatively expensive, method of providing food sources for game birds, deer, rabbits, raccoons, and other species. In this method, fields are planted with grains, corn, millet, legumes, sunflowers, and other plants with high nutritional value for wildlife. The size of food plots varies according to landowner preferences and the requirements of the target wildlife species, but usually they are a minimum of 1/2 to 1 acre in size, with a maximum of 5 acres.

When creating food plots, one of the most important considerations for many wildlife species is distance to escape cover (brushy, shrubby, and wooded areas). Animals may not use the center of larger plots if they feel they are exposed and too far from shelter where they can hide from predators and human disturbance. Rectangular plots have

the advantage of keeping distance to cover relatively short, while size can be increased as needed with added length. Rectangular plots also have far more edge than square or circular plots of similar size. Because wildlife diversity and abundance is typically greater at edges, the more edge you have the more individual animals you are likely to see. In most cases, food plots should be distributed across the property to make them available to as many animals as possible and lessen foraging pressure on any one plot. Well-distributed food plots will also fall within more animals' home ranges and therefore will benefit more individuals. Generally, 1- to 5-acre food plots should comprise approximately 1–5% of your land area.

Generally, it is best to provide food for wildlife year round by planting both cool- and warm-season food plots. Try to plant your cool- and warm-season food plots in different fields or in different sections of a field. That way you will not have to remove available food in preparation to plant the next season's food plot. Each season, make sure you plant a mixture of different plants in each food plot. Mixed plantings reduce the risk of losing entire food plots to poor weather, insect pests, or disease. They also provide a diverse food source and, as different plant species grow at different rates and times even within a season, ensure that new plant species are available to replace those that have matured and died. Diverse food plots also attract a wider variety of insects, which are important to certain wildlife such as turkey and quail, particularly when they are rearing young.

As with any crop, the successful establishment of food plots starts with proper soil sampling and depends on good seedbed preparation followed by proper liming and fertilization. Seed selection is important and should be based on your soil type and the wildlife species or groups of species you are targeting.

The Florida Fish and Wildlife Conservation Commission, the Natural Resources Conservation Service (NRCS), or the Cooperative Extension Service can provide advice on which crops to plant for your target wildlife species, the suitability of your soil for these crops, and their cultural requirements. For more information on wildlife food plots see the following Extension publications:

- 2010 Wildlife Forages for North Florida—Part I: Cool Season Food Plots (<http://edis.ifas.ufl.edu/ag140>)
- A Walk on the Wild Side: 2010 Cool-Season Forage Recommendations for Wildlife Food Plots in North Florida (<http://edis.ifas.ufl.edu/ag139>)

- Soil Fertility Management for Wildlife Food Plots (<http://edis.ifas.ufl.edu/ss468>)
- Establishment of Food Plots for White-tailed Deer in Central and South Florida (<http://edis.ifas.ufl.edu/uw262>)
- Supplemental Feeding and Food Plots for Bobwhite Quail (<http://edis.ifas.ufl.edu/uw264>)

Fruit and Nut Plantations

Small fruit and nut plantations are another way to attract wildlife. Fast-maturing species like sawtooth oak, red mulberry, honeylocust, persimmon, black cherry, and Chinese chestnut should produce fruit by age 10. Large-caliper trees (diameter = 2–4 inches) should be stagger planted approximately 50 feet apart in rows 12 feet apart. Bareroot stock can be planted using a spacing pattern of 8 feet by 12 feet. Once these mast producers bear fruit, watch them for about three years and note which trees produce well and which produce poorly. As thinning becomes necessary, remove the poor-producing trees to provide additional light and space for the best-producing trees and understory plants.

In the case of dioecious species such as red mulberry and persimmon (which produce male and female flowers on different trees), only the female trees bear fruit. To provide growing space for fruit-producing trees, you should remove most of the male trees, leaving only a few to pollinate the female flowers.

Use caution when considering species. Some exotic species, such as sawtooth oak and Chinese chestnut mentioned above, have been championed due to their production of abundant mast at a young age. However, a multitude of native fruit and nut producing trees is available in Florida. Planting a variety of native species of fruit and nut trees is considered a superior alternative to planting exotic species.

In areas where deer or rabbits may excessively browse or girdle newly established seedlings, it may be necessary to use some type of protection device, such as a tree shelter. These devices provide physical protection for seedlings until they become established and can withstand some damage.

Enhancing Wildlife Food Production in Existing Forests

Regular forest management practices can also increase diversity, availability, and quality of wildlife food. The primary objective of these practices will be to replace older shrub and hardwood cover with younger sprouts and herbaceous vegetation.

Prescribed Fire

Fire causes many shrubs, grasses, and herbaceous plants to re-sprout from roots and produce more succulent foliage and flower more prolifically than they would in the absence of fire. Fire also recycles nutrients, raises the soil pH and increases germination of seeds that have accumulated in the soil surface. Fire frequency and season will favor different species. For example, a one- to two-year burning schedule keeps the understory open and creates habitat favorable for quail. A three- to five-year burning schedule allows browse and cover plants to develop, thereby favoring deer. Some plant species only bloom when they are burned during a certain season. Other plant species will re-sprout if burned in one season but are killed if burned at a different time of year. All of this affects the availability of wildlife food and cover resources. For more information on prescribed fire and wildlife see the following extension publications.

- Effects of Prescribed Fire on Florida's Wildlife and Wildlife Habitat (<http://edis.ifas.ufl.edu/uw132>)
- Benefits of Prescribed Burning (<http://edis.ifas.ufl.edu/fr061>)
- Understanding Fire: Florida's Land Management Tool (<http://edis.ifas.ufl.edu/uw124>)

Thinning

Thin dense pine plantations to allow more sunlight to reach the forest floor, which promotes growth of herbaceous plants, grasses, shrubs, and vines. Residual pine densities of 50 to 70 ft² /ac are a little lower than optimum for timber production, but will favor understory plant development and are a good compromise if wildlife is to be included in forest management objectives. Follow-up treatments of prescribed burning or fertilization will increase ground cover development and the nutritional value of forage and mast. For more information on thinning and other forest management practices that benefit wildlife, see the following Extension publications:

- Ten Tips for Increasing Wildlife Biodiversity in Your Pine Plantations (<http://edis.ifas.ufl.edu/uw319>).
- Ten Tips for Increasing the Use of Your Pine Plantations by Game Species (<http://edis.ifas.ufl.edu/uw318>).
- Management of Pine Forests for Selected Wildlife in Florida (<http://edis.ifas.ufl.edu/uw098>)
- Management Practices to Support Increased Biodiversity in Managed Loblolly Pine Plantations (<http://edis.ifas.ufl.edu/fr236>)

Promote Diversity

Forests with a variety of stand ages and/or species mixtures generally support more animals than do forests with little habitat diversity. Pines and hardwoods, although not always economically compatible, are a very good combination for creating habitat diversity. Protect hardwood hammocks or clumps, hardwood stands along streams, and productive, mast-producing individual trees. Also, wildlife populations benefit when stands of different ages are available because each age represents a different stage of plant succession that favors different plant and animal species. Balancing the age structure of a forest accomplishes two objectives: (1) sustained yield of forest products, and (2) diverse wildlife habitat.

In addition to the availability of wildlife food plants, consider the availability of *protective cover*. Many things can be considered cover—tall grass, brush piles, thickets, snags, stands of mature timber—depending on the wildlife species you wish to promote. In the ideal situation, plants that provide wildlife food will provide cover as well. Many animals often hesitate to stray far from cover; therefore, to obtain the greatest benefit from your wildlife food sources, try to maintain patches of protective cover nearby.

Conclusion

Mast and forage production for wildlife can be increased on your forest property through the judicious use of open areas, edge strips, food plots, prescribed burning, thinning, and stand diversity, singly or in various combinations. The two most important criteria for the success of your efforts will be the diversity and seasonal availability of food sources.

References

Baughman, M. 1996. *Building Partnerships for Ecosystem Management: Westvaco and the ACE Basin*. SAF/SFRC Spring Symposium. Gainesville, FL.

Decker, D. J., J. W. Kelley, T. W. Seamans, and R. R. Roth. 1990. *Wildlife and Timber from Private Lands: A Landowners Guide to Planning*. Info. Bul. 193. N.Y.S. Coll. of Agr. and Life Sci. Cornell Univ.: Ithaca. 56p.

Dickson, J. G., and E. O. Maughan (eds.). 1987. *Managing Southern Forests for Wildlife and Fish*. General Tech. Report SO-65. USDA Forest Service, New Orleans. 85p

Fazio, J. R. 1987. *The Woodland Steward*. The Woodland Press, Moscow, Idaho. 211p.

Hunter Jr., M. L. 1990. *Wildlife, Forests, and Forestry*. Prentice Hall, Inc.: Engelwood Cliffs N.J. 370p.

Jackson, J. 1995. *Maintaining Permanent CRP Wildlife Plantings*. U. Georgia Coop. Ext. Serv.: Athens. 3p.

Marion, W. R., M. Werner, and G. W. Tanner. 1986. *Management of Pine Forests for Selected Wildlife in Florida*. Circular 706. FL Coop. Ext. Serv., IFAS, University of Florida, Gainesville, FL. 9p.

Sekerak, C. M., and G. W. Tanner. 1994. *Making the Most of Your Mast*. SS-FOR-3, FL Coop. Ext. Serv., IFAS, University of Florida, Gainesville, FL. 4p.

Ten Tips for Increasing Wildlife Biodiversity in Your Pine Plantations¹

Holly K. Ober, Stanton Rosenthal, and William Sheftall²

Many forest landowners are interested in managing their property to achieve more than one objective. It is quite common for forest landowners in Florida to aspire to produce timber products while also providing habitat for wildlife. Some individuals are most interested in increasing the abundance of game species to maximize hunting opportunities, and they should see the publication, “Ten Tips for Encouraging the Use of Your Pine Plantations by Game Species,” at <http://edis.ifas.ufl.edu/UW318>, for more information. High priority for other forest landowners is providing habitat that will attract a diversity of wildlife species. Here we discuss strategies to achieve this goal.

Production of timber products and enhancement of wildlife diversity are compatible objectives. However, some trade-offs may be necessary because strategies that maximize timber growth are typically not exactly the same as strategies that will provide habitat for a wide variety of wildlife species. For this reason, it is important to prioritize your objectives and decide where wildlife ranks relative to timber production in your land use planning. If wildlife is your first priority, you may want to incorporate all ten of the tips listed below. If timber production is your top priority and wildlife is second, you may want to adopt fewer of the suggestions provided on ways to tweak pine plantations to provide habitat for a range of wildlife species.

