LONGLEAF PINE: WHY PLANT IT? WHY USE CONTAINERS?

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ABSTRACT—Longleaf pine (*Pinus palustris* Mill.), although widely distributed in the presettlement forests of the southern Coastal Plain, now occupies less that 5 percent of its original range. A highly desirable species, it resists fire, insects, and disease, while producing excellent quality solid-wood products. Longleaf forests also represent an important component of the region's cultural heritage, ecological diversity, timber resources; it provides essential habitat for many animal and plant communities. However, regeneration of the species either by natural methods or by planting of bare-root nursery stock has been difficult. The renewed interest in growing longleaf pine has resulted in evaluation of new approaches to seedling establishment. Using container stock and controlling competition have greatly improved the success of longleaf pine establishment.

INTRODUCTION

Of the southern pines, many consider longleaf pine (*Pinus palustris* Mill.) the most valuable in terms of wood-product quality, aesthetics, and resistance to fire, insects, and disease. Longleaf pine ecosystems once occupied more than 90 million acres of the Lower Coastal Plain of the Southeastern United States from southern Virginia to central Florida and west to eastern Texas (Frost 1993). Heavily harvested in the late 1800s and early 1900s, few longleaf stands survived. Today, less than 4 million acres remain (Kelly and Bechtold 1990). Few seed trees endured these harvests, and much of the area was converted to other species or abandoned to grassland. Natural regeneration is only feasible on a small portion of the area in the longleaf pine type.

Regeneration, both naturally and artificially, is more difficult than for any other southern pine due to the delay in stem elongation (the grass stage) that is a genetic trait of the species. Survival of planted bare-root nursery stock is generally poor, and established seedlings in the grass stage are very sensitive to competition. Using container stock and controlling competition by other vegetation have improved regeneration results. Although the acreage of longleaf pine will never attain historical proportions, future restoration will increase the production of quality wood for humans, the number of species-rich plant communities, and the amount of suitable habitat for wildlife.

THE LONGLEAF PINE ECOSYSTEM

The natural range of the longleaf pine ecosystem covers most of the Atlantic and Gulf Coastal Plains with extensions into the Piedmont and mountains of north Alabama and northwest Georgia. The species occurs on a wide range of sites, from wet, poorly drained flatwoods near the coast to dry, rocky mountain ridges (Boyer 1990). It is a long-lived tree, potentially reaching the age of several hundred years. However, longleaf pine forests are often exposed to catastrophic hazards, such as tropical storms or fire, and to continuing attrition from lightning, which shortens possible rotation ages (Landers and others 1995).

The Nature of the Species

Longleaf pine is a pioneer species that is very shade intolerant. The seedlings evolve through a stemless grass stage. If competition is severe, they may remain in this grass stage for years. The ecosystem is distinguished by open, park-like pine barrens, which are composed of even-aged and multi-aged mosaics of forests, woodlands, and savannas, with a diverse groundcover dominated by bunch grasses and usually free of understory hardwoods and brush (Landers and others 1995). The diversity of understory plants per unit of area places longleaf pine ecosystems among the most species-rich plant communities outside the tropics (Peet and Allard 1993). Although the pine-barrens are known for persistence and diversity, they occur on infertile soils. The ecological persistence of these areas is a product of long-term interactions among climate, fire, and traits of the key plants.

The Role of Fire

Fire was an essential component of the original longleaf pine ecosystems. Longleaf pine and bunch grasses, such as wiregrass and certain bluestems, possess traits that facilitate the ignition and spread of fire during the humid growing seasons (Landers 1991). Frequent fire was largely responsible for the competitive success of longleaf pine and the grasses. These keystone species exhibit pronounced fire tolerance, longevity, and nutrient-water retention that reinforce their dominance and restrict the scale of vegetation change following disturbance. Fires that were ignited by American Indians or by lightning from thunderstorms prevailed over the region. Many of these fires occurred during the growing season and prevented species native to other habitats from encroaching into the pine barrens. The chronic fire regime also maintained the soil structure and nutrient dynamics to which longleaf pine is adapted (McKee 1982).

