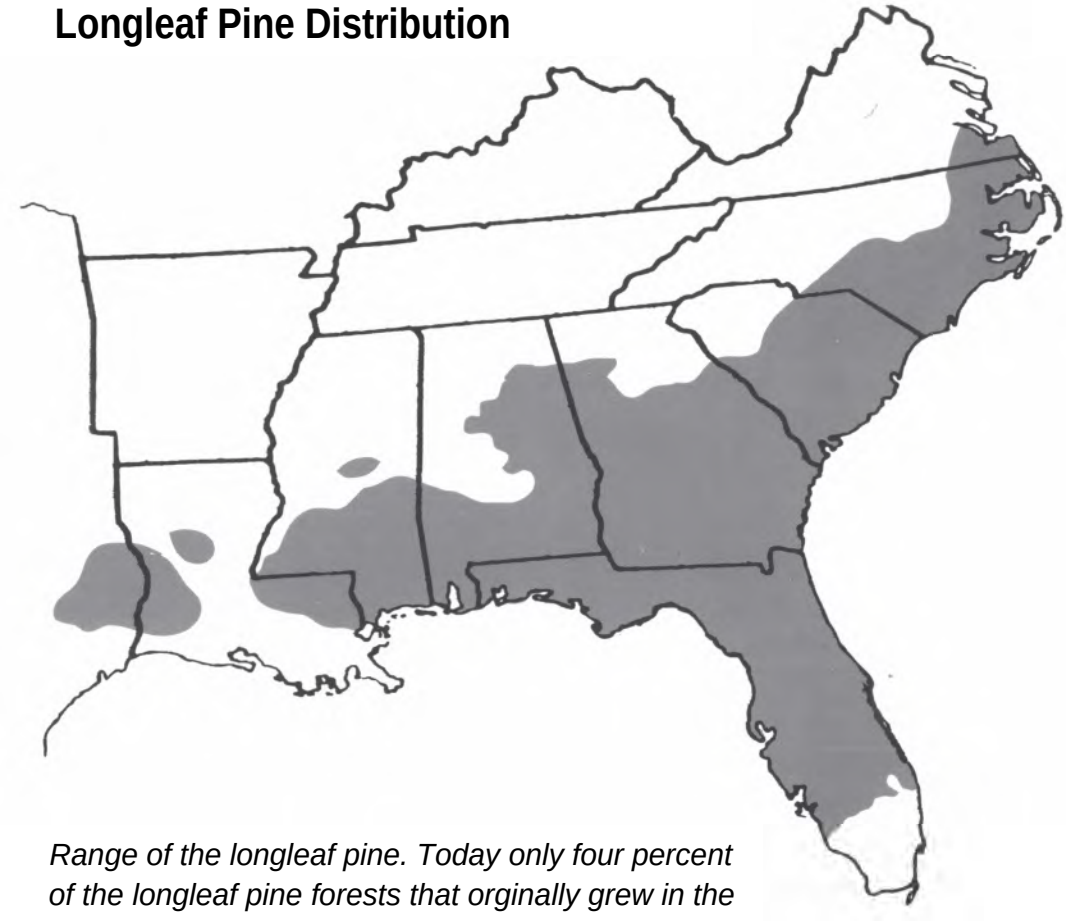
Stewardship of Longleaf Pine Forests:

A Guide for Landowners

Longleaf Pine Distribution



Range of the longleaf pine. Today only four percent of the longleaf pine forests that orginally grew in the Coastal Plain of North America remain.

Stewardship of Longleaf Pine Forests: A *Guide for Landowners*

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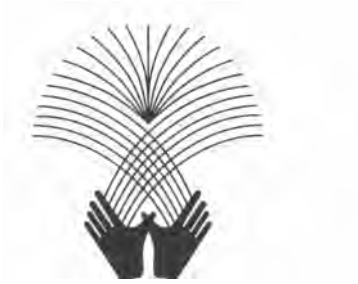

THE LONGLEAF ALLIANCE

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INTRODUCTION:

This book is written for the private landowner in the deep South, the heart of the range of longleaf pine. This tree species was once part of the single largest forest community in North America, covering as much as 90 million acres. Today, less than 3 million acres remain. The future of longleaf as a viable economic and ecological component of our Southern landscapes rests in the hands of the private landowner. Well-managed longleaf forests can provide high-value forest products, excellent wildlife habitat for both game and nongame wildlife and scenic beauty, all on the same property with little or no trade-offs. If you are a landowner in the range of longleaf pine, this book was written for you in a easy-to-read format. As you read through these pages, you will get some ideas about how longleaf forests can fit into the landscape on your property. It is my hope that this publication will assist you in becoming a better steward of the longleaf forests you now care for and, where conditions permit, help you restore this forest community on your land. If you are a natural resources professional, use this book as an overview about longleaf and consider this species in your management recommendations.

I'd like to thank the following people for their review, input and constructive criticism of the text: Bill Boyer, Cecil Frost, Dean Gjerstad, Joe Hamilton, Rhett Johnson, Rick Jones, George Kessler, John Kush, Ralph Meldahl, Joe Mills, Julie Moore, Leon Neel, Steve Nodine, David Van Lear, Tommy Walker, and Greg Yarrow. Also, acknowledgments go to the Auburn University School of Forestry, the Florida Department of Archives, the Longleaf Alliance, the South Carolina Department of Natural Resources, the USDA Forest Service, and Barry Graden for the photographs and illustrations used in this publication. I am also grateful to the Clemson University Cooperative Extension Service for allowing me time to put together this material. Special thanks to Mary Tiller and Judy Liska at Clemson University for their excellent editing and design work on this publication.

Finally, deepest thanks are extended to the Longleaf Alliance for funding the publication of this book.

I dedicate this publication in memory of my grandmother, Susie Malana McCants. She spurred my interest in longleaf pine when I was a child by telling me stories of growing up during the early 1900s in the sawmill camps in the longleaf piney woods of south Georgia and Alabama. Her descriptions of the nature of the longleaf big woods and the animals that lived there, spurred an interest in things dealing with the outdoors and developed within me a life-long interest in longleaf pine communities.

— Robert M. Franklin

A Word About .....

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The Longleaf Alliance has been developed to publicize and promote existing programs and to develop new cooperative efforts that promote the ecological and economic values of longleaf ecosystems. Through the team effort of the Alliance, the goals to encourage better management practices and to reverse the decline of the longleaf ecosystems can be achieved.

The Alliance is a partnership of private landowners, forest industries, state and federal agencies, conservation groups, university researchers, outreach personnel, and others interested in promoting a regional recovery of longleaf pine forests for their ecological and economic benefits. The Longleaf Alliance serves as a clearinghouse for a broad range of information on regenerating, restoring, and managing longleaf pines. A major focus of this group is providing economically viable and voluntary options for the recovery of longleaf on private lands where most of the losses are occurring. To accomplish this, natural resource managers who interface with non-industrial landowners will be targeted for training.

Through the Alliance, landowners and managers will be connected regionally with peers or other public and private organizations who have successfully addressed similar problems or with researchers with similar interests and questions. The Alliance will help facilitate communication among research institutions and between researchers and managers, and build networks between landowners, managers, consultants, industries, researchers, and longleaf proponents. Newsletters and technical bulletins will be distributed to the Alliance's supporters.

STEWARDSHIP OF LONGLEAF PINE FORESTS: A GUIDE FOR LANDOWNERS

Figure 1. Old-growth longleaf pine forest

The early settlers of the Southeast encountered a virgin forest of longleaf pines that covered up to 90 million acres of land on the coastal plain and adjacent areas of the piedmont and mountains. The natural range of longleaf extended from southeastern Virginia to central Florida, westward to east Texas, broken only by the bottomlands of the Mississippi River and other streams. The species also extended up into the mountains of northeast Alabama and northwest Georgia. Today, longleaf pines occur on less than 3.0 million acres of land in the region. The species has declined because of land clearing for agriculture and development, fire suppression, and the replacement of harvested stands with faster-growing loblolly and slash pine.

Longleaf pine forests are unique in many ways. The tree owed its pre-colonial widespread dominance to naturally occurring, surface fires that were. set by lightning and would burn over thousands of acres of longleaf forests annually. It has been estimated that fires burned over, much of the longleaf woods at least once every 3 to 5 years. When the American Indians arrived in the region, they used fire to keep the woods open around their villages, to clear land for farming, and to attract and drive game for hunting. This combination of naturally-occurring and Indian-set fires restricted hardwoods and other less fire-resistant southern pines to stream bottoms and other wet areas that burned less frequently. Because of frequent fire, longleaf forests were open and park-like, with an overstory of pine, a very scattered mid-story of suppressed, fire-tolerant hardwoods and an understory of grasses, fortis, and other succulent plants.

William Bartram, a naturalist who traveled in the South during the 1770s, described one extensive stretch of longleaf woodlands as: "A level open, airy pine forest, the stately trees scatteringly planted by nature, arising straight and erect from the green carpet, embellished with various grasses and flowering plants."

These open, savannah-like woodlands may contain over 40 different plant species per square meter. This makes longleaf forests some of the most diverse plant communities in the Western Hemisphere.

Figure 2. Old logging cart

The longleaf pine has many desirable characteristics for landowners who want to practice multiple-use management. Longleaf yields a higher proportion of pole and piling material than other southern pines, and is the most insect, disease and fire resistant pine species in the South. Because the pine canopy is slower to develop compared to other pines, early successional conditions can be maintained longer in the understory, benefitting many wildlife species. All these factors make longleaf pine more adaptable to multiple-use management for wildlife, timber, and aesthetics.

TABLE 1. CHRONOLOGY OF MAJOR EVENTS IN THE DECLINE OF THE LONGLEAF PINE ECOSYSTEM

1565-1732	Land clearing; introduction of hogs and other feral livestock into the woods; small scale naval stores production.
1714	Introduction of water powered sawmills. Beginning of removal of sawtimber from lands along waterways.
1750	Feral hogs reach saturation density on open range in Virginia and northeastern North Carolina, eliminating longleaf seedling establishment.
1815	First steamboat in the Carolinas; ten in use in South Carolina by 1826. Introduction of steam power marks the beginning of the Industrial Revolution in the South.
1833	Construction of the first railroad in the U.S., between Charleston and Hamburg, South Carolina.
1834	Introduction into the woods of the copper still for the distillation of turpentine. Beginning of the era of massive turpentine operations.
1850	Turpentine production peaks in North Carolina, spreads south as northern longleaf forest are exhausted.
1860	Feral hogs reach saturation density on open range over much of the range of longleaf pine.
1850-1870	Rapid proliferation of steam technology for logging railroads, steam skidders, and steam-powered sawmills.
1880-1890	Beginning of standardization of railroad track sizes, concatenation of isolated railroad lines, making overland transport of lumber feasible.
1870-1920	Era of massive logging, powered by steam technology. Most remaining virgin forest in the South logged.
1880-1930	Stock Laws (Fence Laws) passed in most of the range of longleaf pine. Last major stand regeneration occurs in many areas, in the years between the end of open range and the beginning of modern fire suppression.
1920-1950	Most of the range of longleaf comes under effective fire suppression. Second growth forest succession replaces savannah and woodland diversity.
1943	U.S. Forest Service gives general approval to the use of fire in managing pine forests.
1940-1990	Conversion of woodland to pine plantation.
1962-Present	Tall Timbers Fire Ecology Conferences and numerous other meetings on longleaf pine management. Increasing appreciation of the role of fire in natural ecosystems.

Adapted from Cecil C. Frost, 1993. Four centuries of changing landscape patterns in the longleaf pine ecosystem. Proceedings of the 18th Tall Timbers Fire Ecology Conference.

HABITAT TYPES

Ecologists have classified coastal plain longleaf forests into four major series along a moisture gradient from dry to wet: Xeric, Subxeric, Mesic, and Seasonally Wet. These series are further subdivided into twenty-three longleaf communities based on geography and topographic position. Many of these longleaf forests are extremely rare, especially those on soils which were better suited for agriculture. The majority of remaining coastal plain longleaf forests will usually fall into one of these categories; Sandhills, Flatwoods, Savannahs and Rolling Mesic Hills.

Sandhills longleaf forests are characterized by deep, well drained soils. Typical plant species include longleaf pine, turkey oak, bluejack oak, wiregrass, pineywoods dropseed, and wild blueberries. Some of the rare, threatened, and endangered species that may occur in Sandhills longleaf forest are dwarf or false poison sumac, pixie moss, red-cockaded woodpecker (RCW), gopher tortoise, and Bachman's sparrow.

Flatwoods longleaf sites on the lower coastal plain are characterized by having - soils that are more wet than the Sandhills' soil. Plant species associated with this type include gallberry, saw palmetto, waxmyrtle, wiregrass, and bluestem grasses. Rare, threatened, or endangered species that could inhabit longleaf flatwoods include American chaffseed, white wickey, RCW, and Bachman's sparrow.