Tip #1 – Manage Your Timber on Long Rotations

An individual forest stand will provide habitat for different suites of wildlife species at different points in time as the stand ages. For example, some wildlife species thrive in the early stages of stand development and others at the later stages. Few animals thrive in middle-aged stands because of heavy shading. Landowners who manage on short rotations always have many stands in the middle-aged stage, which means that a large portion of their land is in a stage where it is not producing quality habitat for most wildlife species. Increasing the rotation length of each stand will ensure that a greater number of stands will be producing quality habitat for a variety of wildlife species at any particular point in time.

Mature stands of trees are the most valuable from a wildlife perspective. Many wildlife species thrive in conditions provided by more mature forest stands and will congregate in the few older stands they can find.

Tip #2 – Promote Cavities, Snags, and Logs

Cavities are an important habitat feature for a large number of animals. Nearly 40 species of birds and a variety of mammals require cavities for nesting, roosting, and

1. This document is WEC274, one of a series of the Wildlife Ecology and Conservation Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date December 2009. Revised March 2013. Visit the EDIS website at <http://edis.ifas.ufl.edu>.
2. Holly K. Ober, assistant professor and Extension specialist, Department of Wildlife Ecology and Conservation, University of Florida, IFAS, at the North Florida Research and Education Center, 155 Research Rd, Quincy, FL 32351; Stanton Rosenthal and William Sheftall, natural resource Extension agents, University of Florida, IFAS, at the Leon County Extension Office, 615 Paul Russell Rd, Tallahassee, FL 32301.

denning. Hardwood trees (broadleaved trees such as oaks, maples, beech and sweetgum) and cypress often develop cavities while alive, whereas most conifers (cone-bearing softwood trees) such as pines are more likely to develop cavities after death. Because cavities are often the limiting factor for species that use them (the “limiting factor” is the one key habitat element missing from a given area), it is recommended that trees with cavities always be retained unless they pose a safety hazard during logging operations. If trees with cavities are in short supply, artificial nest boxes can be used as a partial substitute in areas where den trees are lacking. See “Helping Cavity-Nesters in Florida,” at <http://edis.ifas.ufl.edu/UW058>, for additional information on providing artificial cavities for wildlife.

Snags (standing dead or dying trees) provide additional benefits for wildlife in the form of hiding places beneath peeling bark, branches free of foliage to serve as perches for foraging raptors, and food for many animals in the form of insects and fungi. Because artificial nest boxes provide only cavities and not these other resources, nest boxes should not be thought of as an equivalent substitute for dead and dying trees.

Once snags have fallen to the ground, they provide resources for an entirely different group of animals. Logs are used as shelter, as basking sites, as navigational aids, and as a cafeteria of different foods for wildlife which feed on insects, spiders, worms and fungi. See “Dead Wood: Key to Enhancing Wildlife Diversity in Forests,” at <http://edis.ifas.ufl.edu/UW277>, for additional information on the importance of dead wood for wildlife and tips on how to provide it.

Tip #3 – Increase Spacing Among Trees

Planting pines at high densities (greater than 600 trees per acre, or tpa) is a strategy often used to maximize growth rates of pines. With this strategy, little sunlight can reach the forest floor, so little vegetation is able to compete with the pines for nutrients and water. Complete lack of groundcover greatly reduces the ability of a stand to provide food and/or cover for most wildlife species. Many animals rely on herbaceous plants (i.e., grasses, legumes and forbs) on the forest floor for food, and if herbaceous plants are absent, animals will not use the stand.

Two modifications can make pine plantations more suitable for wildlife. First, pines can be planted at lower densities (350 to 500 tpa). Alternatively, pines can be planted at high densities, and then thinned several times early in the life of

the stand. The first thinning should occur when trees reach a merchantable size (usually about 15 years for pulpwood). Later thinning can occur at 5- to 10-year intervals thereafter.

Tip #4 - Use Herbicides to Selectively Control the Hardwood Mid-Story

In stands with widely spaced pines, hardwood shrubs and trees can develop into a dense mid-story that blocks sunlight from getting to the ground. A dense mid-story also increases competition among pines, shrubs, and herbaceous plants growing at the ground level. As mentioned in tip #3, the herbaceous plants that grow at the ground level provide an extremely important source of food for wildlife. Herbicides can be used to selectively remove the hardwoods without harming desirable herbaceous plants and shrubs that produce berries, such as beautyberry, wax myrtle, sumac, plum and saw palmetto. See <http://edis.ifas.ufl.edu/fr158> for specific recommendations on how to control hardwoods in pine stands.

Tip #5 – Use Fire to Stimulate Non-Woody Groundcover and to Control Hardwoods

Florida experiences more lightning strikes than any other state in the country. These lightning strikes often start natural wildfires in wooded areas, which stimulate the growth of many plants that serve as food for wildlife. Prescribed burning is a technique that can be used to obtain the same benefits that would occur after a wildfire, but under more controlled conditions.

Fire can increase habitat quality for wildlife in several ways: it reduces the hardwood mid-story, increases the abundance and diversity of herbaceous plants, and improves the quality of herbaceous plants as wildlife food. The new, succulent herbaceous growth that sprouts soon after a fire is more palatable and more nutritious than the older, tougher plant growth cleared away by a fire. Also, fire increases seed, fruit, and flower production of many plants, which results in a greater diversity and increased quantity of food for wildlife. See <http://edis.ifas.ufl.edu/FR055> for additional tips on prescribed burning.

Tip #6 – Consider Your Choice of Pine Species Carefully

Most of the southeastern Coastal Plain was historically forested with longleaf pine (*Pinus palustris*), so native wildlife species are well adapted to longleaf forests and savannas (sparsely forested grasslands). The branching architecture of longleaf pines is such that more sunlight reaches the forest floor in longleaf stands than in slash pine stands (*Pinus elliottii*). Due to their inability to self-prune, even less sunlight reaches the ground in loblolly (*Pinus taeda*) and sand pine (*Pinus clausa*) stands. Longleaf pines have a longer life span than other southern pines, making them more suitable for the longer rotations many wildlife species prefer. Longleaf pines are also more resistant to many of the insects and diseases that plague other southern pines, such as southern pine beetle. Finally, longleaf pines are preferred by red-cockaded woodpeckers because the trunk of longleaf pines will exude a sticky resin when pecked by woodpeckers below their nest cavities, which provides insurance against predators such as rat snakes

Tip #7 – Don't Be Too Thorough When Cleaning Up After Logging

Logging debris such as tree tops and limbs (called slash) can be a valuable source of food and cover for many smaller animals. If retaining some slash on the ground will not impede future plans for initiating a new stand of trees, some slash can be left—either spread out to break down and recycle nutrients into the stand to improve growth, or collected in small piles to provide escape cover and food for animals. Either approach has the added benefit of reducing the costs associated with collecting and removing these materials after timber harvest.

However, it is important to recognize that leaving large amounts of slash on the ground for extended periods can increase the risk of wildfire. Prescribed burning on a regular basis can greatly reduce this risk while also maintaining the diversity of ground layer plants that provide food for wildlife.

Tip #8 – Maintain Habitat Diversity

The greater the variety of food and cover available in a given area, the greater the variety of wildlife that can reside there. Providing diverse food sources in the areas next to managed pine stands will allow the stands to support more wildlife. Many hardwood trees and shrubs provide hard mast (nuts from oaks, hickories, beech, etc.) and soft mast

(fruit from cherry, dogwood, persimmon, wax myrtle, plum, etc.) that serve as food for wildlife.

Drainages and bottomland forests are areas where hardwoods naturally predominate, and a variety of food resources is typically available there. These areas should not be converted to pines, but should be allowed to stay as is. If any hardwoods are harvested from these areas, care should be taken to retain those individual trees that consistently produce large mast crops. See <http://edis.ifas.ufl.edu/UW293> for additional information on managing oaks for wildlife, and tips on selecting “leave trees” during timber harvest operations.

Providing a diversity of cover options is also important. Small patches of low brushy vegetation in and around pine stands can provide escape cover as well as food resources. Periodically disturbing such areas will stimulate early successional mast-producing species such as blackberries and dewberries, while preventing the growth of woody plants. Creating and maintaining a few small openings will benefit those species that thrive in areas where forests and open areas meet (edges).

Tip #9 – Create Travel Corridors

Most wildlife avoid exposed, treeless areas during daylight hours. In agricultural landscapes where forest stands tend to be isolated, planting narrow forest lanes (3 to 5 rows of trees) to connect isolated stands can increase animal movement between stands. Similarly, fence rows can serve as travel corridors for animals wanting to move between forest stands if natural vegetation is allowed to grow up along them, and if invasive exotic vegetation is controlled. Unfortunately, birds perching on the fence are equal opportunity planters of both desirable and invasive species! See <ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice...hedgerow.../422-fl.doc> for tips on creating natural fence rows.

Tip #10 – Protect Riparian, Aquatic, and Wetland Areas

Standing or moving water is an essential resource for most species of wildlife. All animals require some form of water, and most vertebrate species get their water by drinking (although some can get adequate water from dew and humidity). Many species also require water for breeding, or they require as food some organism that lives only in water bodies. The lush vegetation that grows in wet areas also attracts many wildlife species searching for cover. For all these reasons, areas surrounding water bodies (such as streams, rivers, lakes, ponds, wet sinkholes and even simple

low-lying depressions that fill periodically with water) are hotspots of activity for wildlife. Efforts should be made to protect these areas from erosion, such as retaining buffers around them when harvesting and creating bridges to pass over them rather than placing roads through them.

Guidelines have been established for forestry and road-building activities in and near wetland areas, called Best Management Practices (BMPs). See http://www.floridaforestservice.com/publications/silvicultural_bmp_manual.pdf for details on harvesting, skidding, and road building BMPs.

Additional Information

Andreu, M. G. 2008. Management practices to support increased biodiversity in managed loblolly plantations. University of Florida, IFAS Extension document FOR 183. <http://edis.ifas.ufl.edu/FR236>.

Florida Forest Service. 2008. Best Management Practices for Silviculture. http://www.floridaforestservice.com/publications/silvicultural_bmp_manual.pdf.

Long, A. J. 1999. Prescribed burning regulations in Florida. University of Florida, IFAS Extension document FOR 67. <http://edis.ifas.ufl.edu/FR055>.

