

Sparkleberry
Farm
Alachua Co, FL
80 ac

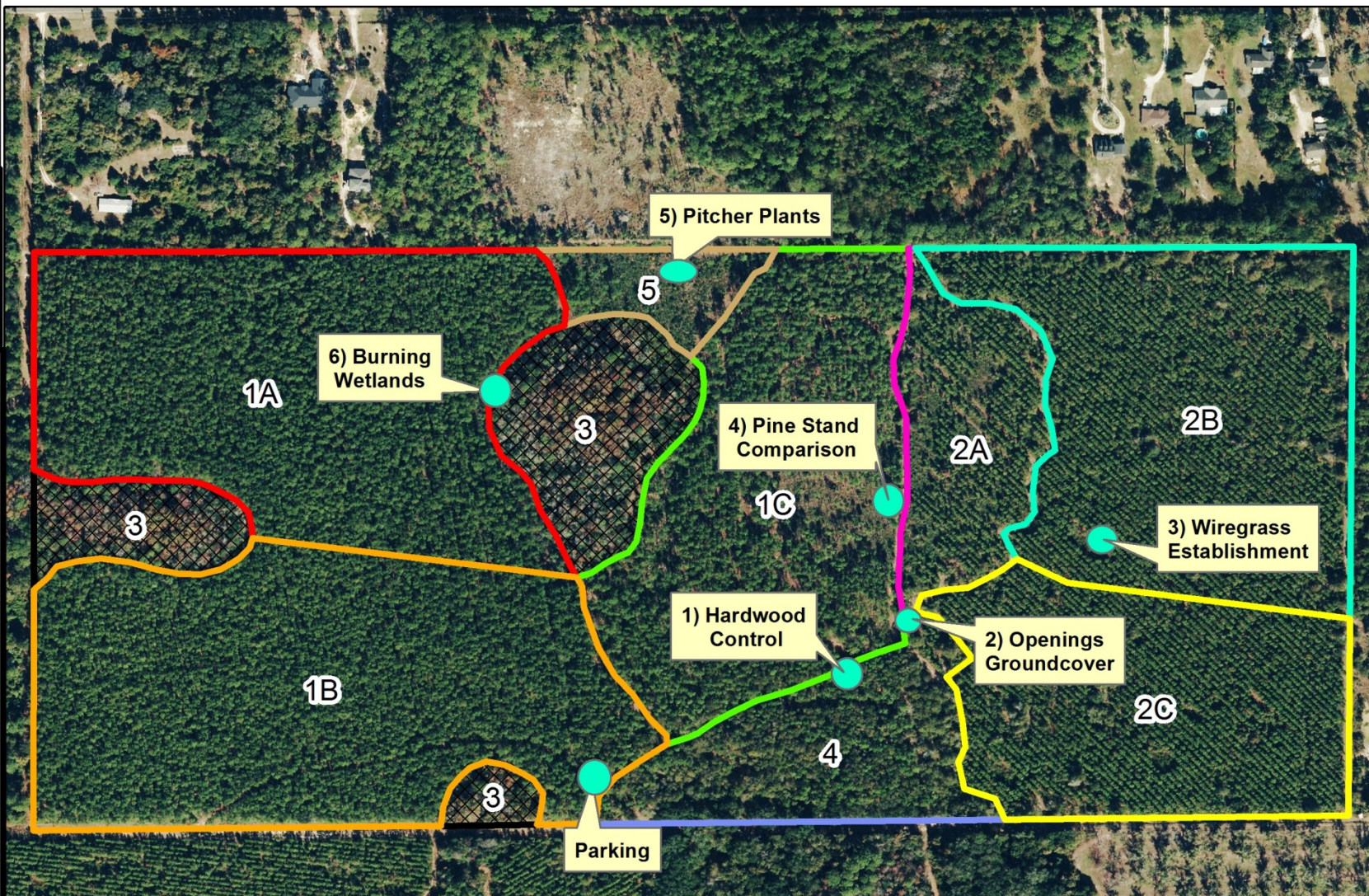
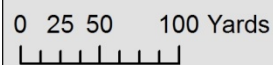
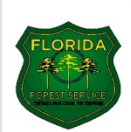


