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Longleaf Pine Regeneration[1]

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Longleaf pine has many favorable characteristics for landowners who have long-term, multiple-use resource management objectives. Of all the southern pine species, longleaf pine yields the largest proportion of high value solid wood products and is the most insect, disease, and fire resistant. When burned regularly, longleaf pine forests provide ideal habitat for many plants and animals.

Longleaf pine is a pioneer species on a variety of sites but is intolerant of flooding during its grass stage. Historically, fire and moisture have been the principle factors controlling longleaf distribution within its natural range. In the lower Coastal Plain longleaf grows best “in comparison” to loblolly or slash pine on sandy, well drained to excessively well drained soils where the other species perform more poorly. Fire removes competing vegetation, exposing the bare soil necessary for successful establishment. In fire-dominated ecosystems, pure stands of longleaf pine are common.

ARTIFICIAL REGENERATION

Options for artificial regeneration include planting of bareroot or containerized seedlings or direct seeding. Survival is usually highest when seedlings are planted. However, direct seeding may be the best option for some situations, such as regenerating relatively small or vast areas.

Site Preparation

Longleaf pine is very intolerant of shade and is difficult to regenerate successfully without vegetation control. Vegetative competition around seedlings must be kept at a minimum until an adequate number of seedlings are at least as tall as the competition. The type and degree of site preparation will depend on the regeneration technique used and site conditions.

Direct seeding should be preceded by prescribed burning as a minimum. Disking also enhances seeding by reducing competing vegetation for a short period of time.

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Site preparation prior to planting depends on site conditions. Hardwoods should be removed mechanically or with an herbicide (e.g., hexazinone). Herbicides are frequently used in conjunction with prescribed fire or V-blade planters on recently harvested sites. On old fields and pastures scalping, disking and/or ripping help break up sod layers or hardpans. Mechanical treatments are most effective if used in conjunction with herbicides because of rapid regrowth of vegetation after most mechanical treatments. Mechanically disturbed soil should have exposure to summer and fall rains so it has a chance to firm before planting. Do not plant directly in subsoiling rips, to avoid channelizing water, but plant close to them so the taproot can extend down the rip.

It is especially important to kill bermuda grass or bahiagrass before planting in pastures or old fields. For best results, broadcast or band spray grasses in August prior to planting with one of the following herbicide treatments: (1) 5-6 qt. of Accord™ per acre, (2) 3 qt. Accord™ & 2 oz. Oust™ per acre, or (3) 20-24 oz. Arsenal™ per acre. Other herbicides labeled for grass control may also be used.

Planting

The success of longleaf pine planting depends on: (1) a well-prepared, competition-free site; (2) fresh, healthy, top quality planting stock; (3) extreme care with handling of the stock from lifting to planting; (4) precision planting; and (5) proper post-planting care. Attention to detail during planting is critical. High quality seedlings can be grown as either bareroot or container stock.

Supplies of longleaf pine seedlings may not be sufficient to meet demands, so order your seedlings by early summer at the latest. For a list of longleaf nurseries, call your DOF County Forester or the Longleaf Alliance, at 334-222-7779, and request a copy of the *Longleaf Nursery List*.

Choose a tree planting contractor carefully. Planting failures frequently result from improper seedling handling and planting. Paying $5 to $10 more per acre for a reputable contractor may help to ensure seedling survival and minimize the possibility of having to replant.

Bareroot Seedlings

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

Height growth begins when the seedlings have a RCD of one inch. Seedlings may reach this size at a younger age if competing vegetation is sufficiently controlled. Once this size is attained, the seedlings will usually initiate height growth, which is soon comparable to loblolly or slash pine. Until the RCD is at least 1 inch, longleaf will remain in the grass stage.

Containerized Seedlings

There is increasing interest in using containerized longleaf pine seedlings because they have an extended planting season and can be used to replant partial regeneration failures in the year they occur. Studies have shown that both fall-planted and late winter-planted containerized longleaf seedlings have better survival and growth compared to winter-planted bareroot seedlings. Containerized seedlings have also been successfully planted during July and August when they receive regular afternoon rain. Large containers can enhance survival if sufficient site preparation and vegetation control measures are taken.

The main drawback of containerized seedlings is cost, which can be more than three times that of bareroot seedlings. Also, they are more bulky to handle during shipping and planting. However, cost-share programs and increased survival make them a feasible option.

Nursery to Field

Proper care and handling of seedlings from the nursery to the field includes: pick-up from the nursery the day lifted; minimal root exposure; refrigerated transportation (if possible) to the planting site; storage in a cool, well-ventilated area for no more than two weeks before planting; and no exposure to sunlight or heat. To optimize success, plant seedlings within three days of pickup from the nursey. If you know that you will have to store seedlings for a longer period, and the nusrey has refrigeratated storage, leave seedlings at the nursery until you are ready to plant.

Longleaf seedlings should be planted between November and April 1 when weather is favorable. Planting during the early part of this time frame is best to give seedlings time to grow new roots before the dry weather of April and May. Containerized seedlings can be planted earlier than November if necessary, but no earlier than September. Avoid planting during periods of low soil moisture, dry weather, freezing or high temperature, low relative humidity, and high winds. Take enough seedlings to the field for one day of planting and keep them moist, but not submerged. For bareroot seedlings, machine planting is preferable to hand planting because the larger slit created by the machine provides for better root alignment. If hand-planting, bareroot seedlings should be planted with a shovel or large dibble. Containerized seedlings should be planted with a cylinder-type dibble.

Position seedlings with taproots straight down and root collars at or slightly below the ground line (no more than 1 inch below), which allows the bud to be exposed once the soil has fully settled. Attention to detail during planting is critical -- a seedling planted too shallow will die quickly, and a seedling planted too deep will die slowly. Depending on your objectives, a survival of 500 to 900 seedlings per acre after the first growing season is a good goal. A lower stocking may be acceptable for some objectives, such as wildlife habitat.

A Word About CRP or WHIP Contracts

If you have a CRP or WHIP contract that requires planting less than 500 trees/acre, the planting crew must know about it. If not, they may plant leftover seedlings in the gaps, causing you problems with your funding.

Post-Planting Care

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

Direct Seeding

Due to recent increases in seed costs, this once cost-effective regeneration option is now potentially expensive, and it involves substantial risk. Failure can occur as a result of inadequate control of competing vegetation, low seeding rates, using seed not treated with bird or rodent repellent, seeding at the wrong time, or adverse weather conditions. Low, poorly drained sites that are likely to be covered with standing water a week or more after seeding should be avoided. Likewise, deep upland sands that dry out rapidly after a rain are also unsuitable for direct seeding. Generally, sites that can be successfully planted can also be successfully seeded. As with planting, site preparation methods must control vegetative competition and expose at least 50% of the mineral soil. Seeds must be in contact with the mineral soil for germination to take place. Seeds lodged in non-soil material will probably not become established.

In general, local seed sources are best. Seed or seedlings from North and South Carolina tend to grow poorly when planted on the Florida peninsula and vice versa. Most genetic improvement work with

longleaf pine is concentrated on breeding for brown-spot disease resistance and accelerated initial height growth.

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

NATURAL REGENERATION

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

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

Preparatory Cut

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

Seed Cut

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

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

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

late-spring burn is most effective in controlling woody stems.

Removal Cut

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

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

CONCLUSION

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

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