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NATURAL LONGLEAF PINE: AN OVERVIEW OF STAND DYNAMICS

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ABSTRACT: Prior to the arrival of settlers to the United States, natural communities dominated by longleaf pine occurred throughout most of the southern Atlantic and Gulf coastal plains. These communities once covered an estimated ninety million acres, or two-thirds of the area in the Southeast. It covered more acreage than any other North American ecosystem dominated by a single tree species. Dissimilar to other southern pines, longleaf pine tolerates a wide variety of habits. It is found growing on dry mountain slopes and ridges, to the low, wet flatwoods, as well as the excessively drained sandhills found along the coast and fall line. Exploitation of longleaf pine-dominated forests led to a steady decline of its acreage. Today, estimates indicate that less than 3 million acres remain. A 1995 Biological Survey Report listed the longleaf pine forest as the third most endangered ecosystem in the U.S. Private, state, and federal land managers have recently undertaken ecological restoration and reforestation in the longleaf pine forests of the southeastern United States. Research from the Escambia Experimental Forest and the long-term U.S. Forest Service Regional Longleaf Pine Growth Study will be used to present an overview of naturally regenerated longleaf pine stand dynamics. Among the topics discussed will be: its ability to sustain growth at high densities and older ages, over 150 years; recent observations of increased growth; factors affecting regeneration success; and its use for high-value wood products and long-term carbon storage.

INTRODUCTION

Longleaf pine ecosystems are considered to be in a perilous condition. A report by the U.S. Department of Interior lists the longleaf pine ecosystem as the second-most threatened ecosystem in the U.S. (Noss 1989). The original longleaf pine forest was self-perpetuating. It reproduced itself in openings in the overstory where young stands developed. The result was a park-like, uneven-aged forest, composed of many even-aged stands.

The character of the ecosystem is best maintained with natural regeneration, with optimum use of processes or treatments simulating the processes that have long maintained longleaf ecosystems over the millennia. However, no phase of longleaf pine management presents more complex and critical problems than does its reproduction. Solutions depend on understanding the prerequisites of the process, the characteristics of seed-bearing trees and longleaf pine seed crops, and the possible causes of failure after seed fall. Predicting seedling performance under varying levels of overstory competition is important for understanding the consequences of silvicultural systems.

Wahlenberg, in his landmark 1946 text, started off his chapter "Problems of Natural Reproduction" with this:

> *"Deliberate regeneration of longleaf pine has been rarely accomplished."*

Wahlenberg concluded the chapter with:

> *"Mismanagement of longleaf pine has been the rule rather than the exception, due to the ignorance of the unique life history and incomplete knowledge of factors determining the life and death of seedlings and hence the succession of forest types."*

Many of the factors governing the ability of longleaf pine to reproduce are obscure, and the innumerable ecological influences are so interrelated as to make their interpretation difficult. A major regeneration problem is irregular seed production. Seed crops considered adequate for regeneration occur at 5- to 7-year intervals with exceptions. Longleaf pine is generally considered the most intolerant of the southern pines. It is intolerant of competition from any source including overstory competition. Survival and growth are closely related to longleaf pine's two unique silvical characteristics: its grass-stage and its high resistance to fire. The grass-stage usually lasts 4-5 years but may range from 1 to 20 years. If reproduction of competing species is allowed to grow freely, it will completely dominate the site while longleaf seedlings

are still in the grass-stage. Once this has occurred, the longleaf pine stand can never regain dominance without some type of intervention.

Unsatisfactory regeneration in longleaf pine forests may be attributed largely to the lack of management or unwise management. Mismanagement may be the rule rather than exception, due to the ignorance of the unique life history of the species and the incomplete knowledge of factors determining the life and death of seedlings.

ARE THERE GAPS IN THE KNOWLEDGE CONCERNING NATURAL REGENERATION OF LONGLEAF PINE?

One of the best places to get an excellent overview of natural regeneration of longleaf pine is to examine the literature that has been already published. As of 2002, 122 sources deal with the topic of natural regeneration of longleaf pine. The most important are:

Wahlenberg, W.G. 1946. Longleaf pine: Its use, ecology, regeneration, protection, growth, and management. Charles Lathrop Pack Forestry Foundation, 429 p.

