

Stewardship Program

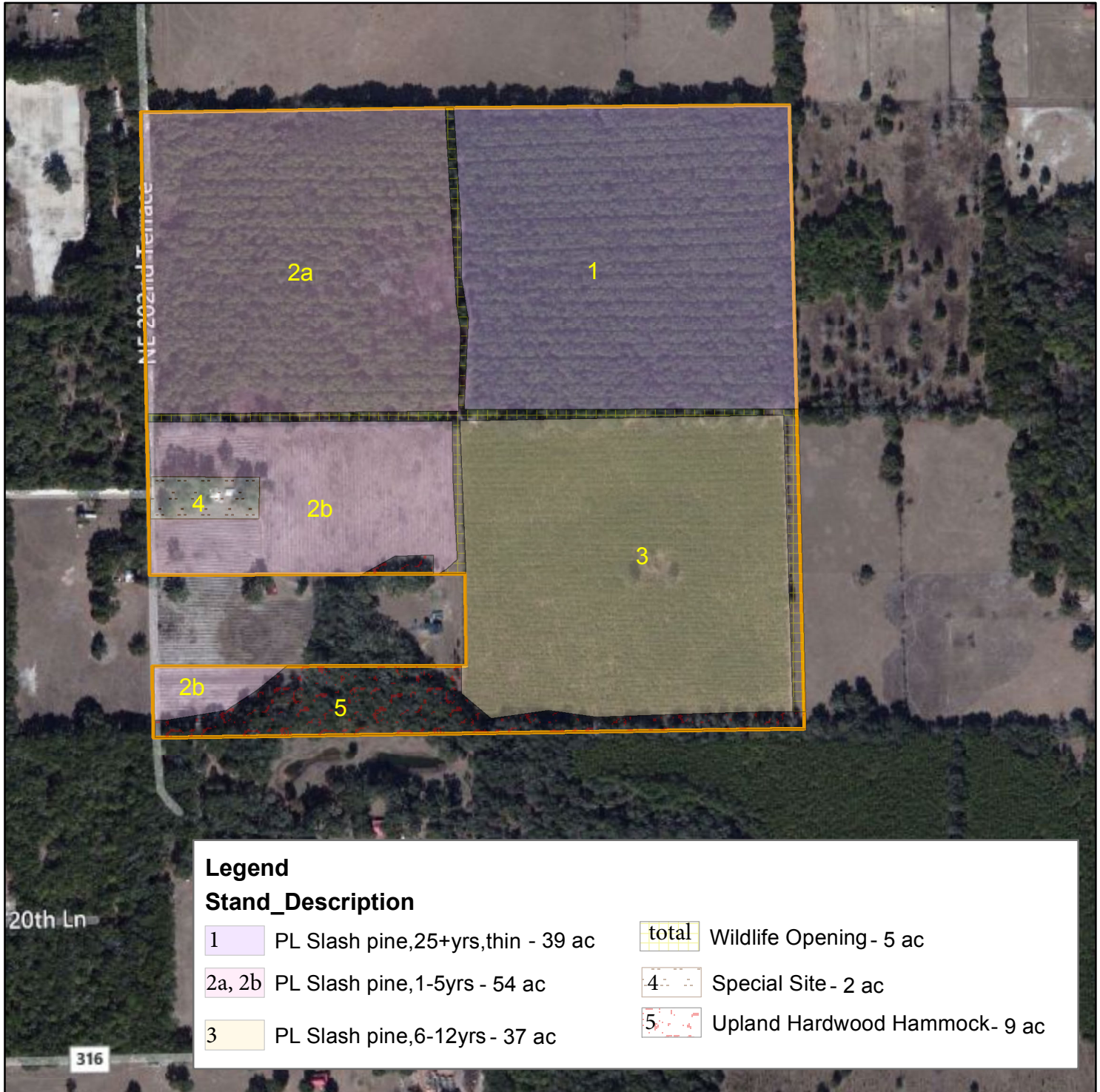
Landowner: William Arnold

Case # 38-0206



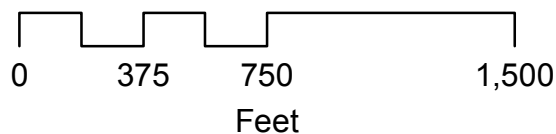
Stand Map

S08, T13S, R19E - Levy, Co
29.367 / -82.367
+/- 146 ac



Legend	
Stand_Description	
1	PL Slash pine, 25+ yrs, thin - 39 ac
2a, 2b	PL Slash pine, 1-5 yrs - 54 ac
3	PL Slash pine, 6-12 yrs - 37 ac
total	Wildlife Opening - 5 ac
4	Special Site - 2 ac
5	Upland Hardwood Hammock - 9 ac

DISCLAIMER
This map is the product of the Florida Forest Service. No warranties are provided for the data therein, its use, or its interpretation.



Map prepared by
Florida Forest Service
Greg Marshall
7/10/13

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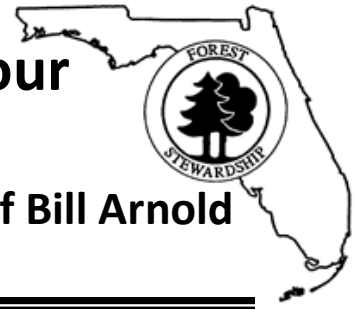
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Forest Stewardship / Tree Farm Tour

Arnold Tract

Tree Farm and Stewardship Forest Property of Bill Arnold
Levy County, FL



Date: Thursday, March 17, 2016; meet at the property at 9:00 AM ET

Tour: Located southeast of Williston, the Arnold Tract is in transition from old agriculture fields and pasture to pine forest stands. Bill Arnold's primary objective is to grow and harvest timber, while enhancing wildlife habitat, soil and water conservation, recreation and aesthetics. The oldest remaining stand of slash pine was planted in 1981 and will be harvested and reforested within the next few



years. Another stand was planted in 2006 and will be ready for thinning soon. A portion of the tract was clearcut in 2012 and planted with slash pines in 2013. Specific timber management practices in the next several years will include harvesting, chemical and mechanical site preparation, mowing, controlling invasive exotic plants, reforestation and possibly prescribed burning. This tour will focus on converting pasture and agricultural fields to pine forests, enhancing habitat and controlling invasive exotic species. Most of the tour will involve riding in vans or an open trailer with several discussion stops.