Savannah sites typically are the wettest sites occupied by longleaf pine, especially along the lower coastal plain adjacent to the coast. They are usually the most open, with more of a woodland-like appearance than that of a forest. Plant species associated with longleaf savannahs include wiregrass and an array of other grasses and sedges, orchids, and insectivorous plants such as pitcher plants and bladderworts. Rare, threatened, and endangered species found in longleaf savannahs include American Chaffseed, venus flytrap, Canby's dropwort, rough-leaved loosestrife, RCW, and Bachman's sparrow.

The Rolling Mesic Hills are more prevalent on the Gulf Coastal Plain and are characterized by finer textured soils and subsoils with a higher clay content. Both scrub oaks and mesic tree species such as sweetgum, blackgum, southern red oak, flowering dogwood, gallberry, and several species of hickory may be present. Both loblolly and shortleaf pine can occur in association with this type. These pines and mixed hardwoods will eventually dominate in the absence of fire. Understory plants associated with this type include Indiangrasses, bluestems, dropseeds, and grasses in the genus *Tridens.* Understory vegetation in the rolling mesic hills may be some of the most diverse in the longleaf pine community and will also include an array of legumes and other forbs. Rare, threatened, and endangered species that may inhabit the rolling mesic hills include the RCW, gopher tortoise (federally protected in Mississippi, Louisiana, and in the Alabama counties west of the Mobile and Tombigbee Rivers), indigo snake, Bachman's sparrow, Alabama grape-fern, American chaffseed, Apalachicola Indiangrass, and pine barrens prairie clover.

REGENERATION

One of the reasons for the decline in longleaf pine acreage was its reputation of being hard to regenerate and a slow grower in its early years. This led to the use of loblolly and slash pines in most reforestation efforts. These trees were easier to plant and had rapid early growth rates. Research has shown, however, that through proper care, handling and planting of seedlings, longleaf pine survival and growth is comparable to other pine species on most sites.

Figure 3. A machine-planted, bare-root longleaf pine seedling.

PLANTING

Landowners who wish to plant longleaf pine have two options -- planting bare-root seedlings or containerized seedlings.

Bare-Root Seedlings: The key to getting longleaf seedlings to initiate early height growth is to get the seedlings to achieve a one-inch root collar diameter (RCD) as soon as possible. Longleaf pine seedlings are stemless and look very much like a carrot with a clump of pine needles on top. They remain in a grass stage condition until the RCD reaches one inch. When this size is attained, the seedlings begin rapid growth comparable to loblolly or slash pine. When planting longleaf pine seedlings, keep these points in mind.

- Minimize competing vegetation for at least two years after planting.

- RCD of bareroot seedlings should be between 0.3 and 0.6 inches, and root systems should have a stout tap root eight inches or longer with numerous, well-developed lateral roots.

- Keep root exposure to an absolute minimum between packaging at the nursery and planting.

- Plant seedlings within three days of pickup from the nursery. If seedlings must be placed in cold storage prior to planting, store them no longer than two weeks. **Get the seedlings from the nursery and plant them as soon as possible.**

- Plant the seedlings so that the root collars will be slightly below the settled soil surface 2 to 3 months after planting.

- Longleaf seedlings may be planted between mid-December and April 1, as long as weather factors are favorable. Planting in the early part of this time frame is usually better. Avoid planting during periods of low soil moisture and dry weather. Also avoid planting during times of low temperature, low relative humidity, and high wind associated with the passage of a strong cold front.

- Control damaging influences such as livestock, brown spot disease, and competition as needed.

- Plant enough seedlings to give 300 to 500 seedlings per acre surviving after one year. Pick a planting spacing that best meets your objectives.

Containerized Seedlings: There is increasing interest in using containerized longleaf pine seedlings in planting operations. Containerized seedlings can be used to extend the planting season and can be used to replant partial regeneration failures in the year in which they occur. In research studies, both fall-planted and late winter-planted, containerized longleaf have shown better survival and growth when compared to winter-planted, bareroot longleaf seedlings.

Also, container longleaf pines show greater tolerance to herbicides used in pine release operations. The biggest disadvantage of containerized seedlings is their cost. Containerized seedlings can cost more than three times as much as bareroot seedlings. They can also be bulky to handle during the shipping and planting stages.

Figure 4. Containerized longleaf pine seedlings.

DIRECT SEEDING

Another option for establishing longleaf regeneration that is less costly than planting is direct seeding. Direct seeding is not without problems. Failures can occur from inadequate control of competing vegetation, low seeding rates, using seed not treated with bird or rodent repellent, seeding at the wrong time, or uncooperative weather. Some tips to follow when using direct seeding:

- Pick your sites carefully. Avoid sites that are wet during the late winter and early spring. Newly germinated seedlings are intolerant of standing water. Avoid excessively dry sites and those subject to erosion. The best sites for direct seeding will be soils of medium moisture-holding capacity on gentle slopes.

- Plan the best time to plant your seeds. Longleaf pines germinate naturally just after seedfall during October and November. In most cases, this is the best time to plant longleaf seeds. If soils in the area are subject to frost-heaving, seed during late winter.

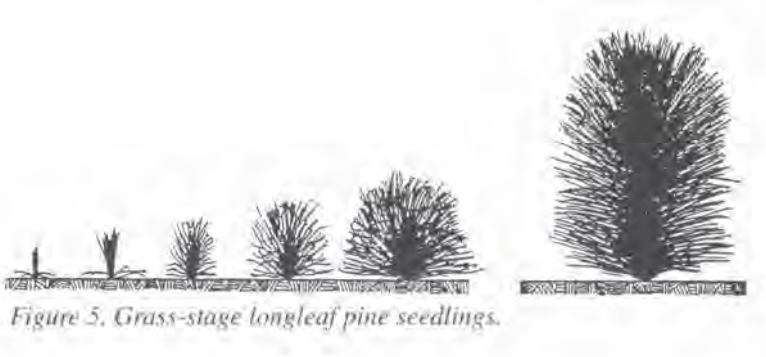


Figure 5. Grass-stage longleaf pine seedlings.

- Always use the best quality seed that can be purchased from reputable seed dealers. Seeds should come from a known seed source or a local source. Seeds should be treated with bird and rodent repellent.

- Rates for the three main methods of seeding are:
  Broadcast - 3 pounds per acre;
  Row Seeding - 1 1/2 -2 pounds per acre;
  Spot Seeding - 3/4 of a pound per acre.

Seeds should come in contact with mineral soil. Seeds caught in surface litter, grass, or other debris will germinate, but will not survive because of the exposed root system. The major benefits of direct seeding are speed and cost. The disadvantages are less control over spacing and density and a lengthy grass stage before height growth begins.

NATURAL REGENERATION

Landowners who already have stands of longleaf pine can opt to use natural regeneration to reforest. A shelterwood method of naturally regenerating longleaf pine has been developed that is low-cost and effective. However, success depends on four conditions: 1) adequate seed supply; 2) receptive seedbed; 3) minimum vegetative competition; and 4) ample soil moisture.

Figure 6. Seed-cut stage of a shelterwood cut.

Adequate Seed Supply: Start the development of potential seed trees about ten years before the planned harvest date. Begin by thinning the overstory to 60 to 70 square feet of basal area per acre. Keep the largest, best formed, and most fruitful trees in the residual stand. Further reduce stand basal area to 25 to 30 square feet per acre with a seed-cut about five years before the final harvest. Monitor seed crops annually in the spring to predict an adequate seed crop. Schedule seedbed preparations such as disking or a seedbed prescribed burn as needed. The seeds produced by 1,000 or more cones per acre should be adequate to establish a new crop of seedlings.

Receptive Seedbed: A good percentage of mineral soil must be exposed for seeds to reach the seedbed, germinate, and become well established. A prescribed burn no more than one year before seedfall will usually create a receptive seedbed. A late summer or early fall bum just prior to seedfall may provide a seedbed for two successive crops of seed, however, burning too late will expose seed to excessive predation. Burn early enough to leave time for litter to accumulute to shield the seeds. Mechanical treatments like disking, that lightly scarify the soil surface may be used in lieu of burning. However, these treatments may cost more and damage the seed trees and the groundcover.

Minimum Vegetative Competition: The use of prescribed fire throughout the rotation will prevent excessive encroachment of woody plants in the midstory and understory. However, if competing woody vegetation is present, remove it, preferably before the seed-cut. This may be done by selling and removing merchantable trees, using approved herbicides, prescribed fire, mechanical treatments or combinations of two or more of these operations. Once an average 3,000 to 6,000 longleaf seedlings greater than one year of age are present per acre, the remaining seed trees can be harvested. Generally, once 1,000 to 1,500 seedlings per acre have started height growth and are free from overhead competition, the new stand is considered established.

Figure 7. Newly germinated longleaf seedlings.

Ample Soil Moisture: Removal of competing vegetation is about all that can be done to maximize available soil moisture during the stage from seed germination through the critical first year. The rest is left to chance. After the seed trees have been removed, the stand should be revisited periodically to monitor the presence of brown-spot disease, encroaching competition, and any livestock impacts. Undesirable levels of any one of these conditions should be controlled promptly.

MULTIPLE—USE MANAGEMENT

Longleaf pines can be managed to provide a desirable mix of wood products while providing excellent populations of game and nongame wildlife. A well-managed longleaf forest's open and park-like nature is aesthetically pleasing to many. The open vistas common in longleaf forests are desirable for many outdoor enthusiasts.

MANAGING FOR TIMBER & STRAW PRODUCTION

Longleaf pines can produce quality wood products when grown in a variety of densities. Longleaf pine timberland owners should especially consider growing and marketing poles and pilings. Historically, these products have provided landowners with stumpage prices that range from 30 to 50 percent or more over sawlog prices. Due to the tree's excellent form, longleaf pines can produce a higher percentage of pole and piling material than the other southern pines. It is the preferred species for poles. Poles and pilings can be produced from well-stocked, even-aged, and uneven-aged stands of longleaf.

On average sites, even-aged stands of longleaf pines can be managed for poles on a 40 to 60 year rotation. Timber thinnings should be frequent and light, concentrating on leaving the best pole candidates and a residual stand basal area averaging 60 to 90 square feet per acre. Pole and piling material is best grown in denser stands in order to reduce the taper of the tree trunks. Growing straight stems with minimal taper is the key to growing quality poles and pilings.

Another forest product which can be produced concurrently with poles and pilings is pine straw. Highest pine straw yields consistently come from well-stocked longleaf pine stands with little or no understory and midstory development. Straw can be initially raked in longleaf plantations between ages 8 and 12 and afterwards every other year until ages 20-30. (Straw production peaks in planted stands at age 20, and at age 25 in natural stands).

Longleaf straw is in high demand as a landscaping material. Retail prices can vary from around $2.50 to $8.00 per bale. Landowners typically receive anywhere from $0.30 to $1.10 per bale. Most straw is sold either on a negotiated per bale basis or on a competitive sealed bid, lump sum by area raked.

Actual straw yields will depend on the age and stocking of the pine stand. Annual yields of up to 200 bales per acre are possible. One study in Georgia indicated that in natural stands of longleaf, commercial straw harvest averaged 87 bales and 1,633 pounds of straw per acre annually. Yields from plantations of longleaf pine should be greater.

If pine straw production is an objective, it should be carefully planned. Most of the nutrients in pine forests are tied up in the pine needles. If care is not taken in monitoring both pine needle and soil nutrient levels when raking straw, it will be very easy to mine the forest's fertility. Fertility levels can be monitored by periodic soil testing and pine needle nutrient analysis. Nutrient loss can be offset by periodic fertilization based on test results.

Keeping brush from encroaching into stands managed for straw is a challenge. Fully stocked stands will shade the understory and reduce brush encroachment. Periodic use of selective herbicides is common, but may be expensive. Mowing and prescribed fire can be used, especially before September. Since most of the needle-fall occurs between September and December, a cool prescribed burn before September followed by harvesting the fresh needles immediately after needle-fall could be the most economical way to control brush.

Also, there is concern that intensive straw management in natural stands of longleaf pine could severely impact the habitat of some rare and threatened plants and animals found only in longleaf pine woodlands and degrade associated wildlife values. Because of this, it is suggested that longleaf plantations be established on old field/marginal croplands with gentle slopes. Advantages to these sites include high residual fertility and little or no competing woody vegetation. In addition, the plantation can be laid out to facilitate mechanized straw raking.

Figure 8. Southern pine beetle damage.

PESTS

Longleaf pine is relatively insect and disease resistant. The southern pine beetle can attack healthy stands of longleaf if populations reach epidemic proportions, but as a rule, longleaf pine is more resistant than other pine species. As with the other southern pines, prevention is the best control method. Good timber management using periodic thinnings to remove weaker trees and give the remaining stems room to grow is the best way to reduce losses from this insect.

Ips engraver beetles can be a problem at times, but these insects typically attack trees under extreme stress such as trees hit by lightning. Black turpinetine beetles also are attracted to stressed trees such as those damaged in logging or by a hot fire. Controlling logging damage is the best way to reduce problems with black turpinetine beetles.