Legend

Planning_Units

Field, Acres

	1A, 14.2
	1B, 15.6
	1C, 11.3
	2A, 4.0
	2B, 12.0
	2C, 9.0
	3, 0.5
	3, 1.9
	3, 3.8
	4, 5.0
	5, 1.5



Forest Stewardship Tour, October 22, 2015

- Field 1A and 1B = Slash Pine planted 1990, 5th row thin 2/2011, brush reduction 2011, Rx 12/2012 & 5/2015
- Field 1C = Slash Pine planted 1990, 5th row thin 2/2011, wildfire 2007, Rx 12/2012 & 5/2015, LLP planted 2013
- Field 2A = Slash Pine planted 2000, brush reduction 2010/13/14, wildfire 2007, Rx 12/2014
- Fields 2B and 2C = Slash Pine planted 2000, brush reduction 2010/13/14, Rx 12/2014, wiregrass planted 2014
- Field 3 = Hardwood Swamp
- Field 4 = Hardwood Hammock / planted slash 1993, hardwood control 2012, Rx 1/2015
- Field 5 = Herbacious wetland, Slash Pine planted 1990, wildfire 2007, brush reduction 2013, Rx 5/2015, LLP planted 2013

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Property Tour

Sparkleberry Farm

Property of Bill Black and Denise Matthews

Alachua County, FL



Date / Location: Thursday, October 22, 2015
9:00 am – 2:00 pm ET
Sparkleberry Farm, near Earleton, FL
Directions to the property on reverse side.



Tour: Bill and Denise purchased this 80-acre tract in November 2010. Their goal is to transform the neglected stands of pine, cypress, and hardwoods into a more productive state for timber, recreation, and native flora and fauna. To accomplish this they are using forestry practices that enhance the native fire-dependent ecosystem, including the use of mechanical understory reduction, prescribed fire, control of invasive species, and restoration planting of longleaf pine and wiregrass in forest openings. In early 2011 they worked with the Florida Forest Service (FFS) and Florida Fish & Wildlife Conservation Commission (FWC) to develop a Forest Stewardship Management Plan. A consulting forester was hired to conduct a timber cruise of the property and a thinning of an older pine stand. They have used the services of FFS fire teams to conduct four prescribed burns, and the habitat improvement support of FWC's Landowner Assistance Program (LAP). The property is certified in the American Tree Farm System and Forest Stewardship Program.



United States
Department of
Agriculture



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 and the Florida Sustainable Forestry Initiative Implementation Committee.

Resource Contacts

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Questions about this or other Forest Stewardship Program activities can be directed to
 Chris Demers, (352) 846-2375 or 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

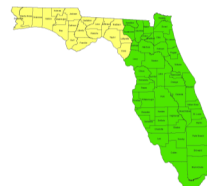
For information on the services listed above or any other services provided by the Florida Forest Service's hydrology section, please contact your local BMP Forester.

Roy Lima

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



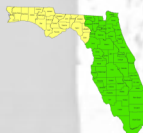
Forestry Wildlife Best Management Practices for State Imperiled Species



- 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? 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.



Think Locally, Act Neighborly
invasive species know no boundaries!



Longleaf Pine Regeneration¹

Chris Demers, Alan Long and Patrick Minogue²

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

Longleaf pine is a pioneer species on a variety of sites but is intolerant of competition and flooding during its grass stage, when it appears like a clump of grass. Historically, fire and moisture have been the principal factors controlling longleaf distribution within its natural range. In the lower Coastal Plain longleaf grows on sandy, well-drained to excessively well-drained soils where loblolly or slash pine perform more poorly. Fire removes competing vegetation, exposing the bare soil necessary for successful seedling establishment. In the historic fire-dominated longleaf pine grass savannah ecosystem, relatively stable plant communities are characterized by an overstory of uneven-aged, widely spaced longleaf pines and fire-tolerant oaks such as bluejack oak (*Quercus incana*) and turkey oak (*Quercus laevis*) and a predominate ground cover of bunch

grasses such as wiregrass (*Aristida stricta*) and bluestems (*Andropogon* spp) which facilitate ignition and spread of periodic fires (Landers 1991). It is interesting to note that, despite this tree's performance on high, dry ground, its Latin name means "swamp pine." It does grow sparsely in wet areas as well.

Artificial Regeneration

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

Site Preparation

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

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

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

The use of specific trade names in this publication does not constitute endorsement of these products in preference to others containing the same active ingredients. Mention of a proprietary product does not constitute a guarantee or warranty of the product by the authors or the publisher.

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

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

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

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

The best results are obtained when vegetation is managed both before and after planting. During the first and sometimes the second growing season following planting, selective herbicides are used to control grasses and broadleaf weeds (herbaceous weed control). This practice significantly improves seedling survival, and accelerates seedling growth rates by reducing the period that seedlings remain in the grass stage by one or more years. In longleaf plantations in the sandy soils of the Coastal Plain, hexazinone and sulfometuron methyl are the most commonly used herbicides for herbaceous weed control in longleaf

pine plantations (Table 1). These herbicides may be applied directly over planted seedlings safely when care is taken to ensure the proper herbicide rate is applied and labeled method is followed. Pine tolerance to these herbicides is best when seedlings have initiated new root growth following transplanting. Many growers excavate a few trees to check for new roots, which are white in color, prior to herbicide application. Herbaceous weed control treatments are most effective when weeds just start to develop in the Spring, which is typically in late March through mid-April.