Funding for Florida's Forest Stewardship Program is provided by the USDA Forest Service through the Florida Department of Agriculture and Consumer Service's Florida Forest Service, a Tree Farm Program Education Grant, and the Florida Sustainable Forestry Initiative Implementation Committee.

Tour Resource Contacts

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

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

Florida's Forest Stewardship Program

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



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

Eligibility

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

Benefits to Landowners

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

Getting into the Program

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

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



Tree Farm Program

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

Eligibility

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

Benefits to Landowners

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

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

Getting into the Program

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

<https://www.treefarmssystem.org/florida>



Florida Forest Service

Silviculture Best Management Practices

Silviculture Best Management Practices (BMPs)

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

Silviculture BMP Courtesy Checks

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

Silviculture BMP Site Assessments

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

Silviculture BMP Notice of Intent

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

Additional Services

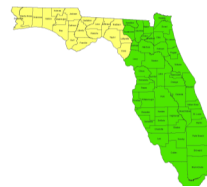
For information on the services listed above or any other services provided by the Florida Forest Service's hydrology section, please contact your local BMP Forester.

Roy Lima

Panhandle Area

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(850) 681-5942

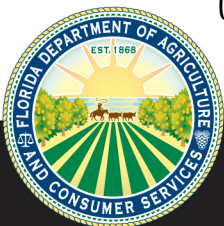


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Florida Department of Agriculture and Consumer Services
Adam H. Putnam, Commissioner



Forestry Wildlife Best Management Practices for State Imperiled Species



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

Florida Forest Service BMP Foresters

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Got Invasives?

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

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

Why was FloridaInvasives.org developed?

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

How does FloridaInvasives.org help you?

FISP has created a searchable database, the [Florida landowner incentives database](http://FloridaInvasives.org), accessible at FloridaInvasives.org that allows you to find an assistance program for your needs. Search by your county, target species or other pertinent information into the online tool, and you will retrieve a current list of available programs.

FloridaInvasives.org will help provide focus to your search so that you can get the right person at the right program.

FloridaInvasives.org:

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

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

Go to FloridaInvasives.org to find out more.

Species Shown from top to bottom:

Mexican Petunia, Boston Fern, Mimosa, Cogongrass, Camphor



Think Locally, Act Neighborly

invasive species know no boundaries!

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 tradeoffs 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.gov.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

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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>.

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Thinning Southern Pines - A Key to Greater Returns¹

Chris Demers, Michael Andreu, Babe McGowan, Alan Long, and Jarek Nowak²

Many landowners plant pines with the intention of harvesting them at some point in the future. When pulpwood markets are favorable, a complete stand harvest within 15 to 20 years is possible and may bring an acceptable return. However, longer rotations can bring higher financial returns on larger diameter trees if landowners are willing to begin thinning their pine stands when trees are 10 to 15 years old. Pine sawtimber, poles and/or plylogs are most often the forest products with the highest value and, if economic returns are a priority, the most desirable products to come out of a timber stand. Thinning is a partial tree harvest in an immature stand to maintain or accelerate diameter growth of the remaining trees. If it is done properly, thinning can bring substantially higher revenues when trees are harvested at 25 to 40 or more years of age. Trees will respond to thinning best if they are thinned before 16 or 17 years of age.

The increased diameter growth after thinning results from the greater availability of light, water, and nutrients to the remaining trees. Ideally, the best and biggest trees should be retained to assure the most rapid increase in timber value. For best results, thinning should favor the tallest, best-formed trees over those that are overtopped, crooked, forked, diseased or otherwise undesirable. Timberland owners who wish to harvest high-value sawtimber-, plylog- or pole-sized products at the end of the rotation should consider thinning a necessity.

For the landowner, thinning can bring

1. increased return on investment from the sale of higher-value forest products;
2. periodic income from the multiple harvests that lead to those higher-value forest products;
3. improved access for equipment, people and wildlife;
4. a healthy, vigorous forest with less risk of insect infestation, destructive fire, and wind damage; and
5. enhanced wildlife habitat with increased herbaceous ground cover

Before describing specific methods of thinning, we will review the underlying concepts of stand density, crown position and forest health. These will dictate if, when, and how to thin.

Stand Density

Stand density describes how much a site is being used by trees and how much the trees are competing with each other for the site's resources (water, light, nutrients, space). At high densities, the growth rates of individual trees slow down because there are more trees competing for the site's limited resources. Trees are usually thinned to achieve a particular density target.

Measures of Density

Trees per acre. In single-species, even-aged stands of known age, site quality, and history, the number of trees per

1. This document is SS FOR24, 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: March 2005. Reviewed December 2006 and April 2010. Revised July 2013. Please visit the EDIS website at <http://edis.ifas.ufl.edu>.
2. Chris Demers, forest stewardship coordinator, School of Forest Resources and Conservation, Michael Andreu, associate professor, School of Forest Resources and Conservation, Babe McGowan, consulting forester, McGowan Forestry Services, Alan Long, former professor, School of Forest Resources and Conservation, and Jarek Nowak, Florida Forest Service, Tallahassee, FL.

acre is a useful measure of stand density. Typical densities in plantations range from 200 to 800 trees per acre.

Volume per acre. Because many management objectives relate to wood volume, it is often used as a measure of density. Stand volume is generally expressed as cubic feet (solid wood), board feet, or cords per acre. A cord is 128 cubic feet of stacked roundwood (whole or split, with or without bark) containing wood and airspace; an example of a cord is a stacked pile of firewood 4 ft high x 4 ft wide x 8 ft long. Tons per acre is a weight measure that is derived from volume. Tons is the unit of measure most commonly used to buy or sell wood.