Brown-spot needle blight is a problem with longleaf pine and can be very destructive. It appears to be more prevalent from south Georgia westward. This fungal disease attacks the needles of seedlings in the grass stage and will delay the initiation of height growth and may kill the infected seedling.

Figure 9. Seedling infected with brown spot needle blight.

One control option is to use benomyl fungicide as a root dip on seedlings before planting. However, in seedling stands already planted or naturally regenerated, prescribed fire is the only practical means of control.

Before using prescribed fire, systematically survey the stand. If 20% or more of the cumulative needles on the best 1000 crop seedlings per acre are infected, a burn is needed. It is important, however, that seedling stands be monitored for this disease. If 40% or more of the needle surface is infected, seedling mortality from the prescribed burn will often exceed survival.

Fusiform rust, annosus root rot, and pitch canker sometimes infect longleaf pine, but longleaf is still more resistant than the other southern pines.

MANAGING FOR GAME AND TIMBER

Most landowners with longleaf pine are interested in some form of game and timber management. Longleaf forests managed as even or uneven-aged stands on rotations ranging from 40 to 100 years or more offer excellent opportunities to accommodate both objectives.

Stand Size: When managing longleaf forests in even-aged units for wildlife, stand size is critical. Forests should be composed of a variety of different aged stands. While it may not be practical to have a stand of timber for each year in the rotation, stands can be managed in 3, 5, 8 or 10 or more year age classes. When using natural regeneration, age classes will be dependent on the frequency of seed crops. In some areas of the South, there may be as many as 20 years or more between seed crops adequate to naturally regenerate even-aged stands.

As an example of this style of management, 240 acres of planted longleaf forest grown on a 60-year rotation can be divided up into 12 age classes at 5 year intervals

with each age class being approximately 20 acres. An array of other size and age combinations is possible. This is called "all-aged management in even-aged units" and is one of the simplest and best ways to accommodate wildlife values in timber management.

TABLE 2. ALL-AGED MANAGEMENT IN EVEN-AGED UNITS
240-ACRE TRACT: AN EXAMPLE

Forest Age-class	Acres	Percent
Young growth	60 acres	25%
Intermediate growth	60 acres	25%
Mature growth	120 acres	50%

Illustration of how even-aged pine and hardwood stands can be arranged and age classes distributed to benefit wildlife without significant loss in timber growth and yield.

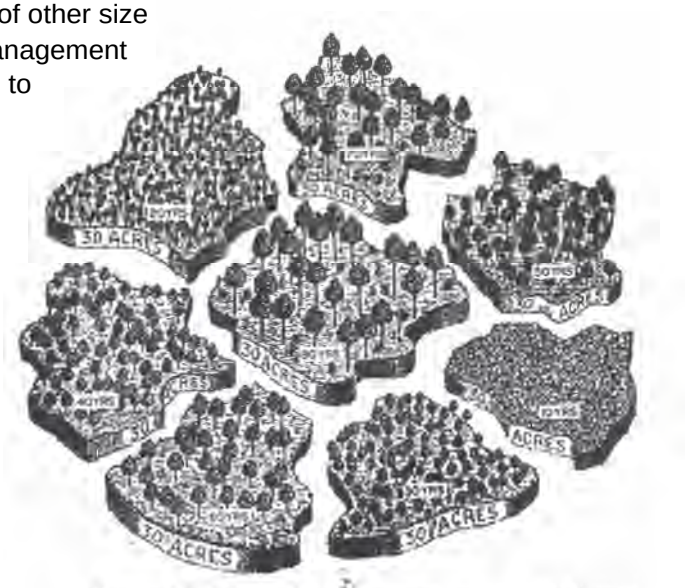


Figure 10. All-aged management in even-aged units.

Timber stand size should be kept as small as practical, but not so small that timber harvests become uneconomical. This size limit will generally depend on the local timber market and harvesting systems that are being used in the area. Stands should be irregularly shaped in order to provide more edge for wildlife. Edges are transition zones where two different vegetation types meet. Edges can provide richer habitat for some wildlife species such as white-tailed deer, bobwhite quail, rabbits, and wild turkey than unbroken areas of one habitat type. Keeping streamside management zones (SMZ's) as wide as practical along streams (300 feet on each side, if possible) and leaving small pockets of mast-bearing oaks, persimmons, hickories, and other hardwoods in upland areas are other ways of improving edge.

Timber Thinnings: On most longleaf forests with multiple objectives that include timber and wildlife, timber thinnings should be frequent, at least every 6 to 10 years. One rule of thumb for stands less than 100 years of age when sawtimber is a primary objective is to thin leaving a residual basal area equal to the site index (base age 50) plus the age, minus 40. As an example, a 35 year old stand with a site index of 80 would be thinned to leave a residual basal area of 75 (80+35-40) square feet per acre. Another rule of thumb when managing for sawtimber is to thin to a residual basal area equal to the 50 year site index of the stand.

When adding wildlife objectives, landowners have the option of further reducing basal areas. In general, thinnings for wildlife should occur every 6 to 10 years as practical. Thinnings should favor the very best timber crop trees and leave residual basal areas in the range of 40 to 80 square feet per acre. This rule of thumb holds true for both even-aged and uneven-aged management. If bobwhite quail management is an important objective, residual basal areas should be in the low end of this range. Deer and turkey will do well at the higher end of this scale.

Uneven-aged Management: The whole purpose of small, even-aged timber stands with irregular boundaries and interspersed age classes is to accommodate various species of wildlife and to improve aesthetics. Large, unbroken, uniform stands of pines can be poor wildlife habitat for many species. Another way of accommodating multiple-resource values is by practicing uneven-aged management.

With uneven-aged management, forests are not segregated into even-aged stands of trees. Each unit of forest land will typically have many young, some middle-aged, and a scattering of mature and old trees growing together. Many landowners who do not like

the appearance of a final harvest cut will like the concept of uneven-aged management.

Because of longleaf pine's excellent fire-tolerance, the tree is suited for this style of management. Areas with mixtures of older trees and seedlings can be burned with care, if the landowner is willing to accept some seedling mortality.

In practicing uneven-aged management on the ground, you must have some way of regulating timber harvest to growth while encouraging reproduction. There are several methods of doing this. At the simplest level, you need to know the volume of timber present and its per acre growth rate. Timber harvest removes a certain percentage of the annual growth on a periodic cutting cycle. For example, a landowner may decide to harvest 75% of the annual growth on a 10 year cutting cycle. If that is the case, the landowner will have a greater volume in residual timber after harvest than at the start of the cycle. Another method of regulating harvest in uneven-aged stands that shows promise is the "basal area- maximum dbh-q" (BDq) method developed by the U.S. Forest Service. In using this method, the timber stand is inventoried and a 'before-cut" stand table is developed. Based on this, an after-cut target structure is set by the stand basal area (B), maximum dbh of the trees to be left (D) and the fixed ratio of the numbers of trees in succeeding diameter classes (q).

Figure 11. Wild turkeys.

A typical BDq prescription would be to leave after harvest 50 sq ft. of merchantable basal area, assume a maximum dbh of 20 inches and use a 1-inch "q" of 1.2.

When marking timber using this method, the poorer trees with respect to form, vigor, and position in the canopy are cut and the better trees are left. Regeneration is encouraged by enlarging existing groups of reproduction by harvesting the border trees if they have seedlings growing underneath and/or by cutting trees above the maximum dbh if they need to be cut and have seedlings underneath. Remaining trees that make up the allowable cut are taken on an individual basis throughout the stand.

Essentially, uneven-aged management of the longleaf pine means harvesting timber with light thinnings and creating gaps for regeneration on a periodic cutting cycle. The trees selected for harvest are marked and selections are made on an individual or small group basis. Decisions on which trees to cut and which ones to leave require the land manager to look at each tree in the stand, its relative position, dominance, health, and rate of growth and compare it to the landowner's objectives, i.e. what he/she wants out of their forest.

Typically, around 20% of the stems are marked for harvest during each cutting cycle Regeneration is encouraged in openings made by timber harvesting, and when it occurs the burning schedule is adjusted to allow the young seedlings time to become fire resistant.

One unique characteristic of longleaf seedlings in openings larger than one-quarter to one-third of an acre is that mild surface fires tend to die out in these patches, giving the seedlings time to reach fire-resistant size. This is one reason you almost always see some scattered longleaf reproduction in annually burned longleaf woods managed for bobwhite quail. When it appears that a bumper crop of longleaf seed will be produced, a growing-season prescribed fire will prepare a good seedbed in longleaf woods accustomed to periodic fire. The next step is to then interrupt the burning cycle in this area for two years or more, giving the seedlings time to become established.

Over the next several cutting cycles, the longleaf regeneration is released so it can grow and become part of the continuous stand. By using light periodic harvests that concentrate on leaving the best trees and encourage longleaf regeneration, uneven-aged management can maintain a forest indefinitely.

Management in this manner produces a patchy longleaf forest with groves of older trees, interspersed with groups of younger saplings, middle-aged clumps and areas of

reproduction. This produces a great deal of diversity on a small scale benefiting many species of wildlife.

It is worth noting that there are trade-offs when managing by uneven-aged management. First, uneven-aged management requires more attention to detail. If care is not taken in planning the harvest, this style of management can quickly "high-grade" the forest. High-grading is a term used to describe a timber harvest where only the best quality trees are harvested. Over time, the quality of the remaining trees is reduced. Second, studies have shown that where timber objectives are important, uneven-aged management will likely result in significantly lower volume growth than even-aged stands on the same site and with the same residual basal area.

A third disadvantage with uneven-aged management is there are more frequent entries into the stand for timber harvesting. Logging impacts occur more often and are spread throughout the stand and could increase damage to the residual timber and/or cause reductions of site quality over time.

The major benefit of uneven-aged management for timber production is that when in place, the landowner will have the opportunity to harvest some higher-valued forest products such as poles and pilings every cutting cycle. With even-aged management, you may have to wait as much as 30 years or longer before you can begin to harvest the higher-valued products.

Some of the nongame species benefited by uneven-aged management and small-scale all-aged management in even-aged units include, bluebirds, ground doves, native sparrows, towhees, woodpeckers, and numerous reptiles and amphibians.

Prescribed Burning: .Prescribed fire is an indispensable tool used to accomplish many vegetation management goals in longleaf forests. The longleaf pine is a part of a fire-adapted plant community and tolerates fire much better than other southern pines. It is resistant to fire throughout most of its life cycle, may be burned later in the growing season than other pines and often may be burned hotter. These characteristics make fire a very flexible tool in the hands of land managers. Through the careful use of prescribed fire, plant communities in the longleaf forest can be set at desired successional stages to favor selected wildlife species.

Winter or dormant season burns every two or three years seem to be the norm in many forest management plans and provide a compromise for managing most southern game species. This type of fire top-kills woody brush, especially if backing fires or strip-headfires are used, and stimulates sprouting to provide readily available nutritious and succulent browse for white-tailed deer. Fires of this type and frequency also allow fruit-producing shrubs such as blueberry and huckleberry time to provide good quantities of these valuable wildlife foods between burns.

Prescribed fire used later in the dormant season has the advantage of a shorter black period and quicker green-up in the spring. If adequate sunlight can filter through the tree canopy, at least some response in herbaceous growth should result. Legumes, grasses, and other fortis will also produce valuable seeds and habitat for insect populations that are important foods in the early lives of turkey poults and quail chicks.

Annual winter fires, as practiced on many longleaf forests, to improve quail habitat may actually reduce nesting and brood-rearing cover to the point that increased losses from predation outweigh any positive benefits of the fire regime. Ring-arounds are frequently used to provide cover and can be successful in doing so if they are large enough in size. These areas are excluded from burning for several years to provide needed cover. Ring-arounds should be irregularly shaped and greater than one to two acres in size. Smaller areas tend to concentrate quail nests and may attract predators.

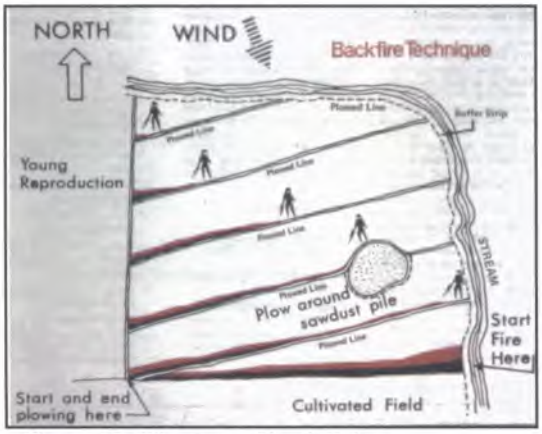


Figure 12. Diagram of back-firing technique.

Figure 13. Back-firing technique.