Croker, T.C., Jr. and W.D. Boyer. 1975. Regenerating longleaf pine naturally. U.S. Department of Agriculture, Forest Service Research Paper SO- 105.

Boyer, W.D. 1993. Regenerating longleaf pine with natural seeding. Proceedings of the Tall Timbers Fire Ecology Conference. 18:299-309.

And several other publications by Dr. William Boyer

HIGHLIGHTS FROM CROKER AND BOYER THAT DEAL WITH CRITICAL ISSUES FOR NATURAL REGENERATION OF LONGLEAF PINE

- Important to achieving successful regeneration would be the monitoring of the seed crop.
- Poor timing of fires rather than competition causes excessive mortality of grass-stage seedlings under an overstory.
- Seedbed preparation must be carefully timed.
- Survival of seedlings appears better on autumn burns and growth may be improved over that on a winter burn made 9 or 10 months before seedfall.
- One of the most important components of naturally regenerating longleaf pine is the use of fire. "Burning is an art acquired by experience". A keen knowledge of how fuels, weather, and topography affect the behavior and impact of fire is necessary.

REGIONAL LONGLEAF PINE GROWTH STUDY

In 1964, the USDA Forest Service established the Regional Longleaf Pine Growth Study (RLGS) in the Gulf States. The original objective of the study was to obtain a database for the development of growth and yield predictions for naturally regenerated, even-aged longleaf pine stands.

Plots cover a range of tree ages from 15 to 120+ years, densities from 30 square feet/acre to more than 180 square feet/acre, and site qualities from site index 50 to site index 90. The study accounts for change by adding a new set of plots in the youngest age class every 10 years.

The seventh re-measurement of these plots has just been completed. The RLGS represents a stable, long-term database and an active "field laboratory" for natural, even-aged longleaf pine stands. The value of this project increases as more and more ownership's in the South consider longleaf pine management alternatives. The plots are available for cooperative studies that do not harm the plots or interfere with future activities.

SURVIVAL OF LONGLEAF PINE SEEDLINGS

Two studies conducted on the Escambia Experimental Forest in the early 1970's examined issues of seedling survival. The first study evaluated longleaf pine seedling survival and stocking in: 1-acre, one-half acre, and one-quarter acre patches.

RESULTS: After 3 years and one prescribed fire patch size had no effect on seedling survival, stocking, or mortality from prescribed burning.

The second study examined the effect of fire, including: fire treatment, soil type, and distance from a forest wall.

RESULTS: Two years later there were no major seedling losses in relation to fire treatment, soil type, or distance from a forest wall.

CONCLUSION FROM BOTH STUDIES: LONGLEAF PINE SEEDLINGS CAN BE BURNED UNDER A WIDE RANGE OF CONDITIONS AND SURVIVE BUT THE BURNING HAS TO BE DONE CAREFULLY.

COOPERATORS IN THE REGIONAL LONGLEAF PINE GROWTH STUDY: Region 8 of the USDA Forest Service, Apalachicola National Forest - Wakulla District, Talladega National Forest - Talladega District, Talladega National Forest - Oakmulgee District, Homochitto National Forest - Homochitto District, DeSoto National Forest - Black Creek District, Conecuh National Forest - Conecuh District, Escambia Experimental Forest (Brewton, AL), T.R. Miller Mill Company (Brewton, AL), Florida Forest Service - Blackwater River State Forest (Munson, FL), Cyrene Turpentine Company (Bainbridge, GA), Eglin Air Force Base (Niceville, FL), Southlands Experimental Forest- International Paper Company (Bainbridge, GA), Gulf States Paper Corporation (Columbiana, AL), Mobile County (Alabama) School Board, Wefel Family Trust (Atmore, AL), AmSouth Bank (Birmingham, AL), Kaul Trustees, North Carolina Division of Forestry - Bladen Lake State Forest (Elizabethtown, NC), Champion International Corporation (DeFuniak Springs, and Milton, FL), John Hancock Mutual/Resource Management Services (Opp, AL), Kimberly-Clark Corporation (Weogufka, AL)