Basal Area. Basal area is a measure of stand density developed by foresters. It is the total cross-sectional area of tree stems in a stand, at breast height (4.5 feet above the ground), measured in square feet per acre. Basal area (BA) of a single tree in square feet is calculated using the formula:

$$BA = 0.005454 \times d^2$$

Where: d = diameter (inches) of the tree at breast height (often abbreviated as “DBH”).

Tree Crown Position

Thinning reduces stand density by targeting trees belonging to different tree crown classes. (Tree crown is composed of all the live branches of the tree.) Each tree class is described by the vertical crown position of its members relative to trees of lower or higher classes. Most planted pine stands have an even-aged structure, which means there is little or no difference in the age of the trees. However, as an even-aged stand grows, the trees compete for site resources and begin to differentiate in height and diameter. As the level of tree competition increases over time, individual tree growth slows down. This growth deceleration happens at different rates for different trees due to genetic, microsite and other differences. In the absence of thinning, the weakest and slowest-growing trees die and provide more room for larger and healthier neighbors. The variation in tree growth results in four distinct tree crown classes:

1. Dominant trees:

- crowns extend above the main tree canopy layer
- crowns receive full sunlight from above and the sides
- crowns are large and well-developed
- characterized by large diameters and exceptional tree vigor

2. Codominant trees:

- crowns form the main canopy layer
- receive sunlight from above but are restricted at the sides
- have medium-sized crowns and diameters

3. Intermediate trees:

- crowns reach only to the lower part of the main canopy
- receive sunlight from above only partially, if at all
- have small, crowded crowns and small diameters

4. Overtopped (suppressed) trees:

- crowns are entirely below the main canopy
- receive no direct sunlight
- are usually the smallest trees with poorly developed crowns
- show very low vigor

Forest Health

Forest health is the focus of forest management and the purpose of thinning. The primary purpose of thinning is to remove poorly performing trees and leave a healthy, vigorous stand. A healthy forest produces more tons of valuable timber per acre resulting in more tons of higher quality wood available to sell. The various insects and diseases that affect pine stands in the South have evolved to exploit unhealthy, stagnated, or damaged trees that are stressed. Healthy pine stands resist damage from insects, disease and wind. If done early in the pines' development, thinning is an important tool to prevent problems with insects, diseases, or other stresses such as wildfire or strong winds.

Fusiform Rust

Fusiform rust is a native, fungus-caused disease that deforms and kills pines. Since the late 1950s, it has increased to epidemic proportions in slash and loblolly pine plantations throughout the South. This disease was first reported in the early 1900s and was neither widespread nor prevalent at that time. The spread of fusiform rust increased as the acreage of young, intensively managed pines increased across the South. The fungus causing fusiform rust is greatly favored in young, rapidly growing pine plantations of slash and loblolly pines, especially when established in high rust hazard areas and in close proximity to oaks, especially water oak, which are alternate hosts for the fungus. Oak abundance generally increases in areas where fire is absent. Most stems infected with fusiform rust disease should be removed in a thinning. Larger diameter stems with minor disease on branches can continue to have good growth rates and withstand high winds after thinning. If the stem infection rate of a stand exceeds 50%, the best option may be to clearcut and regenerate with genetically improved, rust-resistant pines. However, if there are at least 150–200 healthy, well-formed trees per acre, removing the diseased trees and retaining the healthy ones

is usually the best option. If there is an abundance of red oak species, especially water oak, in surrounding stands, they should be reduced if possible. A professional forester can help you make appropriate management decisions to minimize or deal with problems associated with fusiform rust. More information about this disease can be found at http://www.floridaforestservice.com/publications/fh_pdfs/fusiform_rust_of_pines.pdf.

Southern Pine Beetle

Southern pine beetles (SPB) are native, aggressive insects that live predominantly in the inner bark of pine trees. Trees attacked by SPB often have hundreds of light-colored, dime-sized resin masses (i.e., pitch tubes) on the outer tree bark. SPB feed on living bark tissues where they construct winding, S-shaped galleries on the inside of the bark, which can effectively girdle and kill a tree. In addition, SPB carry and introduce blue-stain fungi into trees. These fungi colonize the water-conducting tissue and can block water flow within the tree. Once SPB have successfully colonized a tree, the tree generally will not survive, regardless of control measures. An important way to prevent SPB infestations in pine stands is to maintain high tree vigor. This can be achieved by thinning dense stands to a basal area of 80 sq. ft. per acre or less to reinvigorate tree growth. More information about SPB and its control can be found at <http://edis.ifas.ufl.edu/IN333>.

Cost-share assistance for thinning pine stands, prescribed fire and other treatments is available through the Florida Forest Service's Southern Pine Beetle Assistance and Prevention Program: http://www.floridaforestservice.com/forest_management/fh_insects_spb_prevention_program.html

Annosum Root Rot

Loblolly and slash pine are particularly susceptible to this disease, which may be scattered through a stand or occur in pockets of dying or dead trees. Trees generally yellow and lose needles as they die from this disease, although they may just turn red in a short period of time. Dead trees gradually fall over from a loss of root support. Wind-blown fungus spores from nearby infection centers generally enter a stand by landing on freshly cut stumps or wounds during the colder months of the year. The stump and subsequent root infections spread to adjacent trees through root contact. The disease is most prevalent on well-drained sandy soils with higher pH, such as those found on old agricultural fields. Prevention measures include prescribed burning during winter months before thinning to eliminate the spore-producing conks, thinning in high hazard areas

during summer, and treating freshly cut stumps with borax immediately after thinning. More information about this disease is at: <http://www.freshfromflorida.com/pi/enpp/pathology/pathcirc/pp398.pdf>

When and How Much to Thin Timing

The first thinning should take place shortly after the crowns of the trees start to close (tree branches of neighboring trees begin to touch each other). This is when diameter growth will begin to decrease due to the trees' limited ability to capture sunlight, which is needed to produce the carbohydrates necessary for diameter and volume growth. An important indirect measure of a tree's ability to capture sunlight is *live crown ratio*. Live crown ratio is the percentage of a tree's height occupied by branches with green needles. In southern pines, optimum growth and vigor are maintained when the live crown makes up at least 40% of tree height (a live crown ratio of 40% or higher). Thinning is most beneficial for stand growth before the average live crown ratio falls below 40%.