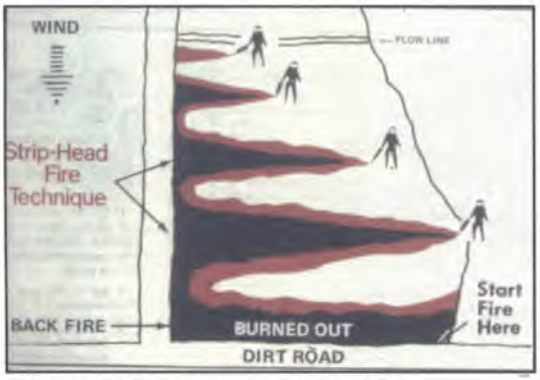


Figure 14.Diagram of strip-head firing.

Figure 15. Strip-headfiring technique.

Current research suggests that quail will benefit from burning in such a manner as to leave fairly large blocks of patchy cover rather than depending on smaller ring-arounds. This may mean distributing fire in such a way as to leave as much as half the ground cover unburned in a given year, in irregularly shaped blocks.

Growing season (spring) burns can eliminate much of the woody vegetation leaving an understory of grasses and fortis favoring those wildlife species that prefer small seeds, grasses, insects and open spaces. However, growing season burns may serve to decrease the number of fruit producing shrubs as well as permanent cover. Ground and shrub nesting birds such as quail, wild turkey, chats, towhees, etc. can be adversely affected by late spring and growing season burns, but if burned areas are kept reasonably small in size (25 to 75 acres) and a patchwork of burned and unburned areas is maintained, there should be adequate renesting to offset potential losses. A combination of dormant and growing season prescribed burning might be best for the widest variety of wildlife species.

Many longleaf forests consist of a series of sandy ridges cut by small drains or stringers containing bays and other hardwood wetlands. These stringers can make useful firebreaks. Firelines should not be plowed around these areas to exclude fire. The abrupt edge created by the fireline is unnatural and excludes many of the transitional-zone plants and accompanying wildlife habitat from the forest. If firelines must be placed around these areas, they should be put in by lightly disking, mowing, or using water sprayed to create a fire barrier. Fire intensity in these transitional areas can be further controlled by starting the fire in these locations to reduce fuel load.

Game species that thrive in longleaf forests include white-tailed deer, wild turkey, bobwhite quail; cotton-tailed rabbit, and the fox squirrel. The open nature of a managed longleaf forest with its intermingling of drains to provide travel corridors, water, escape and resting cover are favored especially by quail, turkeys, and fox squirrels. They all are visually oriented and require open conditions which provide a clear view of their surroundings. Some of the favorite foods of these species are found in longleaf forests. Soft masts like blueberries, dogwood berries, and persimmon all occur regularly. Hard mast species such as post oak, water oak, blackjack oak, turkey oak, live oak, southern red oak, and hickory provide valuable food during the fall and early Winter. The hard coated seeds of many legumes such as lespedeza, partridge pea, beggar lice, and others survive fires very well and are scarified by fire, improving germination. Ragweed, an important quail food, often reestablishes quickly after fires in open stands.

Food Plots: Food plantings for wildlife can be an important element in wildlife management in longleaf forests. One problem with establishing food plots in longleaf pine forests is the soil. Most longleaf today grows on well-drained, nutrient-poor soils. Most of these soils are too dry to successfully and consistently grow most of the popular wildlife food plantings. The best areas for food plot establishment will be soils in transition zones be-

tween uplands and wetter areas, and even then, success is not guaranteed.

When the decision is made to plant food plots for game species, use the following guidelines:

- For bobwhite quail in woodlands, provide one opening to one acre in size for each 15 to 20 acres. Food plots one-tenth to one-third of an acre in size can be planted in the openings. Openings should be shaped long and narrow to maximize edge. Plots should be planted with both a fall and winter food plant.

- Rabbits will benefit from quail plantings, especially if brush piles are developed adjacent to food plots. Brush piles should be no further than 300 feet from other cover. Rabbit food plots should be one-tenth to one-third of an acre in size and long and narrow to maximize edge. One food patch per 5 acres will improve rabbit habitat or "rabbitat."

- White-tailed deer and wild turkeys will benefit from irregular-shaped food plots from 1-3 acres in size. Plant at least one plot per 100 acres of forest land up to about 5% of your woodland acreage. Planting more than 5% is usually too expensive.

One wildlife planting ideally suited for longleaf lands is chufas. The tubers are favorites of turkeys. Quail, rabbits and squirrels eat them readily if turkeys scratch them up. Raccoons and feral hogs can be a pest on chufa patches. In areas of high raccoon populations, chufas should be planted by broadcasting to make it more difficult for the raccoons to feed on them. Hogs can devastate chufa patches. The best remedy for this problem is to exclude hogs from areas where chufas are planted.

Food plots are an important, attractive, and visible way of improving wildlife habitat and attracting animals. However, don't forget the importance of managing native vegetation. Timber harvesting by selective thinning in conjunction with periodic prescribed burning will do an excellent job of stimulating desirable native vegetation. In addition, randomized disking, done at different seasons periodically throughout the woods will further stimulate the growth of many desirable native wildlife plants.

Figure 16. Eastern cottontail rabbit.

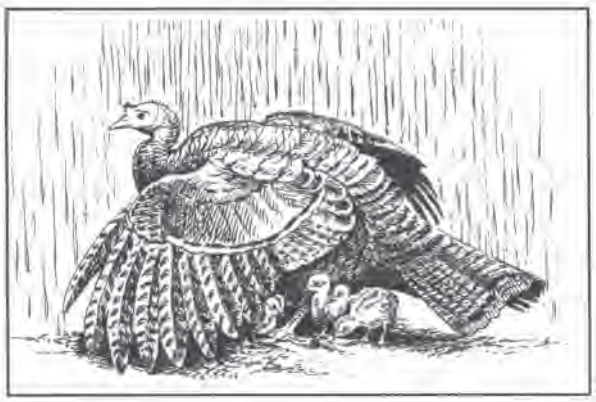
Figure 17. Chufas.

Figure 18. Turkeys in a woodland chufa patch.

Figure 19. Flowering dogwood.

AESTHETICS

Longleaf forests that are managed by frequent use of prescribed fire and kept open through frequent thinnings are aesthetically pleasing to many outdoor enthusiasts. Keeping stand size as small as practical, varying stand density, and including clumps of native flowering trees and shrubs such as dogwoods and native azaleas, are some of the ways landowners can reduce visual scale and provide scenic vistas that will enhance aesthetic values. One way to avoid the artificial appear-



ance of trees planted in rows is to plant pine seedlings on contour or in a coil pattern. Rows will not be evident when using this method, but spacing can still be controlled.

Prescribed fire in conjunction with timely, random soil disturbance can enhance native wildflowers on many longleaf forests. If woodlands are kept relatively open, fire will stimulate flowering. Growing season fire will enhance many fall-blooming species such as butterfly weed and blazing star which are important nectar sources for migrating butterflies. Patchy soil disturbance just prior to using prescribed fire in March and April will encourage the flowering of wild sunflowers if they are present in the forest. Light disking before winter burning will encourage blazing star if this species is present.

In essence, well managed longleaf forests that are carefully burned and managed for wildlife and timber will be aesthetically pleasing. Attention to detail with the timing and scale of land management activities is usually all that is needed to keep these woodlands productive and attractive.

Figure 20. Examples of interesting wildlife that live in longleaf forests

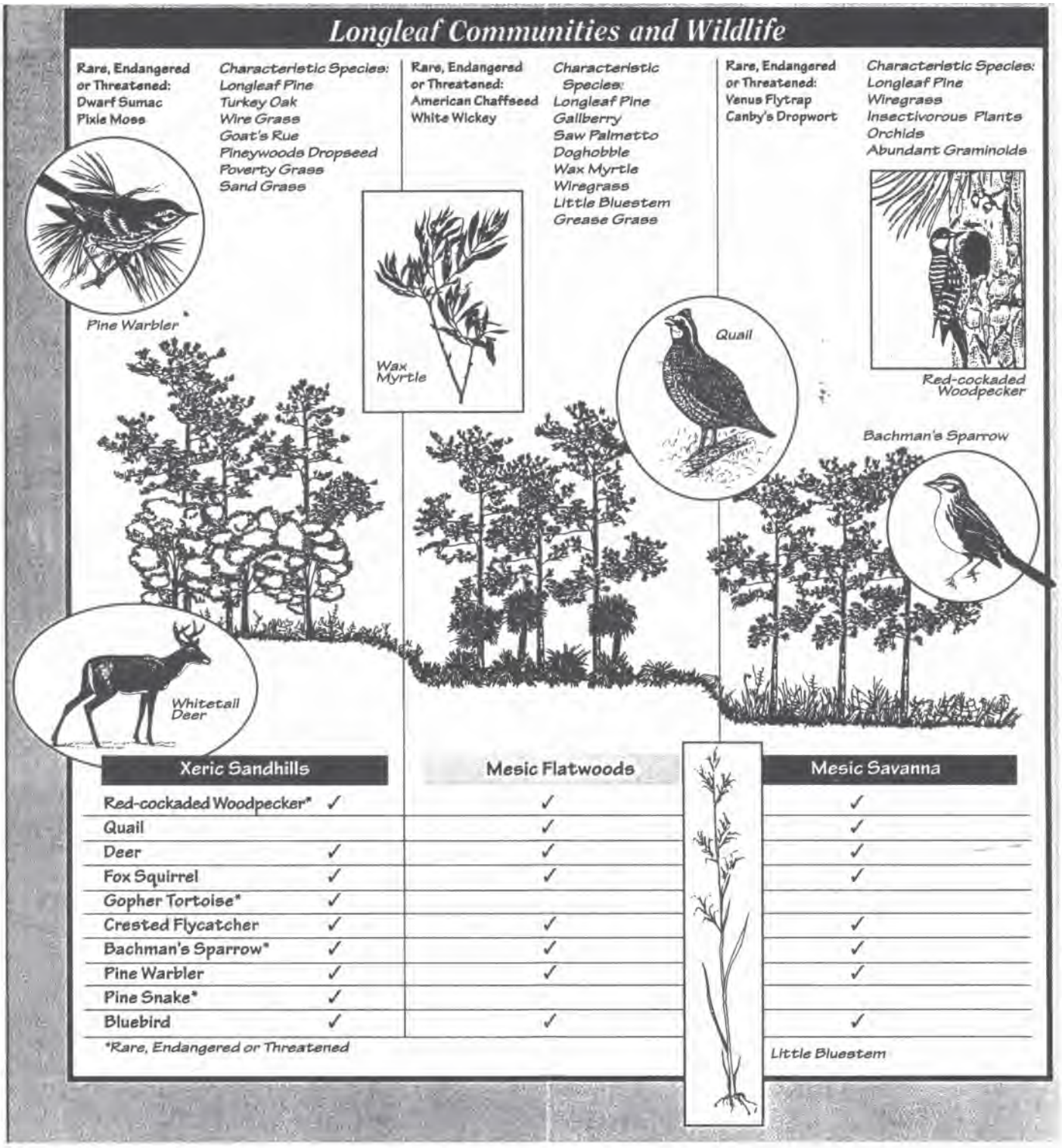
Gopher Tortoise

Fox Squirrel

Indigo Snake

Eastern Diamondback Rattlesnake

TABLE 3. LONGLEAF COMMUNITIES AND WILDLIFE



	Xeric Sandhills	Mesic Flatwoods	Mesic Savanna
Red-cockaded Woodpecker*	✓	✓	✓
Quail		✓	✓
Deer	✓	✓	✓
Fox Squirrel	✓	✓	✓
Gopher Tortoise*	✓		
Crested Flycatcher	✓	✓	✓
Bachman's Sparrow*	✓	✓	✓
Pine Warbler	✓	✓	✓
Pine Snake*	✓		
Bluebird	✓	✓	✓

*Rare, Endangered or Threatened

TABLE 4. SUGGESTED PLANTINGS FOR WILDLIFE

PLANT	SEEDING RATE	PLANTING DATES	FERTILITY	COMMENTS
Bahiagrass	Broadcast: 15-20 lbs/acre.	March-May	300 lbs 10-10-10 in early spring; topdress with 50 lbs N/acre midsummer.	Provides bugging grounds for turkey poults; good for rabbits and quail. Excellent for use on roads.
Browntop Millet	Broadcast: 15-25 lbs/acre. Plant 8-10lbs/acre in 36" rows.	April 1 to July 15	Broadcast 300-400 lbs of 10-10-10 per acre.	Prefers well-drained soil. Used by dove, quail, turkey, and deer.
Chufas	Broadcast: 40-50 lbs/acre. Plant 25-35 lbs/acre in 24-36" rows.	May to July	Broadcast 400-500 lbs of 10-10-10 per acre.	Well drained or sandy loam soil. Rotate after 2-3 years. Excellent for turkey.
Clovers: Crimson & Red	Broadcast 10-20 lbs/ acre. Inoculate seed.	September 1 to November 15	Broadcast 300-400 lbs of 0-15-15 per acre.	These varieties do best on the widest range of soils.
Corn	Plant 8-10 lbs/ acre in 36" rows with plants 8-10" apart.	March 15 to May 15	30 lbs N & 60-80 lbs P & K at planting. Sidedress with 50-60 lbs N.	Fertile, well-drained soil. Used by deer, dove, quail, and turkey.
Cowpeas	Broadcast 1-2 bu/acre. Plant 30-40 lbs/acre in 36" rows.	April to September	Broadcast 300 lbs of 5-10-15 or 3-9-18 per acre at planting.	Prefers well-drained soils. Used by deer, dove, quail, and turkey.
Kobe Lespedeza	Broadcast 25-35 lbs /acre.	February 15 to April 15	Broadcast 250-400 lbs 0-10-20 per acre at planting.	All soils except deep sands. Annual, will reseed. Used by quail.
Shrub Lespedeza: Bicolor or Thumbergii seedlings	Plant 24" apart in 36-48" rows. 1000 plants will make a patch 4-5 rows wide, 300-400 feet long.	December 1 to April 1	Broadcast 300-400 lbs 0-10-20 per acre at planting and annually.	All soils except deep sands and poorly drained. Seed production may be enhanced by mowing in February.
Wheat	Broadcast or drill: 1- 2 bu/acre.	September 15 to November 15	Broadcast 250-350 lbs 5-10-10 per acre at planting. Topdress with 50 lbs/acre N in February.	Prefers well-drained soils. Provides grazing, bugging and seed. Used by deer, turkey, quail, and dove.