Natural Resource Conservation Service. 1999. Conservation Practice Statement. Hedgerow Planting. Technical Guide, Section IV, Code 422. <ftp://ftp-fc.sc.egov.usda.gov/NHQ/practice...hedgerow.../422-fl.doc>.

Ober, H. K., and P. J. Minogue. 2007. Dead wood: key to enhancing wildlife diversity in forests. University of Florida, IFAS Extension document WEC 248. <http://edis.ifas.ufl.edu/UW277>.

Ober, H. K., and P. J. Minogue. 2008. Managing oaks to produce food for wildlife. University of Florida, IFAS Extension document WEC 249. <http://edis.ifas.ufl.edu/UW293>.

Ober, H. K., Rosenthal, S., and W. Sheftall. 2009. Ten tips for encouraging the use of pine plantations by game species. University of Florida, IFAS Extension document WEC 273. <http://edis.ifas.ufl.edu/UW318>.

Osiecka, A., P. J. Minogue, A. Long, J. Nowak, and M. Mossler. 2005. Herbicides registered for pine management in Florida - 2008. University of Florida, IFAS Extension document CIR 1475. <http://edis.ifas.ufl.edu/fr158>.

Schaefer, J. 1990. Helping cavity-nesters in Florida. University of Florida, IFAS Extension document SSWIS901. <http://edis.ifas.ufl.edu/UW058>.

Dead Wood: Key to Enhancing Wildlife Diversity in Forests¹

Holly K. Ober and Patrick J. Minogue²

Animals require specific habitat elements to satisfy their basic needs of food, water, and cover. Although landowners interested in enhancing forest habitat for wildlife often consider the species and age of live vegetation, they often overlook the importance of dead wood. Dead wood provides resources for many different species of animals. In fact, for some forest wildlife, wood only becomes valuable after death.

Three forms of dead wood provide important resources for wildlife: standing dead trees (snags), large diameter dead wood that has fallen to the ground (logs; also called “coarse woody debris”), and smaller diameter branches and twigs gathered into a mound (a brush pile). Each of these forms of dead wood provides unique habitat features for wildlife.

Snags

Cavities within trees are required by many wild animals. Nearly 40 species of birds in Florida nest in tree cavities, including red-cockaded woodpeckers, hairy woodpeckers, downy woodpeckers, pileated woodpeckers, southeastern American kestrels, screech owls, brown creepers, brown-headed nuthatches, white-breasted nuthatches, eastern bluebirds, Carolina chickadees, and Carolina wrens. Many mammals use tree cavities as well, including evening bats, big brown bats, Rafinesques big-eared bats, squirrels, raccoons, opossums, and bears.

Different kinds of trees develop cavities at different ages. In hardwood trees (deciduous, broadleaved trees, such as oaks, maples, and elms), cavities often form while trees are alive. In conifers (cone-bearing, softwood trees, such as pines and cypress), cavities are more likely to form after trees die. For this reason, natural deciduous forests tend to have many more cavities than conifer stands.

Intensively managed conifer plantations are often grown on short rotations to maximize financial returns. In these stands, very few live trees have cavities, and snags are usually removed to provide space for growing trees. Therefore, habitat for all those wildlife species dependent upon cavities may be absent. In regions where managed conifer stands cover large acreages, the scarcity of cavities may severely limit survival of many wildlife species across these large areas. Increases in the number of snags can greatly increase wildlife diversity in these regions.

Only a small number of the wildlife species that use cavities can create them. Examples of such animals, (called “primary cavity excavators”), include woodpeckers, Carolina chickadees, and brown-headed nuthatches. A much larger group of species relies on pre-existing cavities. Examples of animals in this second group, (called “secondary cavity users”), include owls, bats, many songbirds, and many small mammals. In areas where primary excavators, cavity-prone hardwoods, and conifer snags are scarce, artificial nest boxes can provide additional habitat for secondary cavity

1. This document is WEC 238, one of a series of the Wildlife Ecology and Conservation Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date July 2007. Reviewed November 2010. Revised August 2013. Visit the EDIS website at <http://edis.ifas.ufl.edu>.
2. Holly K. Ober, associate professor and Wildlife Extension Specialist, Department of Wildlife Ecology and Conservation; Patrick J. Minogue, associate professor and Forestry Extension Specialist, School of Forest Resources and Conservation, University of Florida, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611.

users. See edis.ifas.edu/uw058 for more information on creating nest boxes for wildlife.

Snags provide more to wildlife than just shelter within cavities (figure 1). Crevices formed between the trunk of a dead tree and the peeling bark provide protection from the sun for bats and amphibians. Branches free of leaves serve as perches for birds of prey to view movements of prey below. Decaying wood is home to many insects and fungi which serve as food for birds, mammals, amphibians, and reptiles.



Figure 1. Snags provide shelter, perches, and food resources.
Credits: H. K. Ober

Logs

Logs are another form of dead wood, useful to an entirely different group of animals. Logs on the forest floor (figure 2) provide shelter for animals of many sizes, such as bear and turkey vultures at the large end of the spectrum, and mice, salamanders, lizards, toads, and frogs at the small end. The high humidity inside and beneath decaying logs offers moist conditions that help wet-skinned amphibians stay wet. The upper sides of logs are used by animals as platforms for basking in the sun. Small mammals such as voles and shrews use the interior of logs as nest sites and as places to hide from predators.

In addition to shelter, logs provide food resources and help animals navigate. The fungi, spiders, beetles, termites, ants, grubs, worms, snails, and slugs found inside rotting logs are food for animals such as salamanders, snakes, birds, mice, shrews, and bears. Logs also provide landmarks, territory



Figure 2. Logs provide shelter, humid microclimate, basking sites, navigational aids, and food resources.

Credits: H. K. Ober

markers, and movement pathways across the forest floor for small mammals.

Brush Piles

Brush piles are mounds of woody vegetation that can be artificially created for the benefit of wildlife (figure 3). The primary function of brush piles is to provide shelter from the weather and from predators. The lower portions of a brush pile provide cool, shaded conditions. These areas can be used as resting sites for amphibians and reptiles and as escape cover for many mammals. The upper layers can be used as perch sites and nest sites by songbirds. In managed stands with no understory trees or shrubs, these piles may be the only place for songbirds to build nests.



Figure 3. Brush piles provide shelter, shade, perch sites, and food resources.

Credits: H. K. Ober

Brush piles also supply food resources for wildlife. As the material in brush piles decays, insects are attracted. Insect-eating animals will soon follow. As the abundance of smaller animals seeking insects or shelter in a pile increases, predators that feed on these smaller prey will be attracted. Thus, owls, hawks, foxes, and coyotes may ultimately visit brush piles.

How Is Dead Wood Created?

Snags

Snags can be created naturally or artificially. Lightning, wind, ice, fire, and accidental logging damage can kill trees instantly. These factors can also weaken trees, increasing the chances of death in the future from disease and insects. Many managed forest landowners remove dead trees because of concerns for safety, fire, and insect outbreaks. When deciding whether or not to allow snags to remain in or near a managed stand, it is necessary to weigh these concerns against the many potential benefits snags can provide for wild animals. In healthy stands, individual trees that are either killed instantly or damaged but not killed can provide excellent habitat for wildlife while posing fairly little risk of epidemic insect outbreak. However, this is not true when such trees are located in stands of stressed trees or in areas where many southern pine bark beetles already exist. Stands of stressed trees can result from planting trees at excessive densities or from planting tree species inappropriate for the growing conditions of the site. In these stands, the risk of epidemic insect outbreaks may increase if newly dead and damaged trees are allowed to remain standing. When deciding whether or not to keep snags in or near managed stands, it is wise to consider the health of the stand. For additional advice on risk factors, contact your local County Cooperative Extension or Florida Forest Service office.

If additional snag habitat for wildlife is desired, there are several ways new snags can be created. Three techniques used to create snags are girdling, topping, and injecting. Girdling involves cutting through both the bark and the cambium (the actively growing layer of cells just inside the bark) around the entire tree trunk, near the base. This will prevent movement of nutrients throughout the tree, causing death. The process may take such a long time that the tree may fall before cavities have formed, creating a log rather than a snag. Topping involves removing the tops of trees with chain saws, guns, or explosives. Finally, snags can be created by injecting live trees with cultures of decay organisms or herbicides near the base of the tree.

Snags are also created through the natural process of suppression (called “suppression mortality”). This process is common in southern pine stands, as the larger, healthier trees shade out smaller, less healthy individuals. Stands planted with 500-800 seedlings per acre may have fewer than 100 trees remaining at maturity, with the rest lost to suppression mortality. A similar process occurs in natural stands. Snags created this way are generally of limited use to wildlife. Because trees with the smallest diameters are most likely to die through suppression, these snags provide habitat for small animals only. Also, the fast decay rate of small diameter snags allows them to provide habitat for wildlife for only a short period of time. Finally, southern pine bark beetle infestations often begin in stressed trees, so allowing suppressed trees to remain as snags is not advisable in stands managed for timber production. See edis.ifas.ufl.edu/in333 for more information on the habits of southern pine beetles.

Logs

Logs are formed naturally when live or dead trees fall. In many intensively managed forests where the main goal is financial returns from timber products, dying trees are harvested before they fall. Therefore, log habitat is usually extremely limited in these areas.

There are several ways log habitat can be created for wildlife. First, a few trees of limited value for timber products can be left on the ground after thinning or harvesting. Second, trees that fall during hurricanes, tornadoes, and ice storms can be left on the ground. Due to the risk of southern pine bark beetle infestation in pockets of injured trees, it is recommended that damaged trees be removed from managed stands when large numbers of trees are affected by storms. However, isolated damaged trees may be felled and left on the ground to provide habitat for wildlife. Once again, the health of the stand surrounding a damaged tree should be considered when deciding whether concern for beetle epidemics outweigh the opportunity to provide habitat for wildlife. Finally, when evidence of southern pine beetles is recognized in a stand, it is recommended that infested trees be felled. Infestations of southern pine beetles can cause death to many surrounding trees if no action is taken. This is particularly true when trees are stressed by dry weather. In this case, felling those trees that are infested can not only protect the stand from epidemic insect outbreak but also provide log habitat for wildlife.

Brush Piles

Brush piles can be created by piling branches into a small mound. Piling larger diameter branches closer to the

ground and smaller material higher up in the heap will result in openings and pathways at the ground level for small animals to move through. Large stumps of decay-resistant tree species, old fence posts, or pole-sized logs can provide a base layer that lasts a long time. Material in the upper layers should be placed in a criss-cross fashion to make the pile stable. Small trees and branches collected during self-thinning, pruning, or road clearing operations can be used to create the upper layers.