Another factor that influences thinning decisions is the marketability of the removed trees. The first commercial thinning should remove pulpwood-size trees and perhaps some chip-and-saw-size trees, if they are poorly formed or diseased. Pulpwood logs must be at least 10.5 feet long and 2–3 inches in diameter at the small end; some local markets require larger log sizes. To meet these minimum specifications, trees must be about 16 feet tall and have an average DBH of at least 5 inches before they are cut. It may be necessary to thin smaller trees if the average live crown ratio of the stand is below 40% and trees do not grow at least 5% in diameter per year. With the demand for woody biomass on the rise in some regions for energy production, these trees may have a market. Otherwise, “pre-commercially” thinned trees are usually left on the ground to decompose. In this case, thinning should be regarded as an investment in the quality of the stand for the future, when final harvest returns may justify the operation. See <http://edis.ifas.ufl.edu/fr243> for information on pre-commercial thinning loblolly pine.

Thinning Intensity

The number of trees to remove depends on the initial stand density, site quality, and management objectives. For timber objectives, a thinning should reduce stand density to a level that maximizes individual tree growth without sacrificing full utility of the site. Density and stocking should be approached from the quality of the residual stand first; and

second, the density of the residual stand. Depending on the site, the density and quality of the trees in the stand you are working with, and your management objectives, the residual basal area after the first thinning will usually fall between 45 to 85 square feet per acre of the very best trees capable of producing a higher-value product. These will be the healthiest, best-formed trees in the dominant and co-dominant crown classes. A suggested rule of thumb is to use basal area as a result, not a target. Basal area does not take into account the age of the stand, site productivity, and tree health and quality. Focus growth on the best trees in the stand and the basal area will follow.

Thinning, especially when followed by prescribed fire, can be great for wildlife habitat. Thinning allows more sunlight to reach the forest floor, encouraging the growth of herbaceous plants and shrubs, which provide food and cover for many upland wildlife species in the southeast. Subsequent thinnings and a prescribed fire regime during the rotation will promote an open tree canopy, diverse groundcover, and productive wildlife habitat. See <http://edis.ifas.ufl.edu/uw132> for more information on the effects of fire on wildlife habitat.

How to Thin

Most producers use a combination of thinning methods to reach economic and/or wildlife habitat objectives. No matter which thinning method you choose, avoid thinning during times of drought or extreme wet weather to prevent damage to the site, and take care not to damage residual trees during logging. When trees do become damaged (frequently, for instance, the “bumper” or “turning” trees at the ends of thinned rows suffer some damage), they should be removed at the end of the logging operation. Landowners are encouraged to consult with or hire a professional forester to assist with thinning and other forest management activities. See <http://edis.ifas.ufl.edu/fr125> for tips on selecting a consulting forester.

Combine Row and Selection Thinning

Although most discussions about thinning southern pines are about which rows to thin, the focus should be on what comes out of the remaining rows. Modern equipment, though large, is capable of taking out trees in the rows between cut rows, as in a 5th or 7th row thinning. Generally, the further apart the cut rows, the better. Think of the cut rows as access for the harvester to cut selected trees out of the remaining rows. It is best to remove trees based on selection thinning from fewer cut rows rather than taking

out every 3rd or 4th row. The first thinning is the most important thinning and sets the growth rate for the rest of the rotation. Properly executed thinnings consistently produce higher valued products, and thus more revenue. In addition to revenue goals, thinning greatly enhances wildlife habitat by providing light needed for important food plants to grow. Removing every 3rd or 4th row is essentially clearcutting 33% or 25% of the stand without regard to quality, and leaves only 66% or 75% of the stand to select from. Unless there is excessive disease or extreme variability in density (see fusiform rust guidelines above), this should be avoided. Leaving the trees distributed over a larger portion of the stand can be much more profitable in the long term because you can select your best trees to grow into larger, more valuable products.

The premise for thinning is simply to take out the poor trees and leave the healthy crop trees for potential future harvest. Trees that are diseased, crooked, forked, suppressed or otherwise of poor quality or health should be removed in the first thinning. For best results, hire a professional forester to mark every thinning. If marking is not feasible for some reason, closely supervise each thinning, but especially the first, to ensure contractual guidelines are followed. Do not assume the logger or harvester operator will leave the trees most appropriate for the long-term health and productivity of the stand.

Conclusion

Thinning is an important silvicultural practice that redistributes the growth potential of the site to the best trees. Diameter growth rates are maintained or increased on residual trees after thinning, which increases the return on investment from higher-value trees. Biologically, thinning accelerates stand development by favoring the tallest, best-formed trees over those that are diseased, overtopped, crooked, forked, or otherwise undesirable and likely to die on their own if left in the stand long enough. In addition, thinning provides periodic income, improves access for equipment, recreation and hunting, and creates a generally healthier stand. Thinning is also beneficial for wildlife, especially when combined with prescribed fire or herbicide use to control competing vegetation. By allowing more light to reach the forest floor, thinning promotes growth of plants important as food and/or cover for wildlife species. Landowners are encouraged to consult with or hire a professional forester to assist with thinning and other forest management activities.