WOODLAND GRAZING IN THE LONGLEAF PINE FOREST

The longleaf pine forests of the South have a long history of use by cattle grazing native forages. Livestock (cattle and hogs) were first brought into the region over 450 years ago by Spanish explorers and settlers. Supplemented by later imports by the colonists who settled Georgia and the Carolinas, these animals formed the nucleus of a subsistence woodland grazing industry that thrived in the South from colonial times up through the first third of the 20th century.

Range management of the longleaf pine woodlands of the deep South was minimal. Early settlers adopted the Native American custom of burning off the woods to drive game and to freshen-up the grass to provide early spring grazing for their cattle. Cattle management consisted of year-round grazing of the piney woods, no supplemental feeding, and survival of the fittest. This resulted in calf crops of under 50 percent and weaning weights of less than 300 pounds. It often took 3 to 5 years to grow cattle to marketable size.

Figure 21. Example of woodland grazing.

After the Civil War, large timber companies moved south and began clearcutting the virgin longleaf pine forests. Between 1880 and 1930, most of the virgin piney woods were cut-over, leaving extensive treeless landscapes. As a result, the understory grasses flourished and grazing conditions were at their all-time high for the native range. Cattle production increased dramatically and the deep South became known as cattle country.

In the 1930's these conditions began to change. Large, stable timber companies and the federal government began buying up much of this cut-over land and replanting pines. This replanting effort along with the anti-cattle and anti-burning bias of foresters working in the region at that time led to the exclusion of all livestock and prescribed burning from the woods.

Interest in woodland grazing began to change with the start of World War II. The war increased the demand for beef and research was initiated to develop proper management methods to coordinate cattle and timber production in southern pine forests.

Native Range Management: Most natural longleaf forests in the South today are considered to be either longleaf pine-wiregrass or longleaf pine-bluestem range. Wiregrass range is found primarily on the coastal plain east of southcentral Alabama. Bluestem grasses generally dominate the range westward into Louisiana and Texas. The wiregrass type is dominated by grasses in the genus *Aristida.* Other important grasses include Curtis dropseed and native bluestems, as well as many species of *paspalums* and panic grasses. Forbs in the legume and aster families are common.

Longleaf pine-bluestem range is dominated by bunchgrasses in the genera *Andropogon* and *Schizachyrium*. Common grasses may include little bluestem, pinehill bluestem, big bluestem, creeping bluestem, pineywoods dropseed, cutover muhly, and Indiangrass. Numerous species of *panicums* and *paspalums* also have the potential to be present. Plants in the legume and aster families are also present.

Livestock management for woodland grazing in this section is limited to grazing by beef cattle. Hogs have no place in longleaf forests because of the damage they can cause rooting-up and eating young seedlings. Because of this, hogs should be excluded from longleaf range.

The best management strategies to improve conditions for grazing are to thin pine forests early and often and to use prescribed fire. As pine stands grow, grass yields decline due to shading. Because of this, frequent thinning of the timber is vital to maintain forage yields throughout the timber rotation. Stands should be thinned as early as practical and every

6 to 10 years thereafter. Where grass production priorities are high, pines should be thinned back to residual basal areas of 50 to 70 square feet per acre or less.

Prescribed fire is considered by many range managers to be the most effective tool in maintaining desirable forage underneath pine forests in the South. The use of fire improves the quality of forage and can be used to concentrate and rotate grazing. Ranges burned on a 3 year rotation get their highest use by cattle the first year after fire and correspondingly less use each year until the area is burned again. For longleaf pine-wiregrass ranges, the best schedule for burning uses a late winter or early spring prescribed fire on a two-year rotation after the time that the pines can tolerate fire. On bluestem range, prescribed burning on a three-year rotation in late winter or early spring is better.

When regenerating or reforesting cut-over pine stands with grazing or wildlife values in mind, use minimal levels of site preparation. This can be a challenge when reestablishing longleaf pine since this species is so competition sensitive. In general, longleaf stands that have a history of prescribed fire will often need no more site preparation than a good prescribed burn during the growing season prior to seedfall or planting. This will actually benefit the grazing resource.

Additional site preparation, especially if mechanical methods or broadcast herbicides are used, has the potential to virtually eliminate native grasses. If mechanical and/or chemical site preparation is needed, consider using the least intensive method possible. One pass with a drum-chopper in conjunction with prescribed fire will damage the forage resource less than shearing or root-raking used with disking. Using spot applications, individual stem treatments or herbicides applied in bands will be less damaging to herbaceous vegetation than broadcast applications. Also, try to use a herbicide to which grasses are resistant.

Grazing Management: Native forages in the South are most nutritious during the spring and summer. Grazing should be timed to take advantage of this. Wiregrass is most nutritious and palatable for cattle when resprouting after a late winter or early spring burn. Range dominated by wiregrass can be best utilized by cattle from early spring to mid-summer. Cattle should be kept off fresh burns until wiregrass is at least 6 inches tall. Utilization of wiregrass by cattle should be no greater than 50 percent and cattle should be stocked only on the range in relation to the amount of forage available. Bluestem ranges can best be utilized by cattle from early spring through late summer. Bluestem grasses can be grazed year-round without damaging the resource if supplemental protein and hay are provided during the fall and winter. Regardless of the range type, cattle and the range itself will do better when utilized during spring and summer, supplemented with periods of pasture grazing from mid-summer into autumn and supplemental feeding of hay, protein supplement, or grazing of winter annual grasses during the winter and early spring.

Always remember, stock livestock only in relation to the amount of food available. Do not overgraze.

Wildlife Considerations: The key to compatible management of wildlife and cattle is being able to adjust cattle stocking to available forage while reserving a portion for wildlife. One rule of thumb used on Louisiana ranges for combined deer and cattle management is to reserve 15% of the total livestock carrying capacity for deer. The actual amount reserved will depend on the landowner's objective and must be accounted for when developing grazing plans. Failure to allow for wildlife use when grazing in longleaf pine woodlands can cause forages to be overgrazed and the soil to be degraded by erosion and compaction.

Grazing can also be used to improve wildlife habitat. Research in Florida discovered that when woodland range is grazed in a short-duration grazing system, forage values can be improved for both cattle and wildlife. In this study, wiregrass range was grazed by cattle to a 50 percent utilization and rested for 4 months. As a result, wiregrass, saw palmetto, and brush were reduced while other grasses and legumes increased. This improved habitat for some wildlife species and grazing values for cattle.

Establishing Pines in Pastures: Another option in integrating timber and cattle is the establishment of pines in pastures. This intensive method of range management is called agroforestry and has reached a high level of development in Australia and New Zealand.

In the South, planting longleaf or slash pine in pastures and establishing bahiagrass (usually *Pensacola Bahia)* in pine stands has been successful. Under this style of management, pines are planted under wide-row configurations such as 8x12 feet or 6x8 feet with 24 feet between pairs of rows (both spacings give 454 trees per acre) and the grass is seeded underneath. The bahiagrass is then fertilized for optimal grass production. After the grass is well established and the pines are 3 to 6 feet tall, cattle can be stocked in these pine pastures at rates similar to open pastures. Cattle typically graze these stands for a 7 month grazing season from spring through early fall. In addition, the pines get some benefit from the grass fertilization and respond with increased growth.

There is concern, however, about destroying and eliminating native plant communities associated with the longleaf pine if this style of management is used in natural or cut-over stands. Because of this, establishment of longleaf pine pastures should be limited to marginal cropland or abandoned open land converted into pine pastures. Converting these sites will also be more cost-effective than establishing pine pastures in natural longleaf' communities.

ENDANGERED SPECIES

A number of rare, threatened, and endangered species of both plants and animals inhabit longleaf pinelands. Most of these species require the open, fire-maintained conditions that are characteristic of this forest type. Many of these species, if they are present on a particular property, can be accommodated by practicing the management strategy outlined in this publication: periodic prescribed burning and frequent timber thinnings. However, some wildlife, like the red-cockaded woodpecker (RCW) require mature pine forests to complete their habitat needs.

The red-cockaded woodpecker is a bluebird-sized, black and white ladder-backed woodpecker with prominent white cheek-patches. It was once common in the mature pine forests of the South. The bird gets its name from a very small red patch or cockade located on the backside of the male bird's head. The RCW is unique among our southern woodpeckers in that it makes its nest-cavity in living southern pines. It is on the federal endangered species list because habitat destruction and conversion to short rotation pine plantations has caused its population to decline throughout the South.

The red-cockaded woodpecker (RCW) requires mature, park-like stands of southern pines at least 80 years of age or older for nesting habitat. Few managed pine forests in the region today attain this age and fire-suppression has degraded many of the acres that remain. When periodic fire is removed from pine forests, a midstory of hardwoods quickly develops. RCW's rarely use pine stands with a hardwood midstory for nesting habitat, possibly because of competition and predation from other wildlife. While the RCW is the only bird that will excavate a cavity in a living pine, other woodpeckers, birds and squirrels that are more common in mixed pine/hardwood forests will compete with them for use of the finished cavity.

Natural History: The RCW has a unique social organization. The bird lives in family groups sometimes called clans centered around a cluster of nest and roost cavities. Clans consist of a breeding pair and one to four helpers. The helpers are usually sons of the breeding male who stay and assist the pair in incubating and feeding the brood and help with cavity excavation. Nesting is usually from April to July. Two to four eggs are laid which hatch in 10 to 12 days. The young leave the nest after 26 days and are fed by the group until they can forage for themselves. Only one brood is raised each year. The birds feed by prying

Figure 22 a.

Figure 22 b.

Figure 22 c.

Figure 22 d.

Figure 22. (a) mature red-cockaded woodpecker, (b) comparison of male (left) and female (right) birds, (c) a RCW cavity tree, (d) RCW colony site.

off scales of loose pine bark and feeding on the insects underneath rather than drilling into dead trees like other woodpeckers. If corn fields are nearby, they will glean them for corn earworms.

Habitat Needs: Two habitat types are critical for red-cockaded woodpeckers — nesting habitat and foraging habitat. The nesting habitat is centered around a colony or cluster which must have mature trees, large enough to develop heartwood and possibly have red-heart disease. Red-heart is a fungal disease that will infect older, mature pines. The disease softens the heartwood, making it easier for the birds to excavate nesting cavities.

Most RCW clusters have one to six finished cavity trees, one for the brood and one roosting cavity for each clan member. Not all the cavities in a cluster are necessarily used at the same time and some are constantly being excavated or enlarged. Clusters can vary in size and shape, but most cavity trees are usually found within the area of a 1500 foot diameter oval or circle.

Foraging habitat consists of pole-sized or larger open pine stands. Foraging habitat is usually adjacent or close to the colony. The amount of foraging habitat needed to support a clan will vary because of habitat quality and clan size.

The U.S. Fish & Wildlife Service is charged with enforcing provisions of the Federal Endangered Species Act and protecting listed species. In working with the red-cockaded woodpecker on private lands, they have emphasized the development of Memorandums of Agreement (MOA) and Habitat Conservation Plans (HCP's). Most notably MOA's have been developed for the lands of several large forest products companies. They have also worked with various state wildlife agencies towards developing statewide HCP's. Recognizing that many smaller private landowners may have difficulty in managing for the RCW, the U.S. Fish & Wildlife Service has developed a set of proposed private land guidelines for the RCW. These proposals consist of the following:

Colony Site:

- All cavity trees (active & inactive) within a colony, plus at least a 200 foot buffer strip.

- If the pine stocking is greater than 50 sq ft of basal area, the colony can be thinned to 50 sq ft, favoring sawtimber sized trees.

- No removal of any active cavity tree.

Foraging Habitat: Suitable & Available

- Pine and pine/hardwood stands containing 10-80 sq ft basal area in 10 inch diameter at breast height (dbh) or larger pines that are 25 years of age or older.