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

Planting

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

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

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

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

seedling survival and minimize the possibility of having to replant.

BAREROOT SEEDLINGS

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

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

CONTAINERIZED SEEDLINGS

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

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

cost-share programs and increased survival make them a feasible option.

NURSERY TO FIELD

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

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

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

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

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

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

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

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

A WORD ABOUT COST-SHARE CONTRACTS

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

POST-PLANTING CARE

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

Direct Seeding

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

be in contact with the mineral soil for germination to take place. Seeds lodged in non-soil material will probably not become established.

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

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

Natural Regeneration For Even-Aged Stands

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

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

Preparatory Cut

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

Seed Cut

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

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

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

Removal Cut

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

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

Natural Regeneration for Uneven-Aged Stands

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

Conclusion

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

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

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

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

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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.

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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

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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.

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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

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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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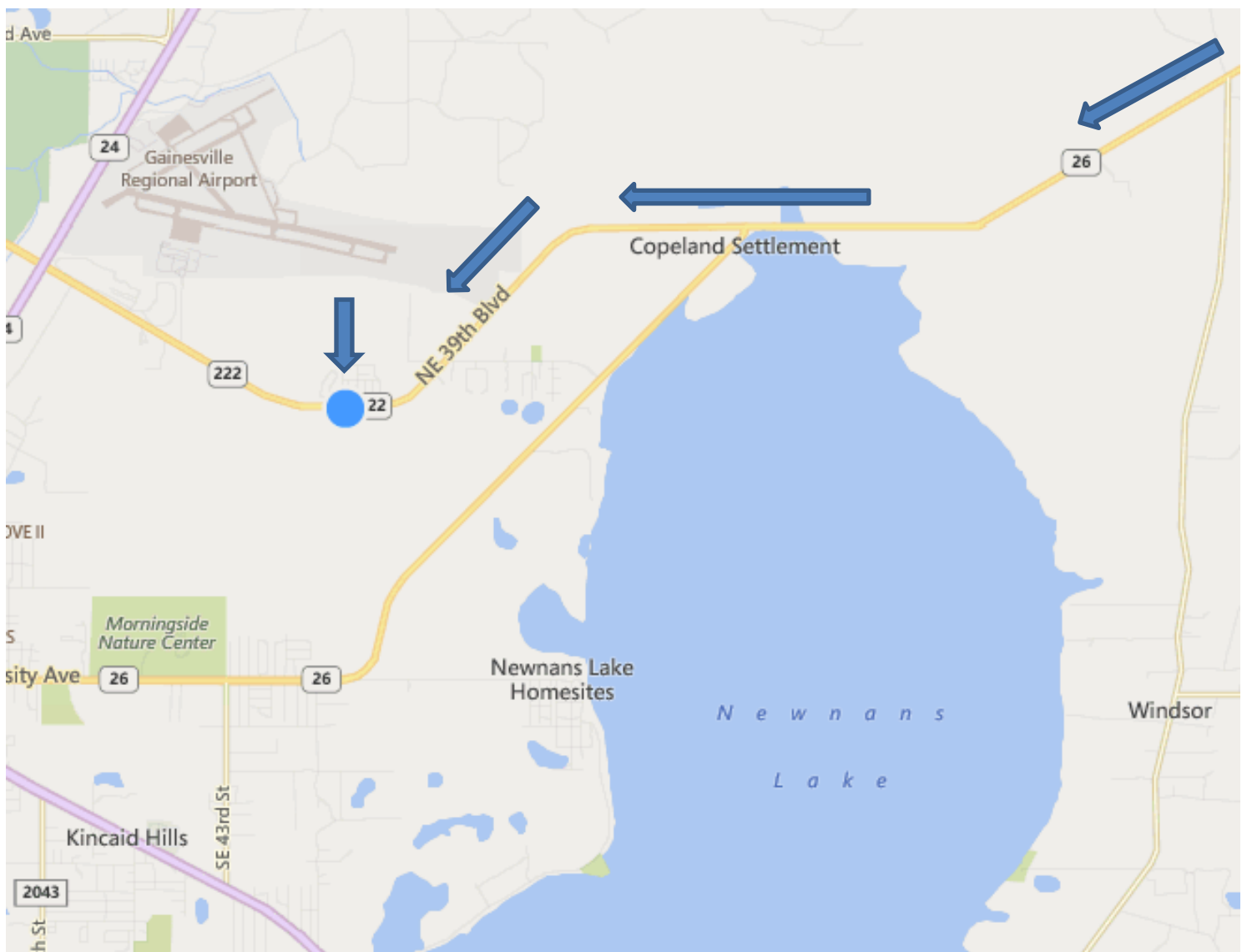
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