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Cogongrass (*Imperata cylindrica*) Biology, Ecology, and Management in Florida Grazing Lands¹

B. A. Sellers, J. A. Ferrell, G. E. MacDonald, K. A. Langeland, and S. L. Flory²

Cogongrass is found on every continent and is considered a weedy pest in 73 countries. In the U.S., cogongrass is found primarily in the Southeast. It was accidentally introduced into Alabama in the early 1900s, and purposely introduced as a potential forage and soil stabilizer in Florida (and other states) in the 1930s and early 1940s. However, soon after investigations began it was realized that cogongrass could be a weedy pest. Since its introduction, cogongrass has spread to nearly every county in Florida. In some cases, it has completely taken over pastures so that it is the only species present. This is a common thread where cogongrass invades; it quickly displaces desirable species and requires intensive management.

There are many reasons why cogongrass is such a prolific invader. It is a warm-season, perennial grass species with an extensive rhizome root system. In fact, at least 60% of the total plant biomass is often found below the soil surface. In addition to the rhizome root system, cogongrass adapts to poor soil conditions, and its fires burn so hot that they eliminate nearly all native species. Cogongrass is drought tolerant and has prolific wind-dispersed seed production. Additionally, it can grow in both full sunlight and highly shaded areas, although it is less tolerant to shade.

Cogongrass spreads through its creeping rhizome system and seed production. The rhizomes can penetrate to a depth of 4 feet, but most of the root system is within the top 6 inches of the soil surface. The rhizomes are responsible for long-term survival and short-distance spread of cogongrass. Long-distance spread is accomplished through seed production. Seeds can travel by wind, animals, and equipment. Seed viability is significant in north Florida and other states of the Southeast; however, there are no confirmed cases of viable seed production in central and south Florida.

An established cogongrass stand invests heavily in its perennial root system. These infestations are capable of producing over 3 tons of root biomass per acre. This extensive network of rhizomes is capable of conserving water while the top growth dies back during prolonged drought. This is essentially a survival mechanism to keep the rhizome system alive. Another key to cogongrass invasion is that the root system may produce allelopathic chemicals that reduce the competitive ability of neighboring plants.

Identification

Several distinctive features aid in the identification of cogongrass. First, cogongrass infestations usually occur in circular patches. The grass blades tend to be yellow to green in color (Figure 1). Individual leaf blades are flat and

1. This document is SS-AGR-52, one of a series of the Agronomy Department, UF/IFAS Extension. Original publication date April 2002. Revised August 2012. Reviewed October 2015. Visit the EDIS website at <http://edis.ifas.ufl.edu>.

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serrated, with an off-center prominent white midrib (Figure 2). The leaves reach 2–6 feet in height. The seed head (Figure 3) is fluffy, white, and plume-like. Flowering typically occurs in spring or after disturbance of the sward (mowing, etc.). Seed heads range from 2 to 8 inches in length and can contain up to 3,000 seeds. Each seed contains silky-white hairs that aid in wind dispersal. When dug, the rhizomes (Figure 4) are white, segmented (have nodes), and are highly branched. The ends of the rhizome are sharp pointed and can pierce the roots of other plants.



Figure 1. Cogongrass plants are yellow to green in color. Note that the edges of the leaf tend to have more yellow than green.
Credits: G. Keith Douce, University of Georgia, www.forestryimages.org.

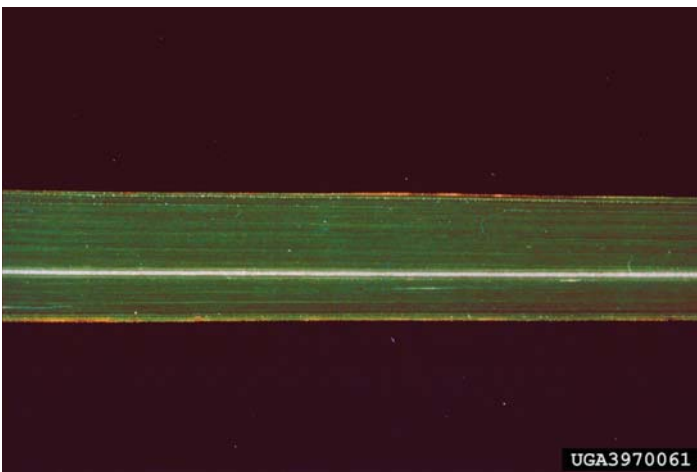


Figure 2. Cogongrass leaves have serrated edges and a prominent, white, off-center midrib.
Credits: L. M. Marsh, Florida Department of Agriculture and Consumer Services, www.forestryimages.org.



Figure 3. Cogongrass seed heads are fluffy and white. Each plant produces nearly 3,000 seeds.
Credits: John D. Byrd, Mississippi State University, www.forestryimages.org.



Figure 4. Cogongrass rhizomes are segmented (have nodes) where new shoots are able to grow.
Credits: Chris Evans, River to River CWMA, www.forestryimages.org.

Forage Value

Cogongrass has been used in Southeast Asia as forage because it is the dominant vegetation on over 300 million acres. In these areas it was found that only very young shoots should be grazed or cut for hay. At this stage, the leaves lack sharp points and razor-like leaf margins. For about four weeks following a prescribed burn, crude protein of regrowth is comparable to bahiagrass. Crude protein of mature stands rarely attains the minimal 7% level needed to sustain cattle, making supplementation essential for livestock production. Cogongrass yields are relatively

low, even under heavy fertilization, and usually do not exceed 5 tons per acre.

Management

For many years researchers all over the world have studied cogongrass control. During this time nearly all available herbicides have been tested, but few effective products have been found. For example, all of the commonly used pasture herbicides such as metsulfuron, 2,4-D, triclopyr, Velpar, and other combinations have little to no activity on cogongrass. Only glyphosate (Roundup, etc.) and imazapyr (Arsenal, Stalker, etc.) herbicides have been found to be effective, but long-term control is rarely achieved.

