In: Kush, John S., comp. Proceedings of the First Longleaf Alliance conference - Longleaf Pine: a regional perspective of challenges and opportunities. 1996 September 17-19; Mobile, AL: [Auburn University, AL]. Longleaf Alliance Report No. 1. 28-29.

Longleaf Pine Can Catch Up

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Introduction

One of the principal southern pines, longleaf (Pinus palustris Mill.) is the key tree species in a fire-dependent ecosystem. In pre-settlement times, longleaf pine forests covered much of the southeastern United States. Once the most extensive forest ecosystem in North America dominated by a single species, longleaf pine now occupies only about 3 percent of its former range.

Longleaf pine is a very intolerant pioneer species. But it has none of the characteristics normally associated with early successional species that depend on prolific seed production, wide seed dissemination, and rapid early growth in order to quickly occupy and dominate an open site. Longleaf pine's adaptation to frequent fire, which its principal competitors cannot tolerate, has given this species its competitive edge, and has allowed it to maintain itself in place for thousands of years.

Longleaf pine has a reputation as a very slow growing species that is difficult to regenerate and so cannot economically compete with either loblolly or slash pines. This bias against the species plays a continuing role in its decline. But is this bias entirely justified? No, according to some evidence that has accumulated over the years.

An Inherent Bias Against Longleaf

A long-standing bias against longleaf pine is inherent in existing yield tables and site index curves which were derived from burned stands. While longleaf pine is a fire-dependent species, this dependence is not without its costs. Periodic fires slow the growth of longleaf, so these yield tables cannot reflect the performance of the species if free from fire. This bias has long been known but not widely recognized (Cary 1932, Stone 1942). Biennial burns in longleaf have resulted in significant reductions in both height growth and volume yield (Boyer 1994). Through stand age 36, cool winter burns have resulted in a 5-foot reduction in height, equivalent to a 6-foot reduction in age 50 site index. Total volume yield was 22 percent greater in unburned than burned stands. This is a substantial bias when comparing performance of longleaf with that of loblolly or slash pine.

Longleaf vs Longleaf

Longleaf pine is very sensitive to competition from any source. When free of competition, it is capable of relatively rapid early growth. Height-over-age curves for longleaf pine are significantly affected by degree of planting site competition control (Boyer 1983). By age 10, for plantations with an age 25 site index of 60 feet, longleaf on old fields will have a 5-foot height advantage over longleaf on unprepared cutover sites. This 5-foot advantage, however, disappears by age 25. Longleaf made up for its slow start by more rapid growth later on. This ability to make up for a slow start has also been observed with delayed release (Boyer 1985). Some naturally established seedling stands were released from overtopping hardwoods at age one, others at age 8. Delayed release retarded early growth, but a check at age 31 indicated no effect of delayed release on average tree height and diameter, or stand volume.

Longleaf planted on intensively prepared sites get a major jump on naturally established seedlings that must continuously compete with associated vegetation on the forest floor as well as with other seedlings, which may number from several to many thousands per acre. The growth of two plantations on intensively prepared sites was compared with development of natural regeneration (unburned, to remove that source of bias). At age 13, planted longleaf had a 13-foot height advantage over the natural stand. By age 26, the difference had closed to 5 feet. At age 13, volume of the natural stand was only 30 percent of that in the plantation. By age 20 it was 47 percent and by age 26 was 75 percent. At this rate, the naturals should catch up with their planted cousins by or shortly after age 30.

Longleaf vs Loblolly and Slash Pines

Much of the slow early growth of longleaf pine can be attributed to time spent in the grass stage. Loblolly and slash pines are free from such drawbacks, and their growth will far exceed longleaf for several to many years after establishment. However, an ability of longleaf to make up for its slow early start by more rapid growth in later years could reduce the apparent competitive edge of the other species on many sites.

One example was from a study with side-by-side plantings of the three species on prepared sites in Mississippi (Schmidtling 1987). While loblolly pine had an 8- to 9-foot height advantage at age 10, this advantage was gone by age 17, when longleaf passed loblolly, and was closing on slash pine by age 25. Another study had side-by-side comparisons of these species planted at 33 locations in Louisiana and Mississippi (Shoulders 1985). With yields adjusted for differences in initial planting survival, by age 20 there was no significant difference in volume yields between longleaf and loblolly pine at 82 percent, and between longleaf and slash pine at 53 percent of the locations. Yields of loblolly and slash were greater at the remaining locations. Of course, at age 20, longleaf is still making up for its slow start. This study indicated that as site quality declines, the performance of longleaf improves relative to the other species. In side-by-side plantings on sandhill sites in Georgia and South Carolina, longleaf had gained an average 6- to 11-foot height advantage over the other two species by age 28. (Outcalt 1993).

Conclusions

1. There is an inherent bias in existing yield tables and site index curves for natural longleaf pine due to growth reductions associated with periodic fires.
2. Slow early growth of longleaf is made up by more rapid growth later.
   a. Within-species comparisons. Longleaf can make up for:
      1) Early differences due to site preparation intensity.
      2) Early differences due to delays in release.
      3) Maybe differences between planted and natural stands.
   b. Comparisons with loblolly and slash pine.
      1) Good sites: longleaf growth poorer.
      2) Average sites: longleaf growth equal or better.
      3) Poor sites: longleaf growth better.
3. Early longleaf growth reduced by competition.
4. Later and ultimate longleaf growth reflects site quality.
5. Growth habits of longleaf are such that early growth differences, which reach a maximum at about age 10-12, are misleading and cannot be used to judge effects of cultural treatments or make valid species comparisons. Such judgments should be deferred until stands reach at least 25-30 years of age. By that time longleaf's catch-up mode should be fully revealed.

LITERATURE CITED

Boyer, W.D. 1994. Eighteen years of seasonal burning in longleaf pine: effects on overstory growth. In Proceedings of the 12th Conference on Fire and Forest Meteorology. p. 602-610. Society of American Foresters, Bethesda, MD.

Boyer, W.D. 1983. Variations in height-over-age curves for young longleaf pine plantations. Forest Science 29:15-27.

Boyer, W.D. 1985. Timing of longleaf pine seedling release from overtopping hardwoods: a look 30 years later. Southern Journal of Applied Forestry 9(2): 114-116.

Cary, A. 1932. Some relations of fire to longleaf pine. Journal of Forestry 30:594-601.

Outcalt, K.W. 1993. Southern pines performance on sandhill sites in Georgia and South Carolina. Southern Journal of Applied Forestry 17:100-102.

Schmidtling, R.C. 1987. Relative performance of longleaf compared to loblolly and slash pines under different levels of intensive culture. In Proceedings, Fourth Biennial Southern Silvicultural Research Conference. D. R. Phillips, compiler, p. 395-400. USDA For. Serv. Gen. Tech. Rep. SE-42.

Shoulders, E. 1985. The case for planting longleaf pine. In Proceedings, Third Biennial Southern Silvicultural Research Conference. E. Shoulders, ed., p. 255-260. USDA For. Serv. Gen. Tech. Rep. SO-54.

Stone, E.L. 1942. Effect of fire on radial growth of longleaf pine. USDA For. Serv. South. Forestry Note No. 43.