Creating brush piles from material collected during other management activities can reduce the costs of moving or disposing of otherwise unwanted material. For example, piles can be created or restocked with the branches, bark, and other woody debris removed from stands when they are cleaned prior to pine-straw collection. Also, instead of creating a single large pile of tree tops (slash) at a logging deck during thinning operations, tops can be left in numerous smaller piles throughout the stand. However, leaving large amounts of fuel on the ground within stands can increase risk of wildfire, so not all slash should be retained. Also, leaving large amounts of slash in direct contact with live trees is not recommended, due to the potential attraction of engraver beetles (*Ips* species) to freshly cut slash. See edis.ifas.edu/in701 for more information on the habits of engraver beetles.

How Much Dead Wood Should Be Provided and Where Should It Be Located?

Careful consideration of the amount, type, and location of dead wood can greatly increase the usefulness of these resources for wildlife. In general, the greater the number and variety of snags, logs, and brush piles, the greater the abundance and variety of wildlife supported. However, animals require more than one habitat element, so consideration should also be given to the arrangement of habitat elements. Locating food and cover resources within close distance of each other is particularly important for animals with low mobility.

Snags

Each species of wildlife has distinct preferences for tree species, size, and states of decay. Therefore, stands with snags of a variety of species, sizes, and ages will be used by the greatest number of wildlife species. Small diameter snags are rarely used by cavity nesters, but they may provide food for insect-eating animals. Larger snags provide benefits for

longer periods of time than smaller snags because it will take more time for them to decay.

Leaving some large diameter live trees at the time of harvest (a practice called “green tree retention”) provides insurance that large diameter trees are available to become snags and then logs in the future. In stands managed for timber production, trees of low value (such as those with forked tops) are a smart choice for green tree retention. These trees are especially likely to develop cavities. Also, leaving a few large diameter snags when harvesting will ensure that snags are available for wildlife at the beginning of the next rotation. This also helps organisms that can’t move (such as lichens and mosses) persist from one rotation to the next. These organisms are important food for some wildlife. Because the number of species a snag provides habitat for increases with age, retaining some snags between rotations ensures quality habitat for many species. An absolute minimum of 3 snags per acre should be maintained. Every 5-10 years, new snags should be created to replace those that have been lost.

The location of snags influences which animals will use them. The territorial nature of some cavity-nesting birds may prevent other birds from using snags located close to a snag already used as a nest site. To increase the chances of snags being used by more than a single pair of cavity-nesting birds, snags should be dispersed rather than clumped in one area. However, because many cavity-nesting birds feed on the larvae of wood-boring insects, they require one snag to nest in and others to forage in. Leaving snags in several small groups may be ideal. Due to their flammable nature, it is advisable not to locate snags near firebreaks where burning snags could pose fire dangers to adjacent stands if they fall.

Logs

The size, decay class, and number of logs will influence which animals use an area. Larger logs are better than smaller logs because larger logs provide more ground cover and greater connectivity across the forest floor, and they last longer. Also, the number of wildlife species that can use a log increases as the size of a log increases. As previously mentioned with snags, different animals prefer logs in different stages of decay. Therefore, providing many logs of different ages is the best strategy to promote a variety of wildlife species. A minimum of 2 logs per acre, each >6 feet long, should be maintained.

Brush Piles

Brush piles are especially useful in areas with little ground and shrub cover. Location is again important: isolated

brush piles will be used less than piles near forest edges, field edges, roads, and water sources. The value of brush piles can be increased if several medium-sized piles (4-8 feet tall and 10 feet in diameter) are created rather than one large pile, and if each pile is placed near other habitat elements important to wildlife. For example, constructing brush piles near wildlife food plots may increase use of both the food plots and the brush piles. Be careful not to locate brush piles close to buildings because they can be flammable. They also may increase nuisance wildlife in the buildings. Also avoid areas where standing water might collect, as many animals may be reluctant to use a damp pile. Because brush piles are composed of dead plant materials, the entire pile will settle over time. New material will periodically need to be added to maintain the pile. Two to four piles per acre are recommended.

Conclusion

No forest stand can provide quality habitat for all the wildlife species that exist in a given region. However, maintaining habitat elements that provide important functions in the lives of many species can have a big impact on the number of species an area supports. Dead wood is one key habitat element that provides resources for a large number of wildlife species.

As the number of people in the state of Florida increases and the amount of natural forestland decreases, managed forests will play a more important role in providing habitat for wildlife. Some of the most obvious differences between intensively managed single-species, single-aged forests versus natural stands is the scarcity of snags, logs, and structural diversity in managed stands. Increasing the numbers of snags, logs, and brush piles in or around managed forests can greatly increase the diversity of species of wildlife these areas support.

Providing a variety of sizes, species, and decay classes of snags and logs will maximize the number of species of wildlife whose needs are met. Providing a combination of food and cover resources close to one another will maximize benefits for the greatest number of wildlife species. Strategies should be developed to ensure that snags, logs, and brush piles are present over the long term.

Additional Information

Eickwort, J. M., Mayfield, A. E., III, and Foltz, J. L. Ips engraver beetles, *Ips* spp. (Insect: Coleoptera: Curculionidae: Scolytinae). IN701 (IFAS Extension Document). University of Florida. Available at <http://edis.ifas.ufl.edu/in701>

Hunter, M. L., Jr. 1999. *Maintaining Biodiversity in Managed Ecosystems*. Cambridge University Press

Lacki, M. J., Hayes, J. P., and Kurta, A. 2007. *Bats in Forests: Conservation and Management*. John Hopkins University Press

Meeker, J. R., Dixon, W. N., Foltz, J. L., and Fasulo, T. R. Southern pine beetle, *Endrocotonus frontalis*, Zimmermann (Insect: Coleoptera: Curculionidae: Scolytinae). IN333 (IFAS Extension document). University of Florida. Available at <http://edis.ifas.ufl.edu/in333>

Schaefer, J. Helping cavity-nesters in Florida. UW058 (IFAS Extension document). University of Florida. Available at <http://edis.ifas.ufl.edu/uw058>

Forest Groundcover Restoration¹

Holly K. Ober and Jennifer L. Trusty²

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

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

Planning a Restoration Project

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

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

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

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

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

1. This document is WEC269, one of a series of the Wildlife Ecology and Conservation Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date November 2009. Reviewed March 2013. Visit the EDIS website at <http://edis.ifas.ufl.edu>.
2. Holly K. Ober, assistant professor and Extension specialist, Department of Wildlife Ecology and Conservation, University of Florida, IFAS, at the North Florida Research and Education Center, 155 Research Rd, Quincy, FL 32351; and Jennifer L. Trusty, research assistant, University of Florida, IFAS, at the North Florida Research and Education Center, 155 Research Rd, Quincy, FL 32351.

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

Important Considerations for Groundcover Establishment

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

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

To help people interested in groundcover restoration to learn from one another, we have created a map of recent groundcover restoration projects. Figure 1 shows the location of over 150 groundcover restoration sites throughout Florida. We recommend contacting individuals working on groundcover restoration in your area for additional assistance. For more information on who is conducting

groundcover restoration, see the groundcover restoration manual at <http://www.sfrc.ufl.edu/cfeor/Short%20Term%202008.htm>.

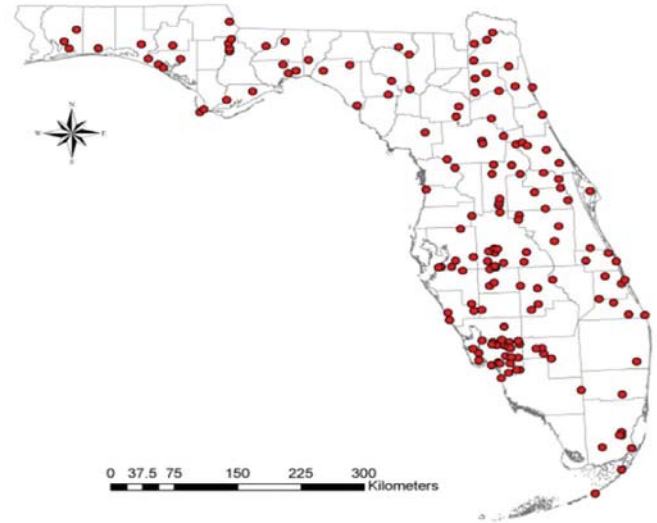


Figure 1. Map of restoration sites.

Additional information

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

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

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

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

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

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

Benefits of Prescribed Burning¹

Alan J. Long²

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

-
1. This document is FOR 70, one of a series of the School of Forest Resources and Conservation, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. First published November 1999. Minor Revision: April 2002. Reviewed September 2006. Please visit the EDIS Web site at <http://edis.ifas.ufl.edu>.
 2. Alan J. Long is Associate Professor, School of Forest Resources and Conservation, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, 32611. This publication was produced by the University of Florida with assistance from a grant from the Advisory Council on Environmental Education of the Florida Fish and Wildlife Conservation Commission.

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Opportunity Institution authorized to provide research, educational information and other services only to individuals and institutions that function with non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations. U.S. Department of Agriculture, Cooperative Extension Service, University of Florida, IFAS, Florida A. & M. University Cooperative Extension Program, and Boards of County Commissioners Cooperating. Larry Arrington, Dean

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.

Prescribed Burning Regulations in Florida¹

Alan J. Long²

Prescribed burning is a precise tool for vegetation management that requires permits, proper training, care, caution and control. As defined in Florida Statutes (FS) Section 590.125, it is the controlled application of fire to vegetative fuels according to a written prescription and under specified environmental conditions. Appropriate precautionary measures must be followed to ensure that the fire accomplishes the specified land management objectives and is confined to the predetermined fire area.

When improperly managed, fire can kill or damage trees and small numbers of animals; it may also create smoke problems for people. Despite these potential problems, prescribed burning contributes significantly to wildland resource health and public safety. Properly managed, it:

- reduces the risk of wildfire by decreasing shrub and herbaceous vegetation and accumulated dead fuels,
- improves wildlife or grazing habitat,
- promotes successful forest regeneration,

- cycles nutrients for healthy ecosystems, and
- maintains fire-dependent species.



Figure 1. The controlled application of fire is an important tool for maintaining a healthy and safe forest. Photo by Bill Simpson, Florida Department of Agriculture and Consumer Services.