Imazapyr is an extremely effective herbicide that controls a variety of weeds, from herbaceous to woody species. One or two applications of imazapyr (0.75 lb/acre) will often effectively control cogongrass for 18–24 months. However, there are several disadvantages to using this herbicide. First, imazapyr will severely injure or kill forage grasses such as bermudagrass and bahiagrass. It also has a long soil half-life and will remain in the soil for several months after application. This often leads to “bare ground” for up to 6 months in the application area because of the non-selective nature of this herbicide. Imazapyr also has the potential to move down slopes during periods of rainfall, killing or injuring other species in the runoff area (oaks and other hardwood trees are especially sensitive). Second, imazapyr can only be used as a “spot-treatment” with no more than 10% of the pasture area treated per year.

Similarly, glyphosate is also a non-selective herbicide that effectively controls a variety of weeds. Unlike imazapyr, glyphosate possesses very little to no soil activity. Non-target effects caused by runoff during high rainfall events are not likely. Since glyphosate has no soil activity, it does not take very long for weeds or desirable grasses to reinfest the treated areas. Cogongrass will likely reinfest the area if only one application of glyphosate is applied during the same year. Research in Alabama has revealed that it takes approximately three years of two applications per year to reduce cogongrass rhizome biomass by 90%.

Small Infestations

Early detection of cogongrass in any setting is extremely important. A young infestation will be much easier to treat and eradicate than established infestations. In this case, we would define a small patch as 20–30 feet or less in diameter. Even for a small patch, monitoring is required after the initial application to ensure that any re-sprouting is quickly

treated. See Table 1 for specific timelines and suggested herbicide rates.

Large Infestations

Large infestations are 30 feet or larger in diameter. These types of infestations can be considered as established and likely have a large, intact root system. This will require more herbicide treatments to completely eradicate cogongrass. See Table 2 for specific timelines and suggested herbicide rates.

Integrated Management

Herbicide inputs alone are rarely successful in eradicating perennial species like cogongrass. In these cases, we need to use all of the tools we have to remove an unwanted species to reestablish a desirable species. This type of strategy is best employed in an area where cogongrass has long been established and is the predominant species present. See Table 3 for specific timelines and suggested herbicide rates.

In general, burn the area infested with cogongrass in August to September. One to four months later, treat the burned area with a mixture of imazapyr and/or glyphosate. Take soil samples prior to spring tillage the next growing season to ensure that the soil pH is adequate for your desirable forage species. Till the treated area the following spring to a depth of at least 6 inches and prepare a seedbed.

Consult with your local county Extension agent to consider your options for forage cultivars and fertility recommendations. Getting a good start on the desirable forage will help limit cogongrass reinfestations in your pasture. Continue to monitor this area in six-month intervals until the fourth year. Spot treat with glyphosate when necessary to remove any new cogongrass growth.

Table 1. Herbicide suggestions for small infestations of cogongrass in grazing areas. This includes both improved and native rangeland. These concentrations are good for mixing in small (3–30 gallon) sprayers. Please read the entire label of the suggested products prior to treating existing cogongrass stands.

	Timing	Herbicide Rate	Application Notes
1 st year	Fall (August–November)	1% Arsenal/Stalker + 0.25% non-ionic surfactant	Treat only 10% of the area to be grazed. No grazing restrictions, but do not cut for hay for 7 days. Read the herbicide label for mixing instructions.
		3% glyphosate	No grazing or haying restrictions. Read the herbicide label for mixing instructions.
		0.5% Arsenal/Stalker + 2% glyphosate + 0.25% non-ionic surfactant	Treat only 10% of the area to be grazed. No grazing restrictions, but do not cut for hay for 7 days. Read the herbicide label for mixing instructions.
2 nd year	Spring (monitor regrowth)	2–3% glyphosate	See above.
	Fall (monitor regrowth)	2–3% glyphosate	See above.
3 rd year–until eradicated	Spring–Fall (monitor regrowth)	Spot treat at the above rates for the 2 nd year.	

Table 2. Herbicide suggestions for large cogongrass infestations in grazing areas, including both improved and native rangeland. These suggestions are intended for large (>1000 gallon) sprayers. Please read the entire label of the suggested products prior to treating existing cogongrass.

	Timing	Herbicide Rate	Application Notes
1 st year	Fall (August–November)	48 oz/acre Arsenal/Stalker + 0.25% non-ionic surfactant	Treat only 10% of the area to be grazed. No grazing restrictions, but do not cut for hay for 7 days. Read the herbicide label for mixing instructions.
		3 to 4 qt/acre glyphosate	Do not graze for 8 weeks. Read the herbicide label for mixing instructions.
		24 oz/acre Arsenal/Stalker + 2 qt/acre glyphosate + 0.25% non-ionic surfactant	Treat only 10% of the area to be grazed. No grazing restrictions, but do not cut for hay for 7 days. Read the herbicide label for mixing instructions.
2 nd year	Spring (monitor regrowth)	2–3% glyphosate	No grazing or haying restrictions.
	Fall (monitor regrowth)	2–3% glyphosate	No grazing or haying restrictions.
3 rd year–until eradicated	Spring–Fall (monitor regrowth)	Spot treat at above rates for the 2 nd year.	See above.

Table 3. Control of cogongrass using an integrated approach. Adjust your timelines based on your location in Florida. For example, burning should be performed earlier in north Florida than in south Florida because of the first onset of a potential killing frost. Please read all herbicide labels prior to treating cogongrass for restrictions and mixing instructions.