The Decline of the Longleaf Ecosystem

The depletion of the longleaf ecosystem resulted from its many desirable attributes that caused its exploitation by European settlers (Croker 1979). However, railroad

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harvesting in the late 1800s and early 1900s provided access to and depleted the vast remaining longleaf timberland. Cutting proceeded from the Atlantic States west through the Gulf Coast region as use of the wood intensified. The harvesting of longleaf pine reached a peak in 1907, when an estimated 13 billion board feet were cut (Wahlenburg 1946). The longleaf ecosystem now occupies only a small part (less than 5 percent) of its original area. Reduced acreage of this habitat type has placed at risk at least 191 taxa of vascular plants (Hardin and White 1989, Walker 1993) and key wildlife species such as the red-cockaded woodpecker, gopher tortoise, and southern fox squirrel (Landers and others 1995).

A combination of circumstances limited regeneration of longleaf pine. The completeness of the harvest left little seed source for natural regeneration, and much of the harvested land was cleared for cropland or pasture. Longleaf pine does not successfully invade open land in competition with aggressive pine or grass species. Regeneration sometimes succeeded old-growth when periodic fires provided a seedbed and controlled woody competition and when wild hogs did not reach a density high enough to destroy established seedlings (Landers and others 1995). The disruption of natural fire regimes, resulting in part from forest fire protection policies implemented during the 1920s, allowed invasion of longleaf sites by hardwoods and more aggressive pine species. Longleaf pine and its associated species could not compete under these conditions.

ESTABLISHMENT BY PLANTING CONTAINER STOCK

Artificial regeneration is used to restore longleaf pines on most sites where the species originally grew. Historically, reforestation by planting bare-root stock has been unacceptable. Problems related to severe competing vegetation, delayed stem elongation, and poor storability of bare-root seedlings have hindered success. Within the last decade, the keys to successful establishment have been available: well-prepared, competition-free sites; healthy, top-quality, fresh planting stock; meticulous care of stock from lifting to planting; precision planting; and proper post-planting care (Barnett 1992). To be consistently successful, all five keys must be met. Because land managers are rarely able to control all five factors, successful planting of bare-root stock remains elusive.

Development of Container Technology

Planting of container stock is now accepted as the most successful method of regenerating longleaf pine (Barnett and McGilvray 1997). Numerous studies have demonstrated that under adverse planting conditions, such as poor sites, moisture stress, and out-of-season plantings, container seedlings survive and grow better than bare-root stock (Barnett and McGilvray 1993, South and Barnett 1986). Boyer (1989) found in a 5-year comparison of bare-root and container plantings in Georgia that the container stock averaged 76 percent survival compared to 51 percent for bare-root stock. Improved survival and growth rates are generally attributed to root systems of container seedlings remaining intact during lifting while roots of bare-root seedlings are severely damaged. Comparative studies have shown that internal moisture stress is consistently less in outplanted container seedlings than in bare-root seedlings (Becker and others 1987). Thus, container seedlings experience a significantly shorter period of transplant shock or adjustment than bare-root seedlings. Practical guidelines for producing longleaf pine in containers are currently available (Barnett and McGilvrary 1997).

Importance of Competition Control

Fire is an essential component of the establishment and management of the longleaf pine ecosystem. Long-term studies show that the frequent use of fire hastens initiation of height growth, reduces undesirable competing vegetation, and stimulates growth and development of species that are an essential component of the understory. Fire is also a critical component for achieving and maintaining the biologically diverse understory that is characteristic of the ecosystem.

When the use of fire is restricted by regulations, location, or condition of the site, herbicides can be used to release longleaf seedlings from excessive competition, either before and after planting. Postplanting competition control is important to ensure early initiation of height growth.

CONCLUSIONS

Longleaf pine is a highly desirable species because it produces excellent quality solid-wood products and resists fire, insects, and disease; its understory typically supports a species-rich plant community. The longleaf pine ecosystem also favors key wildlife species such as the red-cockaded woodpecker, gopher tortoise, and southern fox squirrel. Reforestation success for longleaf pine can be improved by planting seedlings produced in containers. Container stock survives better than bare-root stock on typical longleaf pine sites, and the length of time seedlings stay in the grass stage is reduced. However, using container stock does not eliminate the critical need for controlling competition during the first growing season to ensure that seedlings begin height growth during the second year after planting. By using container stock and controlling competitive vegetation, land managers are more likely to achieve successful reforestation of longleaf pine—a culturally, ecologically, and economically important species in the South.

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