1. This document is FOR 67, one of a series of the School of Forest Resources and Conservation, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. First published November 1999. Revisions: April 2002, and February 2011. Please visit the EDIS website at <http://edis.ifas.ufl.edu>.

2. Alan J. Long, Professor Emeritus, School of Forest Resources and Conservation, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL, 32611-0410. This publication was produced by the University of Florida with assistance from a grant from the Advisory Council on Environmental Education of the Florida Fish and Wildlife Conservation Commission.

Prescribed burning is not "setting fire to the woods" to let them burn as our ancestors may have done decades or centuries ago, although they often did so for some of the same reasons we do today. Rather it is the planned and deliberate use of controlled fire to achieve land management objectives (Figure 1).

An important difference between today and the past is the enormous increase in human population in Florida. Protecting people from physical harm, smoke-filled air, and poor water quality is the basis for the regulations and standards that now govern prescribed burning. This fact sheet briefly describes the origins of burning regulations and summarizes the current regulatory environment.

History of State Fire Regulations

Regulations are basically in two formats: statutes derived from bills that pass the Florida Legislature and additional administrative rules written to clarify and implement the statutes. In both formats, the general objectives are to resolve state-wide concerns or opportunities or to provide state compliance with federal regulations such as the 1970 Clean Air Act and its revisions. Although fire-related regulations are mainly at the state level in Florida, additional rules have been imposed as local ordinances in both counties and cities.

Burning regulations in Florida are at least 70 years old. For example, the Forestry and Timber Laws of the State of Florida (Florida Forest Service Bulletin No. 10, March 1934) included the statement, "Whoever sets fire to or burns any wild forests, woods, lands or marshes, except between February 15 and March 31, of each year, or between the said dates without giving two days' previous notice to all persons living within one mile of the place intended to be fired, shall be punished by imprisonment not exceeding sixty days, or by fine not exceeding one hundred dollars." Other early laws banned burning at any time in Brevard, Indian River, and St. Lucie Counties (Laws of 1927), or allowed burning in Columbia County as long as it was on one's own property and was not allowed to spread elsewhere (Special Act of 1929).

For many years these rules focused on burning restrictions to prevent disastrous human-caused wildfires. The rules have been refined over the years and are currently summarized for landowners in the Florida Division of Forestry (DOF) pamphlet *Know the Law Before You Strike That Match in Florida*. These guidelines are available at all Division of Forestry and many county and municipal fire service offices.

The 1970 Federal Clean Air Act resulted in the establishment of specific air quality standards and the provision that each state would meet those standards through individual State Implementation Plans. A number of new burning regulations and rules in Florida in the last 40 years represent the state's response to the Clean Air Act, ensuring that smoke from prescribed burns will not affect compliance with air quality standards.

Similarly, in response to the 1972 Federal Clean Water Act, individual states are responsible for preventing the degradation of streams, rivers, and lakes. Protection of Florida waterways that are in or flow through forests is achieved by following guidelines described in the Silviculture Best Management Practices (BMPs). The BMPs were developed by representatives from many agencies and organizations and are monitored by the Florida DOF. Those that are relevant to prescribed burning are described later in this paper.

Recent Legislation

As the use of prescribed burning expanded throughout the Southeast in the last 40 to 50 years, so did the incidence of smoke-related accidents on highways and smoke intrusions in urban and metropolitan areas. Along with these unfortunate, unplanned events came real or potential liability issues. By the late 1980s, prescribed burning was often curtailed because of the substantial risks of some type of litigation. In 1990, the Florida Legislature passed the Florida Prescribed Burning Act that provided the definition cited at the beginning of this fact sheet. This act defined important standards for prescribed burning and reduced the liability for burners who were properly certified and abided by the new and existing regulations.

Despite the increased use of prescribed burning, a long history of wildfire control and the lack of prescribed burning in many forested ecosystems have substantially increased the amount of living and dead fuels on many of the state's forest lands. Long before the 1998 fires, which were often intensified by these accumulated fuels, people around the state recognized the potential disasters that were developing on rural lands and in wildland/urban interface areas where residential development was mixed with dense forest and brush lands. The Hawkins Bill (1977) gave the DOF the authority to conduct prescribed burns on private property in interface or other wildland areas to reduce dangerous fuel levels.

Against this background of rules, regulations and experience, the 1998 fires clearly demonstrated the need to promote and protect prescribed burning across the state as well as to increase cooperation among diverse agencies involved in fire suppression and prevention. With those objectives, the 1999 Florida Legislature passed a bill that combined and revised all previous statutes related to prescribed burning and fire control. Accompanying rules in the Florida Administrative Code (FAC) were similarly updated and revised. Some of the most important changes focused on the following:

- increased attention to fuel reduction in interface and other wildland areas,
- increased public education about fire and prescribed burning,
- much greater liability protection for certified burners, and
- expanded burn permit conditions.

The statutes and code have been through additional minor revisions since 1999. The following summary includes all the important rules and regulations with which individual prescribed burners and landowners should be familiar. However, successful prescribed burning requires much more information and experience than just this understanding of regulations. You are **strongly encouraged** to fully understand fire behavior and prescribed burning methods before striking a match!

Florida Statutes for Prescribed Burning

This summary does not intend to cover trash or other open burning in back yards. Refer to the DOF pamphlets *Know the Law Before You Strike That Match Florida*.

Whether or not prescribed burners have been certified (as defined below) by the Florida DOF, **all prescribed fires must** (according to FS 590.125) **fulfill the following:**

1. Be authorized by the local DOF office, or its designated agent before the fire is ignited. The permit must be in writing if the burn area is within an area of severe drought emergency (FS 590.081).
2. Have adequate fire breaks around the planned burn area, and sufficient personnel and firefighting equipment for controlling the fire must be on site.
3. Remain within the boundary of the authorized area.
4. Have someone present at the burn site until the fire is extinguished (which is defined as no spreading flame).
5. Have the specific consent of the landowner or his or her designee.

The DOF issues a burning authorization or permit once they determine that air quality and fire danger are favorable for safe burning. The DOF can cancel authorizations if those conditions change. Burning in a manner that violates any of these requirements is a second-degree misdemeanor.

Certified prescribed fires have additional requirements (FS 590.125.):

1. A written prescription must be prepared before a burning authorization is received from the DOF.
2. A certified prescribed burn manager must be on site with a copy of the written prescription from ignition of the burn to its completion.

A "certified prescribed burn manager" is an individual who satisfactorily completes the DOF certification program and possesses a valid certification number. The certification program includes either a correspondence course, classroom version of the correspondence course or one-week training course, direct experience managing or helping conduct at least three prescribed burns, and recertification every five years. Certification renewal requires a minimum eight hours of approved training or participation in approved Fire Council meetings and use of the certified burner's number on at least two burns or documented participation in five burns. See FAC 51-2.006 for additional rules about certification and prescribed burning (<https://www.firules.org/gateway/Chapter-home.asp?Chapter=51-2>).

A certified prescribed fire that meets all the requirements described in FS 590.125 is considered to be in the public interest and a right of the property owner. Under the 1999 legislation, "a property owner or his or her agent is neither liable for damage or injury caused by the fire or resulting smoke . . . for (certified) burns conducted in accordance with this subsection unless gross negligence is proven." The "gross negligence" condition provides substantially more protection to landowners and certified burners than under previous law. A certified burner who violates any of the requirements commits a second-degree misdemeanor.

Administrative Rules for Prescribed Burning

To comply with the 1999 statute changes, the Florida Administrative Code was also revised. Important rules (see Chapter 5I-2, F.A.C.) for prescribed burning include the following:

1. Daytime burning authorizations are issued for 9:00 a.m. to one hour before sunset for noncertified burners and to one hour after sunset for certified burners.
2. Nighttime authorizations are issued for one hour before sunset to 9:00 a.m., under dispersion indices of 8 or higher and 6 or higher for noncertified and certified burners, respectively.

3. Certified burners must present their number at the time of their permit request, and they must have a copy of the prescription on site for inspection.
4. Minimum requirements for the prescription include stand, site, and fuel description; map of the area to be burned; personnel and equipment to be used; desired weather factors; desired fire behavior; ignition technique; time and date the prescription was prepared; authorization date and time period; an evaluation and approval of the anticipated impact of the proposed burn on smoke-sensitive areas; and signature and number of the certified burn manager. (Prescriptions are not required for fires managed by non-certified burners but are highly recommended for planning and control purposes).
5. Piles or windrows must be at least 100 feet from paved, public highways; they must be attended at all times; and wind direction must carry smoke from them away from public roads.
6. Open burning is not allowed:
 - when the fire or smoke may pose a threat to public health, safety, and property protection;
 - in smoke-sensitive areas between one hour before sunset and 9:00 a.m.;
 - when visibility on public roads would be reduced to less than 1,000 feet;
 - if it reduces visibility at a public airport;
 - during air quality or stagnation advisories.

Local Ordinances

Local legislation (city or county) can be more restrictive than state and federal rules, but not in conflict with them. For example, you are required to obtain a permit from the Florida DOF to be legal for any prescribed fire or other open burning. However, you may also be required to obtain a permit from your local governing authority to be compliant with local ordinances. It is the responsibility of prescribed

burners to make themselves aware of any applicable local regulations regarding burning permits.

Silviculture Best Management Practices (BMPs)

The 2000 BMPs are intended for implementation on all silviculture operations (which may include prescribed burning) whether or not the operations are subject to other regulatory standards or permits. The primary goal of the BMPs is to prevent erosion and sedimentation in Florida's waterways. Several BMPs relate specifically to prescribed burning and are described in more detail in the BMP manual (which is available at Division of Forestry offices or on the DOF websites; see Sources Below):

1. Site preparation burning in either primary or secondary Special Management Zones (SMZs) will only be conducted on slopes less than 18%.
2. Existing barriers and alternative fire line methods (such as harrowed, wet, or foam lines) will be used as much as possible to minimize plowed firelines.
3. Fireline construction will minimize impacts in sensitive areas, avoid SMZs and stream crossings, follow contours, and not connect isolated wetlands or serve as drainage systems.

Summary

Prescribed burning is one important tool available to land owners and natural resource managers for maintaining healthy forests and range lands. Significant regulatory changes in the last decade have greatly enhanced the opportunities for responsible use of prescribed fire. Proper training, thorough prior planning, careful fire and smoke management, and practicing within the regulatory environment will assure wider use of prescribed fire and continued protection for land owners and managers.