	Timing	Herbicide Rate	Application Notes
1 st year	Summer—Fall (August–November)	1. Burn	Cogongrass fires burn extremely hot. Be sure to have firebreaks in place before attempting to burn cogongrass.
		2. Apply herbicide: 24 oz/acre Arsenal/Stalker + 2 qt/acre glyphosate + 0.25% non-ionic surfactant	Treat only 10% of the area to be grazed. No grazing restrictions, but do not cut for hay for 7 days. Read the herbicide label for mixing instructions.
		3. Take soil samples.	Have the soil pH tested at a reputable laboratory. Amend the soil as needed to grow desirable forage.
2 nd year	Spring	1. Tillage	Prepare a seedbed for desirable forage species. Repeated tillage will help to desiccate any remaining cogongrass rhizomes.
		2. Plant desirable forage.	Please consult your local Extension agent for up-to-date recommendations on forage cultivars and fertility recommendations.
3 rd year	Spring (monitor regrowth)	2–3% glyphosate	No grazing or haying restrictions.
	Fall (monitor regrowth)	2–3% glyphosate	No grazing or haying restrictions.
4 th year–until eradicated	Spring–Fall (monitor regrowth)	Spot treat at the above rates for the 3 rd year.	See above.

Table 1. Herbicide control measures as described by Miller (2003). All foliage must be thoroughly covered with the spray.

Escort [®] XP ¹ (metsulfuron methyl)	1-2 oz product /acre	Mix 0.3 to 0.6 dry oz per 3 gallons water, and as a mixture with glyphosate
Arsenal [®] AC ² (imazapyr)	1% in water	Mix 4 fluid oz per 3 gallons water
Glyphosate ³ , Garlon 3A ⁴ , or Garlon 4 ⁵ (triclopyr)	4% in water	Mix 16 fluid oz per 3 gallons water, or a combination of these herbicides

¹Escort[®] XP contains 60% metsulfuron methyl as the active ingredient.

²Arsenal[®] AC contains 4 lb acid equivalent imazapyr per gallon as the active ingredient

³Glyphosate is the active ingredient in Roundup[®], Accord[®], and many other products.

⁴Garlon[®] 3A contains 3 lb active ingredient per gallon as an amine salt of triclopyr.

⁵Garlon[®] 4 contains 4 lb acid equivalent triclopyr ester per gallon as the active ingredient.

Weed alert

Japanese climbing fern

(*Lygodium japonicum*)

Japanese climbing fern

Japanese climbing fern is a highly invasive non-native plant infesting public conservation lands in North and West Florida and present in much of the southeastern U.S. It grows in moist or dry woods, along ditches and rivers, and in various disturbed sites. It tolerates sun and shade. Like Old World climbing fern (*Lygodium microphyllum*), Japanese climbing fern climbs over

shrubs and into the tops of trees where its dense canopies shade out and eliminate the vegetation below. It was likely introduced into Florida as an ornamental plant in 1932. Japanese climbing fern appears to be rapidly spreading in North and West Florida, but also may pose a significant threat to Central Florida.



Left and Below: Fertile leaflets of Japanese climbing fern



Why Japanese Climbing Fern must be managed:

Japanese climbing fern forms dense tangled masses over ground cover and shrubs; its dense canopy eliminates native vegetation.



Florida Fish and Wildlife
Conservation Commission
MyFWC.com

Synonymy: Ophiglossum japonicum; Hydroglossum japonicum; Lygodium dissectum; Lygodium pubescens

Japanese climbing fern (*Lygodium japonicum*)

Lygodium japonicum may be confused with *Lygodium microphyllum*, another invasive, nonnative plant in Florida. *L. japonicum* leaflets are more dissected and lobed than those of *L. microphyllum*.



Leaves: Twining fronds to 90 ft. in length; main leaf stalk (rachis) wiry, twining; leaflets highly dissected or lobed, arranged on branches off the rachis, their lower surfaces pubescent with short curving hairs; the lobes pointed or rounded at the tips, flat at the margins when no sporangia (spore-producing sacs) present (then called “sterile” leaflets). “Fertile” leaflets contracted in shape, with margins curled over rows of sporangia.



Stems: Thin, wiry, dark rhizomes (underground stems) or runners, sometimes forming layered mats on the ground surface.



Flowers: None. Ferns are a spore-releasing class of vascular plants.



Spores: Many thousands of tiny spores released per plant and carried by wind, dust, animals, clothes and equipment.

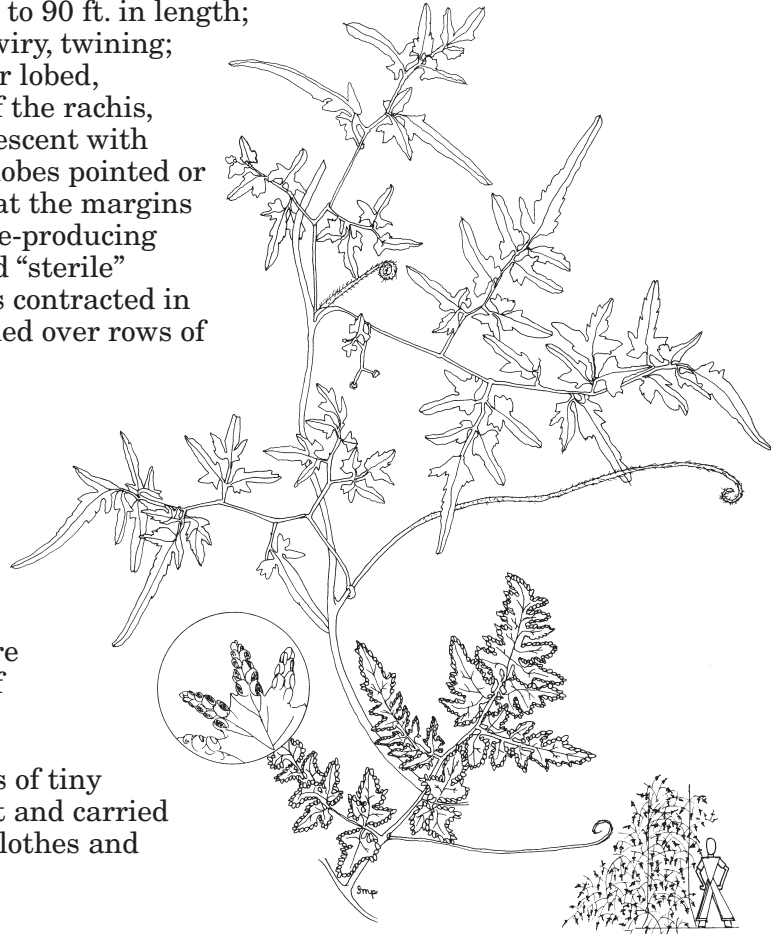


Illustration by Sandra Murphy-Pak, Center for Aquatic and Invasive Plants, University of Florida.