- Colony site included as foraging habitat.

Foraging Habitat: Quantity & Quality

- A minimum of 3,000 sq ft basal area of pine (10" dbh or larger) must be provided on 60 to 300 acres for each active cluster.

- The basal area per acre may range from 10 to 80 sq ft

- The minimum number of stems 10" dbh or larger can vary from 2,000 to 5,000, depending on the average dbh of the stand.

- Stands cannot be considered suitable as foraging acres unless they have open characteristics associated with preferred foraging habitat.

- The separation of the cluster from the nearest foraging stand cannot exceed 300 feet.

Figure 23. A two-aged longleaf pine stand.

One option in the timber management of natural stands that has the potential of maintaining or improving RCW habitat is the irregular shelterwood or two-aged stand. It starts with an even-aged stand being regenerated by the shelterwood system. Once reproduction has become well established, only part of remaining seed trees in the overstory are removed. Because of the competition of the remaining mature trees, the reproduction rapidly breaks into a variety of size classes similar to an uneven-aged stand. After 40 years on an average longleaf site, the largest of the younger trees may approach the size of the smallest of the older trees.

The two-aged approach has several advantages over uneven-aged management. It is easier to maintain area control and a set rotation age. It looks like an uneven-aged stand. Volume growth is equal to that expected from standard uneven-aged management. In addition, thinning can be done as needed to maintain desired density and appearance without aiming at a target diameter class distribution. At the end of the rotation, the stand is reduced to a shelterwood density once more and the process starts over. By using this method, large residuals are always on the site, to be used by the RCW as potential nest trees. This method is very useful in those areas where good seed crops are too infrequent to provide the regular natural regeneration needed for all-aged management in even or uneven-aged units.

Landowners who have existing RCW colonies are required by the Endangered Species Act in its current form and interpretation to manage the colonies in such as way as to prevent harming the species and causing a take situation. These guidelines have been developed to prevent causing a take.

These guidelines may change as conditions and new research develops. For additional information on your responsibilities under this regulation, contact your state conservation agency or the U.S. Fish & Wildlife Service.

Figure 24. Landowner and forester working together.

PUTTING IT ALL TOGETHER

An array of assistance is available for landowners needing help in managing longleaf pine forests. A good start is your state's Forestry Commission and Department of Natural Resources. Their biologists and foresters are available to provide technical advice and limited management assistance to forest owners. If you own at least 10 acres of forestland, you may be eligible to participate in the Forest Stewardship program. This federally sponsored program is administered in most states by the State Forestry Commission. Landowners who participate in the program have a multiple-use management plan developed for their land based on their objectives.

Once this plan is completed, they may be eligible for cost-sharing for many of the practices they will need to implement through the Stewardship Incentive Program (SIP). Some of the practices that can be cost-shared include prescribed burning, wildlife food plot establishment, forest trail establishment for recreation, and planting longleaf pines. The maximum acreage allowed for participation in SIP is 1,000 acres.

Other sources of help include private consulting natural resource professionals who can assist in developing management plans, implementing management activities and marketing timber and other resources such as hunting leases. Consultants charge a fee for their services. In addition, many large forest products companies have landowner assistance programs that offer forestry and wildlife management services on a cost basis for landowners in return for the right to bid on your timber when it is sold. A list of landowner assistance programs as well as sources of contacts for consultants is included in the Appendix. For a list of the natural resource consultants that work in your local area, check with your local county agent or Forestry Commission representative.

Places to see Longleaf Pine Management in Action *

Harbison State Forest, Richland Co., SC; Sandhill longleaf pine - scrub oak.

Sandhills State Forest and Sandhills National Wildlife Refuge, Chesterfield Co., SC; Sandhill longleaf pine - scrub oak.

Fort Jackson, Richland Co., SC; Sandhill longleaf pine-scrub oak.

Francis Marion National Forest, Berkeley &Charleston Cos., SC; Longleaf pine flatwoods & savannahs.

Webb Wildlife Center, Hampton Co., SC; Longleaf pine flatwoods.

Fort Stewart, Liberty & Bryan Cos., GA; Sandhill longleaf pine & flatwoods.

Okefenokee Swamp National Wildlife Refuge, Charlton and Ware Cos., GA; Longleaf pine Savannah.

Bladen Lakes State Forest, Bladen Co., NC; Sandhill longleaf pine-scrub oak.

Green Swamp Nature Conservancy Preserve, Brunswick Co., NC; Longleaf pine savannah.

Croatan National Forest, Carteret, Craven & Jones Cos., NC; Longleaf pine flatwoods & savannahs.

Conecuh National Forest, Covington and Escambia Cos., AL; Sandhill and rolling mesic longleaf woodlands.

Escambia Experimental Forest, Escambia Co., AL; Sandhill and rolling mesic longleaf woodlands.

Solon Dixon Forestry Education Center, Covington & Escambia Cos., AL; Sandhill and rolling mesic longleaf woodlands.

Blackwater River State Forest, Santa Rosa and Okaloosa, Cos., FL; Sandhill and longleaf pine savannahs.

Eglin Air Force Base, Okaloosa, Santa Rosa and Walton Cos., FL; Sandhill, flatwoods and longleaf pine savannahs.

DeSoto National Forest, Forrest, Greene, Harrison, Jones, Perry, Stone and Wayne Cos., MS; Longleaf pine savannahs and rolling mesic woodlands.

Kisatchie National Forest, Grant, Natchitoches, Rapides, Vernon and Winn Parrishes, LA; Longleaf pine savannah and rolling mesic woodland.

Big Thicket National Preserve, Tyler Co., TX; Longleaf pine savannah and rolling mesic woodland.

Sam Houston National Forest, San Jacinto Co., TX; Longleaf pine savannah and rolling mesic woodland.

The are a number of other examples of longleaf management throughout the South. For additional sites, contact your state's conservation agency and forestry commission.

**Adapted from: Goodwin, Carol, and Julie Moore 1995. Longleaf legacies. longleaf pine... the forest that built America. A calender for 1995. Long Needle Press, Gainesville, FL, 3Opp.*

SUGGESTED READING

The following articles and publications were utilized in writing this bulletin. The author gratefully acknowledges both the inspiration and the permission of the authors, agencies and organizations who were involved in writing and publishing these documents. The reader is encouraged to read these for additional information on longleaf pine management and forestry and wildlife management in general. Many of the U.S. Forest Service publications are available free-of-charge from the Southern Region, U.S. Forest Service office in Atlanta. For single copies, call: (404) 347-2385.

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Bevill, V.; Mahan, W.; Strange, T. 1978. Game on your land: part 1 – small games and wood duck. Columbia, SC: South Carolina Wildlife & Marine Resources Department, South Carolina Department of Natural Resources. 74 p.

Boyer, W.D. 1993. Eighteen years of seasonal burning in longleaf pine: effects on overstory growth. In: Fire, meteorology and the landscape: 12th conference on fire and forest meteorology; 1993 October 26-28; Jekyll Island, GA. [Jekyll Island, GA]: Society of American Foresters: 102.

Boyer, W.D. 1989. Response of planted longleaf bare-root and container stock to site preparation and release: fifth-year results. In: Proceedings of the 5th biennial southern silvicultural research conference; 1988 November 1-3; Memphis, TN. Gen. Tech. Rep. SO-74. New Orleans, LA: U.S. Department of Agriculture, Forest Service: 165-168.

Boyer, W.D.; Farrar Jr., R.M. 1981. Thirty years of management on a small longleaf pine forest. Southern Journal of Applied Forestry. 51(2): 73-77.

Byrd, N.A.; Lewis, C.E.; Pearson, H.A. 1984. Management of southern pine forest for cattle production. Gen. Tech. Rep. R8-GR4. Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region. 22 p.

Byrd, N.A.; Lewis, C.E. 1983. Managing pine trees and bahiagrass for timber and cattle production. Gen. Tech. Rep. R8-GR2. Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region. 9 p.

Croker Jr., T.C. 1987. Longleaf pine: a history of man and a forest. R8-FR7. Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region. 37 p.

Croker Jr., T.C.; Boyer, W.D. 1975. Regenerating longleaf pine naturally. SO-105. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 21 p.

Dennington, R.W. 1990. Regenerating longleaf pine with the shelterwood method. R8-MB47. Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region. 2 p.

Dennington, R.W. 1989. A crucial threshold for longleaf pine plantations. R8-MB41. Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region. 1 p.

Dennington, R.W.; Farrar Jr., R.M. 1983. Longleaf pine management. R8-FR3. Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region. 17 p.

Farrar Jr., R.M. 1996. Fundamentals of uneven-aged management in southern pine. Miscellaneous publication no. 9. Tallahassee, FL: Tall Timbers Research Station. 68 p.

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Frost, C.C. 1990. Natural diversity and status of longleaf pine communities. In: Youngblood, G; Frederick, D.L. eds. Forestry in the 1990's - a changing environment. Region Tech. Conference, Pinehurst, NC. Society of American Foresters. 26-35.

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Harper, R. 1958. The travels of William Bartram. New Haven, CT: Yale University Press.

Haywood, J.D.; Tiarks, A.E.; Elliot-Smith, M.L.; [and others]. 1995. Management of longleaf stands for pinestraw harvesting and the subsequent influence on forest productivity. In: Edwards, M. Boyd, comp. proceedings of the 8th biennial southern silvicultural research conference; 1994 November 1-3; Auburn, AL. Gen. Tech. Rep. SRS-1. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 281-290.

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Landers, J.L.; Van Lear;.D.H.; Boyer, W.D. 1995. The longleaf pine forests of the southeast: requiem or renaissance? Journal of Forestry. 93:(11): 39-44.

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Morris, L.A.; Jokela, E.J.; O'Connor Jr., J.B. 1992. Silvicultural guidelines for pinestraw management in the southeastern United States. Georgia Forest Research Paper 88. Atlanta, GA: Research Division, Georgia Forestry Commission. 11 p.

Tall Timbers Research Station. 1993. The longleaf pine ecosystem: ecology, restoration and management, proceedings of the tall timbers fire Ecology Conference, no. 18. Hermann, Sharon M. ed. 1991 May 30-June 2, Tallahassee, FL. Tallahassee, FL: Tall Timbers Research Inc. 418 p.

U.S. Department of Agriculture, Forest Service; Southern Forest Experiment Station. 1990. Proceedings of the symposium on the management of longleaf pine. Farrar Jr.; R.M. ed. 1989 April 4-6, Long Beach, MS. Gen. Tech. Rep. SO-75. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 293 p.

Wade, D.D.; Lunsford, J.D. 1988. A guide for prescribed fire in southern forests. Tech. Publ. R8-TP11. Atlanta, GA: U.S. Department of Agriculture, Forest Service, Southern Region. 58 p.

APPENDIX

SOURCES OF ASSISTANCE

Federal Agencies:

U.S. Forest Service
Southern Region
1720 Peachtree Road, N.W.
Atlanta, GA 30367
(404) 347-4177

Southern Research Station
P.O. Box 2680
Asheville, NC 28802
(704) 257-4300

National Forests in Alabama
2946 Chestnut Street
Montgomery, AL 36109
(334) 832-4470

National Forests in Florida
Suite F-100
325 John Knox Road
Tallahassee FL 32303
(904) 942-9300

Kisatchie National Forest
2500 Shreveport Highway
Pineville, LA 71360
(318) 473-7160

National Forests in Mississippi
100 West Capitol Street
Suite 1141
Jackson, MS 39269
(01) 965-5486

National Forests in North Carolina
P.O. Box 2750
Asheville, NC 28802
(704) 257-4200

Francis Marion & Sumter
National Forests
4931 Broad River Road
Columbia, SC 29210-4021
(803) 561-4000

National Forests in Texas

Homer Garrison Federal Building
701 North First Street
Lufkin, TX 75901
(409) 639-8501

U.S. Fish & Wildlife Service
Region 4 Office
Richard B. Russell Federal Building
Room 1200
75 Spring Street, SW
Atlanta, GA 30303
(404) 331-0830

State Extension Services:

Alabama Cooperative Extension Service
School of Forestry
Auburn University, AL 36849-5627
(334) 844-1038

Institute of Food & Agricultural Science
Extension Forestry/
Natural Resource Education
P.O. Box 110420
University of Florida
Gainesville, FL 32611
(904) 846-0882

Cooperative Extension Service
Extension Forestry
University of Georgia
Athens, GA 30602
(706) 542-3446

Louisiana Cooperative Extension Service
Extension Forestry
P.O. Box 25100
Baton Rouge, LA 70894-5100
(504) 388-4087

Mississippi Cooperative Extension Service
Extension Forestry
P.O. Box 9681
Mississippi State, MS 39762
(601) 325-3150

Extension Forestry
P.O. Box 8003
North Carolina State University
Raleigh, NC 27695
(919) 515-5578

Clemson University Cooperative
Extension Service
Extension Forest Resources
272 Lehotsky Hall
Clemson, SC 29634-1003
(864) 656-2478