Sources

- Florida Dept. of Agriculture and Consumer Services. *Know the Law Before You Strike That Match in Florida*. 2 p.

• Florida Dept. of Agriculture and Consumer Services. 2009. *Silviculture Best Management Practices*. 116 p.
(http://www.fl-dof.com/publications/silvicultural_bmp_manual2009.pdf)

A Walk on the Wild Side: 2013 Cool-Season Forage Recommendations for Wildlife Food Plots in North Florida¹

A. R. Blount, S. M. Olson, D. L. Francis, C. L. Mackowiak, H. K. Ober, J. H. Freeman, K. H. Quesenberry, R. D. Barnett, T. W. Wilson, and R. W. Gornito²

There is great interest in wildlife forages nationally. Florida poses different challenges for successful food plot plantings. Light, sandy soils, hot and humid summers, and distinct seasonal droughts make selecting forages for wildlife unique and challenging. We recommend using **adapted varieties** developed for Florida's particular growing conditions. We also suggest using **forage blends** to increase the longevity and stability of the plot, as well as using supply variety to suit multiple wildlife components. It is important to **soil test** and apply fertilizer and/or lime based on the soil test report. Information on soil testing is available on EDIS at http://edis.ifas.ufl.edu/topic_soil_testing.

Cool-Season Legumes

Winter legumes are more productive and dependable on either the heavier clay soils of northwest Florida or sandy soils underlain by a clay layer than on deep upland sands or sandy flatwoods. White clover and ryegrass overseeded can be grown successfully on certain flatwoods areas in

northeast Florida. Inoculation of legumes is very important because it eliminates the need to supply nitrogen. Certain plants manufacture nitrogen if the proper inoculant (*Rhizobium* bacteria) is used. Many clovers and alfalfas come **pre-inoculated**. If the legumes you intend to use are **not** pre-inoculated, there are commercially available inoculants **specific** to each legume variety.

Alfalfa

This high-quality legume is usually grown as a winter annual in Florida. Several new varieties have been selected under grazing by cattle and are low-dormancy types. Low dormancy means that the alfalfa will sprout and grow in Florida's mild winter climate. Many food plot blends sold commercially include mid- or high-dormancy type alfalfas that do not grow well in the southern United States. Alfalfa requires a soil pH of 6.5–7.0, high soil fertility, and good management, making it difficult to manage in wildlife food

1. This document is SS-AGR-28, one of a series of the Agronomy Department, UF/IFAS Extension. Publication date: April 2002. Latest revision: September 2013. Please visit the EDIS website at <http://edis.ifas.ufl.edu>.
2. A. R. Blount, professor, North Florida Research and Education Center, Marianna, FL; S. M. Olson, professor, North Florida Research and Education Center, Quincy, FL; D. L. Francis, wildlife biologist, Florida Fish and Wildlife Conservation Commission; C. L. Mackowiak, associate professor, North Florida Research and Education Center, Quincy, FL; H. K. Ober, associate professor, North Florida Research and Education Center, Quincy, FL; J. H. Freeman, associate professor, North Florida Research and Education Center, Quincy, FL; K. H. Quesenberry, professor emeritus, Agronomy Department; R. D. Barnett, professor emeritus, North Florida Research and Education Center, Quincy, FL; T. W. Wilson, UF/IFAS Extension livestock and forages agent, UF/IFAS Extension Bradford County; R. W. Gornito, UF/IFAS Extension agent, UF/IFAS Extension Highlands County; UF/IFAS Extension, Gainesville, FL 32611.

The use of trade names in this publication is solely for the purpose of providing specific information. UF/IFAS does not guarantee or warranty the products named, and references to them in this publication does not signify our approval to the exclusion of other products of suitable composition.

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Opportunity Institution authorized to provide research, educational information and other services only to individuals and institutions that function with non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, marital status, national origin, political opinions or affiliations. U.S. Department of Agriculture, Cooperative Extension Service, University of Florida, IFAS, Florida A&M University Cooperative Extension Program, and Boards of County Commissioners Cooperating. Nick T. Place, Dean

plot situations. Recommended varieties are Bulldog 805 and Amerigraze 702.

Arrowleaf Clover

This is an annual clover similar to crimson clover in soil adaptation, management, and fertility requirements. It is mainly grown on heavier soils in northwest Florida. It is more productive in late spring than crimson clover. The recommended varieties are Yuchi and Apache.

Berseem and Other Miscellaneous Clovers

There are many other small seeded clovers, including Rose, Berseem, Hop, Bur, Subterranean and Ball clover, all of which work fairly well for wildlife food plots. Limited local seed availability or high seed costs may be limiting factors. Generally these clovers produce less forage than crimson, white, arrowleaf, and red clover, and have a short duration growing season. Ball and hop clovers reseed well. Recommended varieties include Bigbee Berseem, Grazer Select, Don Ball Clover, and Overton Rose Clovers.

Red Clover

This clover behaves as a winter annual under most North Florida conditions, and some reseeding may occur. Non-dormant (or low dormancy) varieties are recommended. Red clover does not tolerate flooding. Recommended varieties are Southern Belle, Bulldog Red, Barduro, and Redland. Southern Belle and Barduro were developed in Florida.

Crimson Clover

This is a well-adapted legume for North Florida. It is an excellent forage producer and can reseed itself each year, if weather conditions permit. It is an annual clover adapted to fertile, well-drained soil. Of the clovers, it appears to be the least sensitive to soil pH. It has a relatively short grazing season, so it may be grown in combination with ryegrass, clovers, or a small grain crop to extend the period of forage availability. Recommended varieties are Dixie and AU-Robin.

Vetch

Vetch grows best on well-drained, fertile, loamy soils. It has a spreading, viney growth habit and is an annual plant. The plant does reseed itself fairly well. Seed and foliage are consumed by many wildlife species. Recommended varieties are Hairy, Americus, AU-Early Cover, Cahaba White, and Nova II. Commercial seed production of most vetch varieties will be limited in 2013.

White Clover

White clover in Florida is usually a winter annual, but may act as a short-term perennial under optimum fertility and moisture conditions. It is adapted to moist soils throughout Florida and is a good reseeder. Nematodes and other pests can limit production. Recommended varieties are Ocoee and Osceola (both developed in Florida), Louisiana S-1, Barblanca, and Regal Ladino. Durana and Patriot are also well adapted, and have a prostrate growth habit and longevity.

Winter Peas

This annual legume is best suited to well-drained soils with high clay content. They typically are not very cold hardy. Austrian, Whistler, and Maple are recommended varieties. Several new varieties are commercially available and may be well suited for wildlife food plots in this region, but these have not been broadly evaluated.

Cool-Season Grasses

Cool-season grasses generally include ryegrass and the small grains—wheat, oats, rye, and triticale (a man-made cross of wheat and rye). These grasses provide excellent winter forage and a spring seed crop readily used by wildlife.

Oats

Oats may be planted and grazed by wildlife earlier than rye. When seeded in mid-fall they should produce very palatable forage by late fall. Oats are not as cold hardy as rye or wheat and may be susceptible to freeze injury. It is important to choose recommended oat varieties. Many “feed” oats are sold and planted as seed oats, but often they do not have a guarantee on the percent germination. Feed oats also may not have any resistance to the heavy disease pressure in Florida, particularly to rust and virus. Recommended varieties include Big Boss Wildlife Forage Oat, Horizon 270, Plot Spike LA 9339, Ram LA 99016, Horizon 201, SS76-40, and Buck Forage. Big Boss Wildlife Forage Oat, Buck Forage, and Ram Oat are relatively new varieties that have improved crown rust resistance, winter hardiness, and good grain and forage production for wildlife interests in Florida.

Rye

Rye is widely used for winter grazing for cattle, but may be grazed by deer as well. Rye is more cold tolerant than oats and generally produces more forage than either oats or wheat. Rye should not be planted as early as oats because of

several disease problems occurring in the early fall. It is best to wait until cool weather to begin planting. Recommended varieties are FL 401 (for early grazing or use in blends), AGS 104, Wrens 96, Wrens Abruzzi, Bates RS4, and Oklon. Wintergrazer 70 and Early Graze have performed well in past trials, but have not been included in our variety trials in recent years.

Wheat

Wheat is excellent for wildlife. Deer graze the forage, and birds use the seed. Recommended varieties are SS8641, USG 3592, Pioneer 26R6, and AGS 2038. Hessian fly resistance is important in wheat, particularly with early planting as wildlife forage. Coker 9553, Roberts, and GA-Gore are Hessian fly susceptible and are no longer recommended.

Ryegrass

Ryegrass is a valuable and hardy forage crop for use on flatwoods soils or the heavier sandy loam soils in northwest Florida. Seeding ryegrass with small grains and clover lengthens the seasonal forage availability. **In wildlife food plots, ryegrass may become a weedy problem and dominate the food plot.** Ryegrass also has a tendency to reseed and may germinate the following year.

Early recommended varieties: Attain, Big Boss, Earlyploid, Bulldog/Grazer, Ed, Flying A, Oregro DH-3, Rio, TAM-TBO, and Verdure

Late recommended varieties: Attain, Big Boss, Earlyploid, Jackson, Jumbo, Marshall, Rio, TAMTBO, Prine, and Verdure

Season-long recommended varieties: Attain, Big Boss, Earlyploid, Jackson, Diamond T, Jumbo, Ocala, Nelson, Marshall, Prine, Rio, TAMTBO, and Verdure. (Varieties Marshall and Jackson are susceptible to rust and gray leafspot.)

These varieties were selected based on their recent three-year, multi-location performance.

Other ryegrass varieties, such as Florlina, Surrey II, Big Daddy, Passeral Plus, Brigadier, Fantastic, Graze-N-Gro, King, and Beefbuilder III, have also performed well in regional trials. Other new varieties may be suitable but have not been adequately tested in Florida.

Triticale

This is a very high-quality, robust small grain that resulted from a cross of wheat and rye. It is very well adapted to North Florida, has good disease and insect resistance, and grows well even when late planted in December and January. Seed availability may be limited because seed production is scarce. Recommended varieties include Trical 342 and Monarch.

Brassica and Forage Chicory Crops

Brassicas are annual crops that are highly productive and digestible and can provide forage in as short as 40 days after seeding, depending on the species. Forage brassica crops such as turnip, swede, rape, and kale can be both fall- and spring-seeded. **Little is known about adaptability of forage brassicas to Florida or if wildlife accepts them as a food source.**

Kale

Kale (*Brassica oleracea* L. acephala group) is very winter hardy. Varieties include Premier, Vates, and Siberian.