Look for first:

- Tangle of wiry, twining fronds
- Fern-type leaflets with hairs on undersides
- Sporangia under curled leaflet margins

Distribution

Native to Eastern Asia, temperate to tropical zones. Escaped in the United States, from the Carolinas through Georgia and Florida and west to Texas and Arkansas. In Florida, most common in North and West Florida but spreading down the peninsula and has been found as far south as Collier and Broward counties.

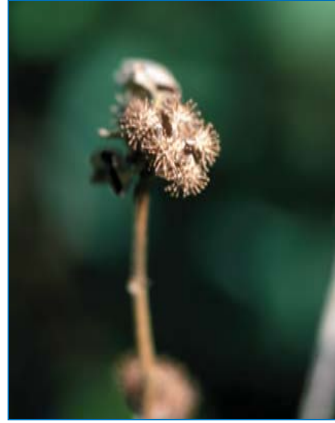


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Division of Habitat and Species Conservation
Invasive Plant Management Section
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Urena lobata L.



Common Name: Caesarweed; Caesar's weed; burr-mallow

Synonymy: None

Origin: India and tropical Asia

Botanical Description: Tough, erect, woody perennial herb or sub-shrub, to 3 m (10 ft), but usually to 1.5 m (5 ft); stems and leaves covered with star-shaped hairs; often many branched at base. Leaves simple, alternate, papery, upper surface rough, lower surface grayish, broadly ovate, often with 3-5 shallow, angular lobes at apex, to 10 cm (4 in) long; margins finely toothed, bases heart shaped; petioles to 5 cm (2 in) long; stipules tiny, linear. Flowers small, showy, hibiscus-like, solitary on short stalks in leaf axils, subtended by 5 basally united (involucral) bracts to 0.7 cm (0.3 in); calyx 5-lobed, hairy, to 0.6 cm (0.2 in); petals 5, rose or pink, darker at base, rounded, to 1.5 cm (0.6 in) long; stamens fused into an obvious pink column beneath a 5-lobed style. Fruit a small, barbed, spiny capsule, to 1 cm (0.4 in) across, with 5 prominent segments each containing 1 dark brown seed.

Ecological Significance: Introduced to Florida before 1895 and "escaped to waste places" before 1897 (Chapman 1897, Parsons 1895). Widely naturalized and considered a "serious threat" in hardwood hammocks and roadsides in south Florida by 1976 (Morton 1976). Reported from over 100 conservation areas in central and south Florida (Gann et al. 2001, FLEPPC 2002). Forms thickets, and is often abundant on swamp edges and in wet woodlands (Godfrey and Wooten 1981). Found sprouting in tropical hardwood hammock gaps after Hurricane Andrew (Gordon et al. 1999). May occur as scattered plants but can quickly spread to form dense patches and, occasionally, monocultural stands (FLEPPC 2002). Colonizes pine rocklands and prairie hammocks (Gann et al. 2001). Widespread throughout peninsular Florida in almost all habitat types, including hammocks, disturbed sites (Wunderlin 1998, Austin 1999b), pine flatwoods, sandhills, river edges, maritime forests, salt marshes, and coastal dunes (FLEPPC 2002). Occurs in closed canopy forests in its native range (Oommachan 1977). Declared a noxious weed in Fiji and Hawaii (PIER 2002).

Invades coastal dunes in Australia (Batianoff and Franks 1998a). A serious weed in Melanesia and West Polynesia, and common or present as a weed in many countries around the world (Holm et al. 1979). Distributed extensively as a fiber crop and for its many medicinal uses (Austin 1999b). Nectary glands on underside of leaves are used as a food source in Florida by native and nonnative ants (Dreisig 2000).

Distribution: Herbarium specimens documented from 36 counties throughout Florida. Naturalized in Hawaii, Puerto Rico, the Virgin Islands, and Louisiana (USDA NRCS 2002). Weedy in Central and South America, the Caribbean (Fryxell 1988, MOBOT), throughout the Pacific Islands (PIER 2002), Japan (RIB 2002), Australia (Auld and Medd 1992), and most tropical regions of the world. Targeted for removal from commercial production by FNGA/TBWG growers associations (FNGA 2001).

Life History: Fast growing, up to 2.75 m (9 ft) in 5 months; produces large amounts of biomass; may uptake substantial amounts of soil nutrients (Dempsey and Baumann 1970). Grows well in acidic soils (Nascimento and Vilhena 1996) to pH of 3.5 (Souza Filho et al. 2000), and survives in highly eutrophic wastewater (Kent et al. 2000). Withstands occasional flooding; tolerates dry conditions (FLAS, SEPASAL 2002) and a variety of soils, including sandy loam, lateritic gravel, silty clay, fine sand, rich muck, wet prairie, and wetland soils (FTG, Harris 1981b, Dempsey and Baumann 1970). Seeds are highly viable and have high dormancy rates (Harris 1981a), however the hard seed coat requires water soaking or scarification (Veena et al. 2001). Treated seeds had 96-100% germination (Veena et al. 2001), but untreated seeds have very low germination rates (Harris 1981a). Seeds germinate well between pH 5.6-7 and between 20-30°C (68-86°F) (Figueiredo and Popinigis 1980, Harris 1981a). Flowers year-round in Florida (Wunderlin 1998), but may not produce seed in colder climates (Dempsey and Baumann 1970). Barbed fruits readily cling to clothing and are dispersed by animals and humans (Austin 1999b).

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