Extension Forestry
302 Horticulture & Forest Sciences
Texas A & M University
College Station, TX 77843
(409) 845-1351

State Forestry Agencies:

Alabama Forestry Commission
513 Madison Avenue
Montgomery, AL 36130
(334) 240-9300

Florida Division of Forestry
3125 Connor Boulevard
Tallahassee, FL 32399-1650
(904) 488-4274

Georgia Forestry Commission
P.O. Box 819
Macon, GA 31298-4599
(912) 751-3500

Louisiana Office of Forestry
Department of Agriculture & Forestry
P.O. Box 1628
Baton Rouge, LA 70821
(504) 925-4500

Mississippi Forestry Commission
Suite 300, 301 Building
Jackson, MS 39201
(601) 359-1386

North Carolina Division of
Forest Resources
P.O. Box 27687
Raleigh, NC 27611
(919) 733-2162

South Carolina Forestry Commission
P.O. Box 21707
Columbia, SC 29221
(803) 896-8800

Texas Forest Service
Texas A & M University System
College Station, TX 77843
(409) 845-2641

State Conservation Agencies:

Alabama Department of Conservation
and Natural Resources
64 North Union Street
Montgomery, AL 36130
(334) 242-3465

Florida Game &
Fresh Water Fish Commission
620 South Meridian Street
Tallahassee, FL 32399-1600
Georgia Department of Natural Resources
Wildlife Resources Division
Social Circle, GA 30299
(770) 918-6401

Louisiana Department of Wildlife
and Fisheries
P.O. Box 9800
Baton Rouge, LA 70898-9000
(504) 765-2800

Mississippi Department of Wildlife,
Fisheries and Parks
P.O. Box 451
Jackson, MS 39205-0451
(601) 362-9212

North Carolina Wildlife Resources
Department
512 N. Salisbury Street
Raleigh, NC 27604-1188
(919) 733-4984

South Carolina Department of Natural
Resources
P.O. Box 167
Columbia, SC 29202
(803) 734-3886

Texas Wildlife and Parks Department
4200 Smith School Road
Austin, TX 78744
(512) 389-4800

Consulting Foresters: *Check with your local County Extension or Forestry Commission office for lists of consulting foresters that work in your area or contact:*

Association of Consulting Foresters
5400 Grosvenor Lane, Suite 300
Bethesda, Maryland 20814-2194
(301) 530-6795

Research and Conservation Foundations:

The Longleaf Alliance
Solon Dixon Forestry Education Center
Route 7, Box 131
Andalusia, AL 36420
(334) 222-7779

Tall Timbers Research Station
Route 1, Box 678
Tallahassee, FL 32312-9712
(904) 893-4153

The Nature Conservancy
Southeast Regional Office
101 Connor Drive, Suite 302
Chapel Hill, NC 27515
(919) 967-5493 ext. 142

Joseph W. Jones Ecological
Research Center at Ichauway
Route 2, Box 2324
Newton, GA 31770
(912) 734-4706

Industry-Sponsored Landowner Assistance Programs: *These companies are a few of the forest products companies that offer landowner assistance programs within the range of longleaf pine. The list is not all-inclusive. For additional information on other companies, contact your local timber industries.*

Alabama River Woodlands, Inc.
P.O. Box 99 Perdue Hill, AL 36470
(334) 743-8259
Southwest Alabama.

Boise Cascade Corp.
Southern Forest Resources
P.O. Box 2000
DeQuincy, LA 70633
(318) 786-6835
West Louisiana and eastern Texas.

Columbia Timber Company
4131 NW 13th Street
Gainesville, FL 32609
(904) 375-1473
North Florida and south Georgia.

Georgia Pacific Corporation
P.O. Box 1089
Holly Hill, SC 29059
(803) 496-5013
Parts of Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina and South Carolina.

International Paper Company
Sustainable Forest Technology
P.O. Box 518
Georgetown, SC 299442
(803) 546-2573 ext 3216
The entire range of longleaf pine.

Stone Container Corporation
P.O. Box 21607
Columbia, SC
(803) 359-7232
Parts of Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina and South Carolina.

Union Camp Corporation
(Informal landowner assistance program)
P.O. Box 1391
Savannah, GA 31402
(912) 238-7610
In parts of Alabama, Georgia, Florida, North Carolina and South Carolina.

Westvaco Cooperative Forest Management
P.O. Box 1950
Summerville, SC 29484
(803) 871-5000
South Carolina.

Sources for Longleaf Pine Seedlings:

ALABAMA

Alabama Forestry Commission
513 Madison Avenue
Montgomery, AL 36130
(334)240-9300

Alabama Super Tree Nursery
International Paper
264 Co. Rd. 888
Selma , AL 36702
(334) 872-5452

E.A. Hauss Nursery
Route 3, Box 322
Atmore, AL 36502
(334) 368-4852

International Forest Seed Company
P.O. Box 490
Odenville, AL 35120
(205) 629-6461

Inverness Tree Nursery
Rt. 1, Box 244
Union Springs, AL 36089
(334) 474-3228

R.E. Mitchell Nursery
P.O. Box 336
Pine Hill, AL 36769
(334) 682-9882

Scott Paper Company
29650 Comstock Rock
Elberta, AL 36530
(334) 986-5210

FLORIDA

Andrews Nursery
P.O Box 849
Chiefland, FL 32644-0849
(352) 493-6096

Buckeye Nursery Inc.
P.O. Box 450
Perry, FL 32347
(904) 838-2680

Central Florida Lands and Timber
Rt. 1, Box 8899
Mayo, FL 32066
(904) 294-1211

Dwight Stansel Farm and Nursery
5553 164th Street
Wellborn, FL 32094
(904) 963-2827

Florida Division of Forestry
3125 Conner Boulevard
Tallahassee, FL 32399-1650
(904) 488-4274

Keen Forest Manangement
Rt. 1, Box 782
Mayo, FL 32066
(904) 294-2234

Superior Trees Inc.
P.O. Box 9325
Lee, FL 32059
(904) 971-5159

The Liner Farm, Inc.
P.O. Box 1369
St. Cloud, FL 34770
(800) 330-1484

The Natives
2929 Carter Road
Davenport, FL 33837
(941) 422-6664

GEORGIA

Bell Farms
P.O. Box 128
Bellville, GA 30414
(912) 739-2273

DRS Enterprises
147 West Plum Street
Jesup, GA 31545
(912) 427-8911

Flint River Nursery
Rt. **1,** Box 40
Byromville, GA 31007
(912) 268-7308

Georgia Forestry Commission
Box 819
Macon, GA 31211
(912) 751-3486

International Forest Seed Company
P.O. Box 1477
Statesboro, GA 30459
(912) 587-5402

J.F. Sisley Nursery
P.O. Box 539
Buena Vista, GA 31809
(912) 649-6625

O'Quinn Tree Farm
P.O. Box 1163
Jesup, GA 31545
(912) 427-4177

Powell Propagators and Nursery, Inc.
6801 Warm Springs Road
Columbus, GA 31909
(706) 568-1271

Rayonier Inc.
P.O. Box 312
Glennville, GA 30427
(912) 654-4065

Simmons Tree Farm
Rt. 1, Box 56
Denton, GA 31532
(912) 375-7520

Sims and Harris Tree Farm
6330 Odum-Screven Road
Jesup, GA 31545
(912) 586-6145

Southern Seed Company
Pp. Box 340
Baldwin, Georgia 30511
(706) 778-4542

Spandle Nurseries
Rt. 2, Box 125
Claxton, GA 3041 7
(800) 553-5771

Walker Nursery
HC01-Box 217
Reidsville, GA 30453
(912) 557-7821

Waters Nursery
785 Cowboy Road
Jesup, GA 31545
(912) 427-7546

LOUISIANA

Beauregard Nursery
P.O. Box 935
DeWridder, LA 70634
(318) 463-5509

Louisiana Office of Forestry
P.O. Box 1628
Baton Rouge, LA 70821
(504) 925-4500

MISSISSIPPI

Mississippi Forestry Commission
Suite 300
301 Building
Jackson, MS 39201
(601) 359-1386

Waynesboro Nursery
1063 Buckafunna - Mt. Zion Road
Waynesboro, MS 39367
(601) 735-9512

W.W. Ashe Nursery
368 Ashe Nursery Road
Brooklyn, MS 39425
(601) 584-8488

NORTH CAROLINA

Claridge Nursery
762 Claridge Nursery Road
Goldsboro, NC 27530
(919) 731-7988

JB Lattay Forest Tree Nursery
P.O. Box 1007
Lumberton, NC 28359
(910) 739-7596

NC Division of Forest Resources
P.O. Box 29581
Raleigh, NC 27626-0581
(919) 733-2162

Tree Nursery
1123 Dinah's Landing Road
Washington, NC 27889
(919) 946-7718

Weyerhaeuser Company
2630 V.O.A. Road
Washington, NC 27889

Comfort Seed Orchard
250 Weyerhaeuser Lane
Trenton, NC 28585
(910) 324-1116

SOUTH CAROLINA

Creech Containerized Seedling Facility
P.O. Box 206
Wedgefield, SC 29168
(803) 494-8110

SC Super Tree Nursery
5594 Highway 38 South
Blenheim, SC 29516
(803) 528-3203

SC Forestry Commission
P.O. Box 21707
Columbia, SC 29221-1707
(803) 896-8863

Taylor Nursery
Box 116
Trenton, SC 29847
(803) 275-3578

Tall Pines Forest Nursery
430 Reforest Way
Cross, SC 29436
(803) 753-3341

TEXAS

Champion Timberlands International
Route 6, Box 491
Livingston, TX 77351
(409) 563-2302

Louisiana-Pacific Corporation
Route 6, Box 63611
Winnsboro, TX 75494
(903) 629-3262

Indian Mound Nursery
P.O. Box 617
Alto, TX 75925
(409) 858-4202

Texas Forest Service
Texas A&M Universtiy Station
College Station, TX 77843
(409) 845-2641

GLOSSARY

The following glossary is included with definitions of terms used in this publication. In addition, many common forestry-related terms not used in this publication are included. For additional information on forestry-related terminology, contact your local county Extension agent or Forestry Commission representative.

All-aged management in even-aged units: The interspersion and management of even-aged units of forest land in such a way as to provide all condition classes of the forest in a relatively small geographic area. The method contains suitable flexibility over forest composition, stand density, and age-class dispersion required to accomplish most multiple-use management objectives.

Agroforestry: Growing and managing agricultural crop such as pasture grass and a forest crop on the same land at the same time. In the South, this is usually a combination of trees and grass in plantations for animal grazing.

Bare-root seedling: A tree grown in nursery beds which will be lifted and packaged at the nursery and out-planted in the field. The seedlings are packaged and planted with little soil around the root systems.

Basal area: (a) Of a tree: the cross-sectional area (in square feet) of the trunk at breast height (4.5 feet above the ground). For example, the basal area of a tree 14 inches in diameter at breast height is about 1 square foot. Basal area = 0.005454 times diameter squared. (b) Of an acre of forest: the sum of the basal areas of the individual tree on the acre. For example, a well-stocked pine stand might contain 80 to 120 square feet of basal area per acre. It is a term that helps describe stocking.

Best management practices: A set of approved land management activities such as road-building standards, streamside management zones and stream crossing requirements that are part of the voluntary program to control non-point source pollution as required by Section 404 of the Federal Clean Water Act.

Board foot: A unit of wood equaling 144 cubic inches. The term is commonly used to measure and express the amount of wood in trees, sawlogs, veneer logs, or lumber. Board feet in a piece of wood is determined by: [length in feet x width in inches x thickness in inches] divided by 12.

Breast height: 4.5 feet above ground level.

Brownspot needle blight: Disease caused by the fungus *Scirrhia acicola*. This fungus can infect and delay the initiation of height-growth of longleaf pine seedlings. Seedlings are often heavily infected while in the grass stage and often die after repeated defoliations. The disease can be controlled by periodic prescribed burning, fungicide sprays in the nursery or fungicide root dips at planting.

Browse: Leaves, buds, and twigs of shrubs and trees which are eaten by livestock and wildlife.

Buffer: A designated zone or strip of land of a specified width along the border of an area, stream or road. Buffer strips of standing trees may be used to shield an area from view, serve as wildlife travel corridors or filter strips adjacent to streams to protect water quality.

Containerized seedling: Tree seedlings which are grown in containers. When out-planted, the seedlings have a root-ball of soil around the roots.

Clearcut: A harvesting and regeneration method which removes all trees (regardless of size) on an area. Clearcutting is most used with the southern pines which require full sunlight to reproduce and grow well. Clearcutting produces an even-aged forest stand.

Codominant: Term used to describe crown or canopy position in forest stands. Codominant trees have medium-sized crowns which form the general level of the crown cover. They receive full sunlight from above but are crowded on the sides and receive little, if any, side-light.

Competition: The struggle among adjacent trees and plants for growth requirements such as sunlight, nutrients, water, and growing space. Competition goes on among both the roots and the tops of trees and plants in the 'same stand.