Rape

Rape (*Brassica napus* L.) would also be considered to be very winter hardy. Varieties include Rangi, Rangiora, Barnapoli, Dwarf Essex, Emerald, and Winfred.

Turnip or Turnip Hybrids

Turnips (*Brassica rapa* L.) grow very fast, reaching near maximum production levels in 80–90 days. Varieties include Purple Top, White Globe and Barkant. Some varieties such as All Top and Seven Top only produce tops.

Swede

Like turnip, swedes (*Brassica napus* L.) produce a large edible root. Yields are higher than those of turnip, but they grow slower and require 150–180 days to reach maximum production.

Daikon Radish

Daikon radish (*Raphanus sativus*) is a highly palatable brassica and is well adapted to light, sandy soils. It is often referred to as tillage radish. Early planting may cause early bloom. Consider staggered planting dates to encourage longer season availability. Recommended varieties are Trophy and Daikon radish.

Forage Chicory

Forage chicory (*Cichorium intybus* L.) is a perennial plant (forb) suited to well or moderately drained soils with medium to high fertility levels and a pH of 5.5 or greater. Varieties available at this time are Puna and Forage Feast.

Recommended Cool-Season

Forage Blends

Best Buy for your Buck

- 50 lb (2 bu) oats
- 50 lb (1 bu) wheat or triticale
- 6 lb red clover
- 15 lb crimson clover

Double Treat (for well-drained sites)

- 10 lb red clover
- 15 lb crimson clover

Triple Treat (for wet or poorly drained sites)

- 4 lb white clover
- 12 lb red clover
- 4 lb arrowleaf clover

Tetra Treat (for medium-drained to wet sites)

- 15 lb crimson clover
- 6 lb red clover
- 4 lb arrowleaf clover
- 2 lb white clover

Soil Fertility Management for Wildlife Food Plots¹

C.L. Mackowiak²

Introduction

A good seed bed is the foundation for a successful wildlife food plot. Soil fertility is an important component of seed bed preparation. At a minimum, growers should be familiar with their soil characteristics. Deep sands typically do not hold many nutrients. The heavier, red soils such as those found in the Florida Panhandle, will likely hold more nutrients when fertilized. Your local County Extension or NRCS (Natural Resources Conservation Service) office should have a soil survey book or you can go online and use the NRCS Web Soil Survey at <http://websoilsurvey.nrcs.usda.gov/>. The soil maps and descriptions of your property will describe soil type, inherent fertility and pH, and will guide you in choosing a plot location, thereby avoiding marginal soils.

Soil Sampling

Your next step is to sample the soil for pH and plant-available nutrients. You want to be certain that the small package of soil you send to the lab represents the soil you intend to manage for your food plots. This is best accomplished by gathering a composite soil sample.

A composite soil sample is comprised of several representative subsamples taken throughout the food plot that are combined into a single sample, using a 5-gallon bucket or a clean, non-metallic container. Metal containers may contaminate your soil sample with iron, zinc or other metals that may affect the lab results for those metals. Ten to 20 subsamples taken from the upper 6-8 inches of topsoil



Figure 1. Examples of soil sampling options. From left, soil probe, spade, sharpshooter and soil auger.

are used to create a composite sample. If you are unsure, take additional subsamples.

A shovel, soil probe or soil auger can be used to remove soil. To further prevent contamination, be sure the equipment is rust-free, particularly if micronutrient analysis will be conducted (Figure 1). Soil probes are fairly inexpensive and provide much more uniform core removal than shovels. Prices range from about \$50 to over \$200.

The most systematic method for gathering samples is subsampling at either grid centers or intersections (Figure 2). This approach is used in precision agriculture, but is less necessary for wildlife food plots. Instead, a random or

1. This document is SL248, a fact sheet of the Soil and Water Science Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Publication date: March 2007. Revised May 2012. Please visit the EDIS website at <http://edis.ifas.ufl.edu>.
2. C.L. Mackowiak, associate professor, Department of Soil and Water Science, North Florida Research and Education Center, Quincy, FL; Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611.

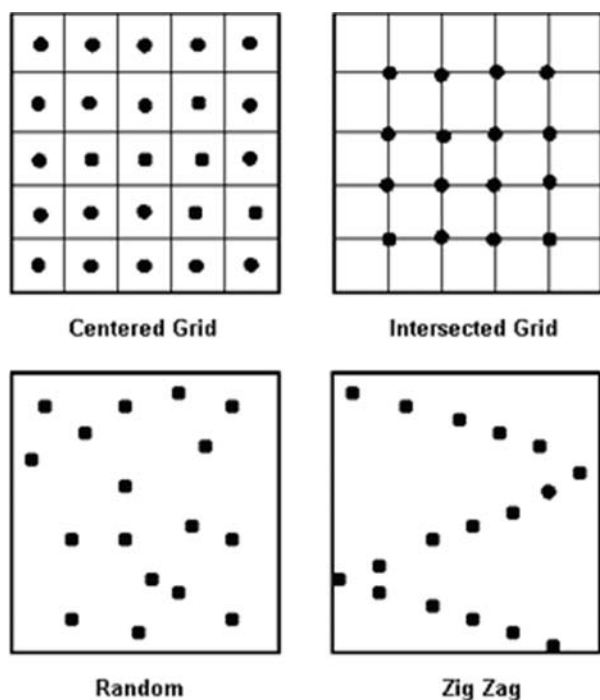


Figure 2. Each example represents a 10-acre field. Each point represents a subsample.

zig-zag sampling pattern is acceptable. The zig-zag method has the preferable advantage over random sampling of removing some unintentional bias in selecting subsampling points (Figure 2).

If soil pH and fertility are in good standing, sampling every three years is adequate. Annual sampling may be required if fertility is sub-optimal or the food plot is located on deep sands.

Approximately two cups of a soil composite are required by an analytic laboratory. Allow your soil sample to air-dry (e.g., spread sample on a cookie sheet) before packaging it for delivery. Soils are analyzed for plant-available nutrients, not total nutrients. Moist soil samples kept in air-tight bags may undergo chemical changes, which may produce an inaccurate representation of nutrient availability in the original sample. You may send your samples to a trusted commercial lab or contact your local Extension agent for instructions on sending them to the University of Florida (UF) Extension Soils Testing Lab (ESTL), which is located on UF's campus in Gainesville.

Soil Analyses

Laboratory analytic parameters may include soil pH, buffer pH, available $\text{NO}_3\text{-N}$, P_2O_5 (phosphate), K_2O (potash), Ca, Mg, Fe, Mn, Zn, Cu, B, cation exchange capacity (CEC), and percent base saturation. At a minimum, the soil should be tested for pH, buffer pH (used for calculating lime

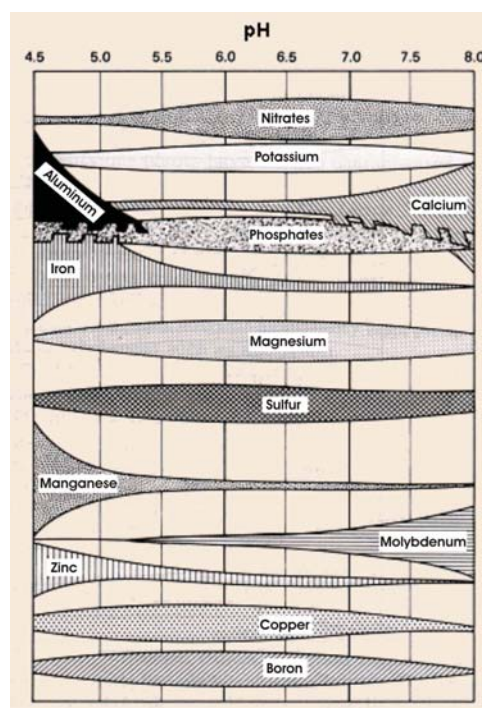


Figure 3. Relationship between soil pH and relative plant nutrient availability (a widening bar equates to greater availability). Where nutrients are shown interlocking, they combine at that pH to form insoluble compounds that reduce phosphate solubility.

Credits: Taken from R.W. Miller and D.T. Gardiner. *Soils in Our Environment*. Prentice Hall, 2001.

requirement), P_2O_5 , and K_2O . Nitrate-N soil values change rapidly over time; therefore, soil testing for $\text{NO}_3\text{-N}$ may not be warranted, nor is it recommended by UF/IFAS.

Percent base saturation, buffer pH, Ca and Mg values provide information relative to soil acidity and liming status. Cation exchange capacity provides an estimate of nutrient storage and release from soil particles whereby the higher the CEC value, the more fertile the soil may be. Because clays tend to hold more nutrients, the CEC provides an approximation of soil texture and vice versa. Sandy soils typically have a CEC below 12, and loamy soils typically have a CEC above 20. Soils high in CaCO_3 (calcium carbonate) may have a higher CEC than their soil texture would infer. This is typically true of soils overlying marl or karst topography (i.e., limestone).

Micro or minor elements (Fe, Mn, Zn, Cu, B, Mo) are required in much lower doses than N, P, and K, and they are not measured as often. However, some Florida soils are deficient in one or more minor elements and, therefore, trace elements should be analyzed every few years, more often in very sandy soils. It is important to act cautiously when applying trace nutrients because excessive applications can harm plant growth over many years.

Soil pH/Liming

If your soil pH is above 6.0, then liming is probably not required. Without a proper soil pH, some fertilizer nutrients become less available (Figure 3), resulting in lower yields. In comparison, an acid soil (pH < 5.0) increases the risk of plant aluminum (Al) and manganese (Mn) toxicity.

It is best to incorporate the lime several months before planting your food plot. This provides time for the lime to neutralize soil acidity. Applying lime to the surface without incorporating it into the soil may limit liming effects to the upper inch or two of soil.

Not all liming materials are the same! Pure calcite is used as the standard to rank all other liming materials. Calcium carbonate equivalent (CCE) is a term used to describe relative effectiveness. If you have a material with a CCE of 70, then it will take 1.3 tons of your product to produce the same liming effect as 1.0 ton of pure calcite. Additionally, some fertilizers have either a liming or acidifying

effect (negative CCE) (Table 1). Lime particle (mesh) size determines liming effectiveness or the effective neutralizing value. Rule of thumb: large lime particles (less than 20 mesh) will have minimal neutralizing value so choose smaller particle (higher mesh) sizes.

Often food plot fertility is accomplished at fall planting. Since agricultural lime requires some time to affect soil pH, pelletized lime may be used to get more rapid liming. Pelletized lime is often pulverized lime pressed into a pellet, which provides effective liming in a relatively short time. The ESTL will provide liming recommendations with your soil analysis report.

Fertilizer Recommendations

Fertilizer recommendations may be provided in either parts per million (ppm) or lbs per acre. If the analytic results are in ppm, they can be converted to lbs per acre by multiplying the values by 2. A good guide to follow for fertilization requirements of specific forages common to food plots is SL129/SS163: *UF/IFAS Standardized Fertilization Recommendations for Agronomic Crops* (<http://edis.ifas.ufl.edu/ss163>).

In addition to the UF/IFAS forage recommendations, some legumes (many clovers, alfalfa) tend to have a higher pH requirement (6.5), but there are several species, such as crimson clover and perennial peanut, that perform well in moderately acidic soils (pH 5.5 or greater). Since forage blends are frequently used, a rule of thumb is to lime to keep soil pH around 6.0. Besides being high-quality, legumes rarely need N fertilizer since they often have root associations with microorganisms that fix N, which benefits the microorganisms, the host plant, and sometimes neighboring plants, particularly as the legume is grazed, browsed, or dies.

There is plenty of anecdotal information suggesting that intermixing legumes with other forage species may reduce the need for fertilizer N. Legumes, in particular, tend to have higher S, Ca, Mg, and B requirements and, therefore, may benefit from additional fertilization with one or more of these nutrients.

To make the most use of fertilizers, follow the best management practice (BMP) of splitting the recommended fertilizer rate into two or more applications. This improves the likelihood that the plants will capture more of the fertilizer to meet their nutrient requirements. Additionally, splitting applications will lessen the economic loss from

Table 1. Typical CCE of some liming materials.

Liming Materials	Typical CCE (%)
Calcite (pure)	100
Calclitic limestone	75 - 100
Dolomitic limestone	75 - 108
Aragonite	95 - 100
Hydrated lime (Ca(OH) ₂)	120 - 136
Marl	50 - 90
Burned lime (CaO)	178
Flue dust	60 - 80
Wood ash	30 - 70
Basic slag	50 - 70
Other Materials	
Calcium nitrate	20
Potassium nitrate	23
Rock phosphate	10
Gypsum (land plaster)	0
Urea	-83*
Ammonium sulfate	-110*
Diammonium phosphate	-70*
Humus	9
Milorganite	10
Sludges	20 - 80
*Negative values represent acidifying.	

leached fertilizer and reduce the potential for surface and groundwater nutrient contamination.

Organic Fertilizers

Organic fertilizers, such as manures, litters and composts, can sometimes be used for wildlife food plots. The organic matter often improves a soil's water holding capacity and nutrient retention. The amount of available nutrients found in composts is low. Therefore, application rates may approach 20 ton/acre to meet plant nutrient requirements. In comparison, manures and litters are more nutrient-dense, so application rates are typically 5 tons/acre or less. One to 2 tons per acre is a frequent application rate.

Biosolids (AA-rated municipal sludge) are also good sources of plant nutrients. However, wildlife (deer in particular) may have an aversion to the material until it degrades and becomes incorporated into the soil. Thus, biosolids may work to protect against browsing pressure for a time, allowing for better forage establishment. To delay early encroachment by deer, application rates of around 300 lb dry biosolids/ac are all that is required. It might be advantageous to test biosolids on a small area for one or more seasons to evaluate their effectiveness as a temporary deer repellent prior to using them on larger acreage.

To learn more about specific wildlife food plot forages, see the following:

- SSAGR28/AG139: *A Walk on the Wild Side: 2010 Cool-Season Forage Recommendations for Wildlife Food Plots in North Florida* (updated yearly) - <http://edis.ifas.ufl.edu/ag139>
- SSAGR84/AA266: *2011 Cool-Season Forage Variety Recommendations for Florida* (updated yearly) - <http://edis.ifas.ufl.edu/aa266>

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

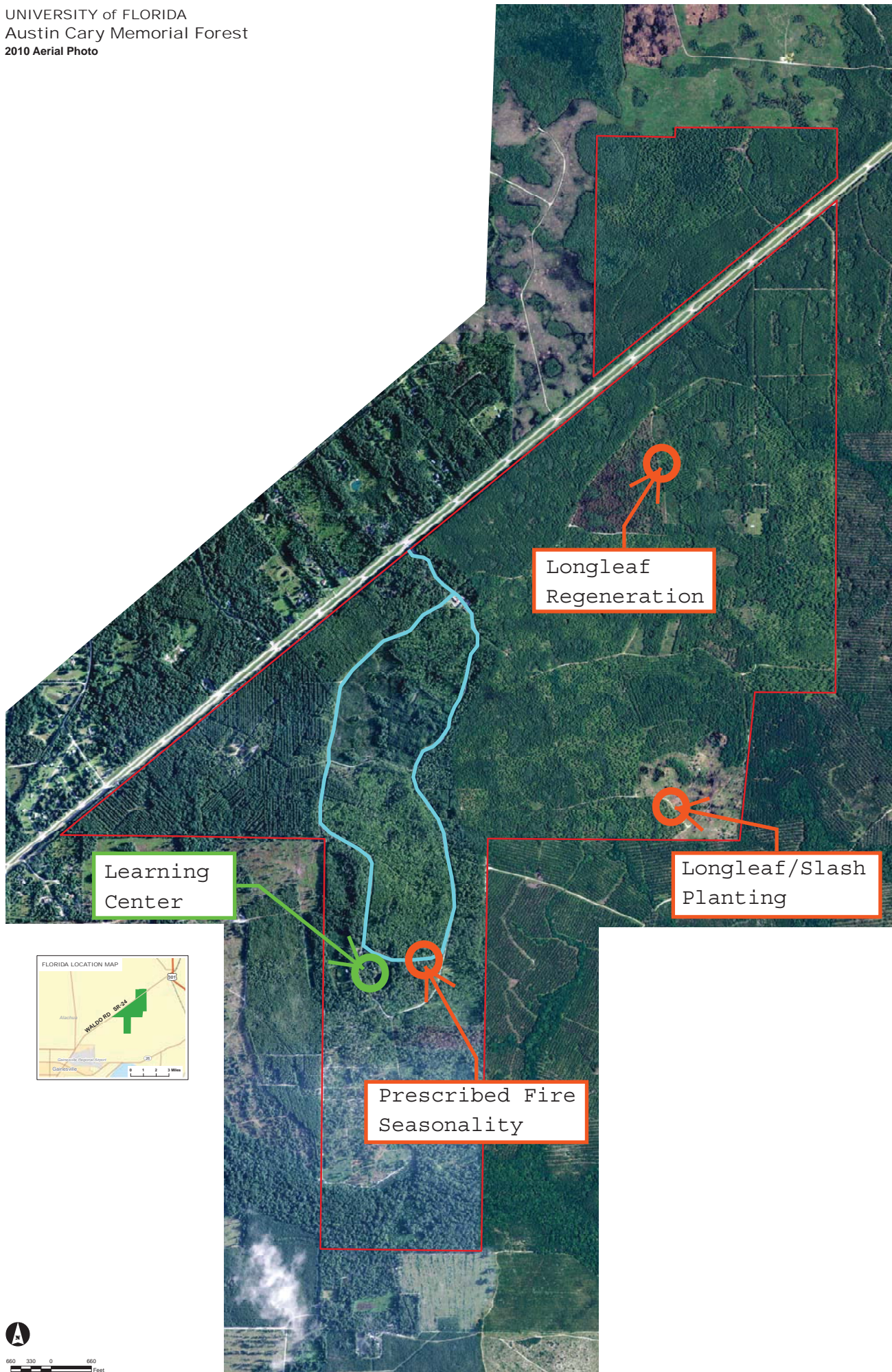
http://edis.ifas.ufl.edu/TOPIC_Forest_Management_and_Stewardship

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

This image shows a full page of blank white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page, providing a template for writing or drawing. There are no margins, text, or other markings present.

[illegible]

[illegible]



**THANKS to our SPONSORS for their support of
2015 Florida Forest Stewardship Program Events**

**Blanton's Longleaf
Container Nursery**

Jason Blanton
(850) 973-2967

blantonsnursery@earthlink.net



Frankie Hall
(352) 374-1542



**National Wild
Turkey
Federation**

www.floridanwtf.org
www.nwtf.org



(850) 222-5646
info@forestfla.org



Leasing • Loans • Financing • Crop Insurance

866.824.5626
www.FarmCreditFlorida.com



Wayne Bell
(229) 985-0321
(800) 633-4506
Mobile: (229) 873-4316
wbell@interforestry.com

**FORESTRY SOLUTIONS
THAT MEET YOUR OBJECTIVES.**



Fifty Years and Growing

DENSON HELMS
Marianna, FL
850.482.6573

RUSS WEBER, ACF, CF, RF
Gainesville, FL
352.377.2924

www.fwforestry.com



**Forest
Environmental
Solutions, LLC**

Joseph Gocsik
(352) 206-8776
JOE@FESFL.com



**Southern
Forestry
Consultants**

Monticello, FL office: (850)-997-6254
Quincy, FL office: (229) 246-5785
Northwest FL office: (334) 393-7868

**Forestland
Management**

Ray Horne
(352) 485-1924
rhorne1964@earthlink.net



Alan Jaye
(334) 830-1677
ajaye@greencirclebio.com

McGowan Forestry

Babe McGowan
(229) 376-0581
babemcgowan@gmail.com

**American
Forest
Management, Inc.**



Alachua Office: (386) 518-6344
13570 NW 101st Drive, Suite 500
Alachua, FL 32615

Marianna Office: (850) 526-5110
4962 Old Spanish Trail
Marianna, FL 32448

Americanforestmanagement.com



Wildlife Habitat Management
Prescribed Burning
Forestry Management & Consulting
Equipment Services

Brannen Willis
PromiseHabitatServices.com
352.408.1193
39711 Crest Haven Ct.
Umatilla, FL 32784



352.375.1473
800.344.1473 toll free
www.ColumbiaTimber.com
info@ColumbiaTimber.com

4424 NW 13th Street, Suite C-2, Gainesville Florida 32609



No One Knows The Country Like We Do!

352.225.3668
877.632.3668 toll free
www.UCLandAndLifestyle.com
info@UCLandAndLifestyle.com