Conservation: The protection, improvement and wise use of our natural resources to pi vide the greatest social and economic value now and in the future.

Cutting cycle: The planned time interval between major harvesting operations in the same stand, usually in uneven-aged stands. For example, a cutting cycle of 10 years in an uneven-aged longleaf stand means a harvest every **10** years.

DBH: Abbreviation for-tree diameter at breast height (4.5 feet above the ground). DBH is usually measured in inches.

Diameter: The length of a straight line passing through the center of a tree. Tree diameter is usually measured 4.5 feet above ground level, but log diameter is measured at the small end.

Direct seeding: A method of artificial regeneration where tree seeds are planted or sown on a prepared site.

Dominant tree: A tree having a crown extending above the general level of crown cover and receiving full sunlight from above and partly from the side; a tree that is larger than the average trees in the stand with a full, well-developed crown.

Ecology: The branch of science dealing with the interrelationships of plants and animals to their environment.

Ecotone: The community formed where two other communities meet. Sometimes called an **edge,** this is an actual, discrete ecological community that will have plants and animals from both adjacent communities and usually some unique residents found only in ectones.

Edge: The area where two different plant communities meet.

Endangered species: A species, subspecies or race that is threatened with extinction throughout all or a major portion of its range.

Even-aged management: Forest management with periodic harvesting of all trees on part of the forest at one time or in several cuttings over a short time to produce stands containing trees all the same age or nearly the same age.

Feral: Reverting to a wild state after being domesticated. For example, feral hogs.

Firebreak: Fire lane - a natural or man-made barrier created by the removal of brush, trees, leaves, other vegetation and natural fuels. Used to prevent the spread of fire.

Forb: Any herbaceous, broad-leaved plant other than grasses, sedges or rushes.

Forests: Any of a variety of vegetation types dominated by trees and usually having a well-defined, closed canopy, which shades the understory.

Forestry: The science, art and practice of managing and using trees, forests and their associated resources for human benefit.

Growing stock: All live trees in a forest or stand, including sawtimber, pole timber, saplings and seedlings.

Habitat: The natural environment of a specific plant or animal. An area combining all the necessary resources for the plant or animal to live, grow and reproduce.

Hardwood: Term used for broad-leaved, usually deciduous trees such as the oaks, maples, ashes, hickories, etc.

Harvest: In general, the removal of some, or all of the trees or members of a wildlife population on an area.

Harvest methods: See clearcut, seed tree method, selection method and shelterwood harvest.

Intermediate cut: Removing immature trees from the forest sometime between reproduction and maturity to improve the quality of the remaining forest stand

Intermediate trees: Trees shorter than the dominant or codominant trees but with crowns extending into the general canopy formed by the taller trees. These trees receive little sunlight from above and none from the sides.

Legume: Any plant in the bean family such as partridge pea, lespedeza, soybean, honey locust, etc.

MBF: Abbreviation for thousand board feet. A unit of measure for tree volume or sawn lumber.

Multiple-use management: A concept of land management in which a number of products are produced from the same land base. For example, forests managed for timber, wildlife, recreational areas and water yield.

Natural stand: A stand of trees resulting from natural seedfall or sprouting. The seed tree method, selection harvesting and the shelterwood method all produce natural stands.

Overtopped trees: Suppressed trees. These trees have crowns entirely below the general level of the forest canopy and receive no direct sunlight.

Pilings: Pole-sized timber driven into the ground to bear a load or to support weight. See pole timber.

Plantation: An artificially forested area established by planting or direct seeding. It is usually made up of a single species.

Pole timber: (a) Trees whose diameters range from 4 inches to 8 to 12 inches. (b) A slender column of timber which is usually used to support wiring and cable.

Predation: The act of animals (predators) capturing live food (prey). For example, a Cooper's hawk capturing and eating a cotton rat.

Prescribed burn (or fire): The controlled use of fire to achieve land management objectives. Prescribed fire can be used to reduce hazardous fuel levels, control unwanted vegetation, improve visibility and improve wildlife habitat.

Preservation: Maintaining a natural environment undisturbed by human influence or activities.

Pulpwood: Wood cut primarily to be converted into wood pulp for the manufacture of paper, fiberboard or other wood fiber products. Pulpwood tree sizes are usually a minimum of 4 inches DBH.

Reforestation: Reestablishing a forest by planting or seeding an area where forest vegetation has been removed.

Regeneration: See reproduction.

Regeneration cut: A cutting operation to remove old trees and leave environmental conditions favorable for the establishment of reproduction.

Reproduction: (a) Young trees that will grow and become the older trees of a future forest. (b) The process of forest replacement or renewal. This may be done artificially by planting seedlings or seed or naturally by sprouting or natural seeding.

Rotation: The number of years required to establish and grow trees to a specified size, product or condition of maturity.

Sapling: A small tree, usually between 2 and 4 inches in diameter.

Sawlog: A log large enough to be sawed into lumber, usually at least 10 to 12 inches in diameter.

Sawtimber stand: A group of trees with individual trees large enough to be sawed into lumber.

Seed tree method: Removing all trees from the harvest area at one time except for a few scattered trees left to provide seed to establish a new forest stand.

Seedling: (a) A tree, usually less than 2 inches in DBH, which has grown from a seed. (b) A tree, grown from seed in a bed or container in a nursery.

Selection cut: Harvesting individual trees or small groups of trees at periodic intervals (usually 5 to 15 years) based on their physical condition or degree of maturity. This produces an uneven-aged stand.

Shelterwood harvest: Removing trees on the harvest area in a series of two or more cuttings so new seedlings can become established from the seed of older trees. This method produces an even-aged forest.

Shrub: A low growing perennial plant with a woody stem and a low branching habit.

Silviculture: The art, science and practice of establishing, tending and reproducing forest stands of desired characteristics. It is based on knowledge of species characteristics and environmental requirements.

Site: (a) A tract of land with reasonably uniform soil and climatic factors. (b) An area with the capacity to produce a particular forest or other vegetation because of biological, climatic and soil factors.

Site index: A measure of forest site quality based on the height (in feet) of the dominant trees at a specified age (usually 50 years for natural stands and 25 for planted stands). A site index of 85 means that the expected height of the dominant trees at an index age of 50 years would be 85 feet on that particular area of land.

Site preparation: Preparing an area of land for planting, direct seeding or natural reproduction by clearing, chemical vegetation control, burning, disking, bedding, windrowing or raking.

Species: A population or group of related plants or animals capable of interbreeding and biologically classified into the same category.

Stumpage: The value of a tree or group of trees as they stand in the woods uncut (on-the-stump).

Succession: The replacement of one plant community by another over time until ecological stability (climax forest) is achieved. For example, an abandoned farm, if left to nature, would gradually go through different stages of vegetative cover and finally reach the climax forest stage after 100 or more years.

Thinning: A cutting to reduce the number of trees per acre. Thinnings are done in timber management to improve the growth rate and quality of the remaining trees, in wildlife management they are used to improve wildlife habitat for specific species.

Threatened species: Species that could become endangered over all, or part of their range in the near future.

Timber: Growing trees capable of being used for wood products.

TSI (Timber stand improvement): Improving the quality of a forest stand by removing cull trees and brush, leaving a stand of good quality trees. Cull trees may be removed by chemicals, fire, girdling or cutting.

Understory: Vegetation, consisting of seedlings, shrubs, grasses and forbs that grow on the ground level and are shaded by a canopy of taller plants.

Uneven-aged forest: A forest with many ages of trees present and with considerable differences in ages, usually within close association.

Uneven-aged or all-aged management: Managing a forest by periodically removing individual trees or groups of trees from the stand while preserving its natural appearance.

Wildlife management: The art and science of changing the characteristics and interactions of habitats, wild animal populations, and humans in order to achieve specific human goals by means of the wildlife resources.

Woodland: Any of a variety of vegetation types consisting of widely spaced trees with a well-developed understory.

NINE CONCEPTS FOR MAINTAINING WHOLE-COMMUNITY SPECIES DIVERSITY ON TIMBERLANDS WITH LONGLEAF PINE

by
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1. Growing season burns approximate the natural fire regime to which native birds, animals,and plants are attuned. Many bird species in fire communities have their breeding cycles synchronized with the April-September pre-settlement fire season, with nesting and fledgling completed by the time fires would be likely. Other species select fire-safe microsites such as burrows within the fire landscape.

2. Growing season burns can eliminate woody understory and greatly enhance diversity. Winter and early spring burns for hardwood understory control have led to the conversion of thousands of square miles of open longleaf pine savannah to stands with a dense scrub oak understory that resprouts after each fire. Most shrubs and saplings expend a large portion of their below-ground carbohydrate reserves in producing the new year's crop of foliage in April and May. Fires in early summer catch them at their lowest ebb and many are killed outright by one or more growing season burns. In contrast, a fire in February or March may kill the stem above ground but the plant still has its full complement of carbohydrate stores in the roots, and vigorous new sprouts are produced as soon as spring arrives.

3. Fire for hardwood understory control or other purposes enhances species diversity. Virtually all native understory species of upland forests of the coastal plain in the South are adapted to fire. Most are perennials with underground storage structures that enable them to resprout quickly after fire. Reduction in fire frequency leads to the elimination of the herb layer which provides seeds for small-game species like rabbits and quail, as well as for hundreds of nongame birds and small mammals like mice and voles. These creatures in turn support hawks, owls, and mammalian predators. Much of this complex food web collapses when fire is eliminated from woodlands.

4. Species diversity is enhanced by burning across the whole moisture gradient. In many areas, it has been a frequent practice to burn uplands but not wetlands by plowing between the two. But many of the rarest species in the South and many of the showy savannah orchids and bog species like Venus flytrap, pitcher plants, and sundews depend on fire to keep shrubs out of their wet habitat. It is becoming a more common practice to burn against wetlands without a plow line so that fire runs into a wetland until it goes out, keeping these critical wetland-upland ecotones open. Small wetlands included within savannah or woodland sites may be safely burned in any season. To maximize species survival, a good prescription should avoid placing plow lines in wetland- upland boundaries and should include small pocosins and small wetlands like seasonal pools,swamps, moist swales, small stream bottoms, and streamhead sloughs within the burn compartment.

5. Patchiness in forest systems maintains diversity. Natural communities and fire communities especially, are patchy by nature. In frequent-fire communities without woody

understory, the diverse herb layer responds to every variation in moisture and elevation so that a complex ground mosaic is often visible. Patches of moist soil will be colonized by a wet-mesophytic assemblage, while a few feet away a different community abounds on a slightly drier site. These patches provide different kinds of habitat for rare plant species and different kinds of food and cover for different kinds of wildlife.

Historical photographs and remnant longleaf pine savannahs indicate that natural stands originally occurred in all densities. Sometimes closed-canopy longleaf forest, large treeless areas and every density in between were to be found on the same site. Natural patchiness was largely due to variations in wildfire behavior on different soils and slopes. Patchiness in woodlands can be attained in a number of ways, including the use of more than one type of silvicultural method in a given tract of woodland. The notion that patchiness is good runs counter to the century-long striving for uniformity in agriculture and silviculture, but the necessity of patchiness for maintenance of species diversity in natural communities is gaining recognition.

6. Species diversity can be maintained by tolerating patches of sub-commercial stocking of longleaf in woodlands. Traditional U.S. Forest Services recommended target stocking densities, designed for productive commercial stands, are too high to allow significant diversity in the understory. Such fully stocked, closed-canopy stands are of little value to many kinds of wildlife or for the maintenance of diversity of grasses and herbs. This is due to the reduced light that reaches the forest floor. Diversity can be maintained, however, if a few islands of open, or nearly treeless, savannah are left. As little as one acre in 25 might suffice if these islands are maintained across rotations.

7. Is there a well-developed groundcover of grasses and herbs? This question is an overall rule of thumb for high-quality longleaf pine stands. While commercial productivity requires closed- canopy management of some lands, there should still be some sunny, open areas if native plant and animal diversity is valued. A healthy longleaf pine community has fire char on the trunks and only two principle vegetation layers — the pine canopy and a rich ground cover of grasses, legumes, and other flowering herbs —and only widely scattered hardwoods, such as scrub oaks and hickories, in the mid-story.

8. Pine straw raking depletes legumes (members of the bean family), the most beneficial herbs for wildlife, along with many other species in the herb layer and should be avoided where species diversity is valued. Where pinestraw raking is practiced, avoid raking some areas. This may preserve species diversity by providing habitat for those species that cannot tolerate raking and by providing cover and food for animals.

9. Group and single tree selection methods may be best for preservation of high species diversity in longleaf pine communities. In combination with regular fire (1 to 5 years), this method appears to sustain most native plant and animal species while still providing timber for harvest. It also provides the bare soil that longleaf seeds need for germination. In the canopy, it provides for light and gaps needed for growth.

Franklin, Robert M. 1997. Stewardship of longleaf pine: A guide for landowners. Longleaf Alliance Report No. 2. The Longleaf Alliance, Solon Dixon Forestry Education Center, Andalusia, AL. 44 p.

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