



Establishing Mixed Shortleaf Pine-Hardwood Stands

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Historically, before the advent of fire control and Smokey Bear campaigns in the 1950s, shortleaf pine-hardwood forests (Fig. 1) were abundant on average to poor productivity sites of the Cumberland Plateau, foothills and side slopes of the Blue Ridge Mountains, and the Piedmont region. These forests are defined as having pine basal areas of 25 to 75% per unit area.⁶ Frequent fire created seedbed conditions of bare, mineral soil to allow successful seed germination and seedling growth and some control of understory and midstory vegetation. Shortleaf pine-hardwood forest types have transitioned to predominantly hardwood forests due to natural succession, southern pine beetle outbreaks, and the absence of fire, which is often necessary to naturally regenerate shortleaf pine. Many of the former mixed stands do not have a shortleaf pine seed source to perpetuate the species. Thus, to create these species mixtures, artificial regeneration of shortleaf pine is necessary through planting.

Shortleaf pine-hardwood mixtures are attractive management options for landowners compared to other management practices such as pine plantations and pine savannas which tend to have high establishment and maintenance costs and require large acreages to be economically feasible. Most private landowners who own less than 50 to 100 acres of land have a bias against pine plantations, whatever



Figure 1: Example of a remnant shortleaf pine-hardwood site in Campbell County, Tennessee. Credit: Wayne Clatterbuck, University of Tennessee

the species, and pine-hardwood mixtures offer landowners more species diversity and wildlife habitat options⁴ as well as wider markets for various forest products.

Pine-hardwood mixtures are a transitional forest type that will eventually succeed to longer-lived hardwoods.⁵ Without disturbance to allow the shorter-lived pine to re-establish in more open canopies, the pine will diminish. The disturbance, whether burning, harvesting or weather-related, has to be timed with a good seed-producing year which occurs fairly infrequently. Good shortleaf seed crops occur every 3 to 10 years³ and often do not coincide with the disturbance event. Shortleaf pine seed do not remain viable from one year to the next. Thus, if exposed mineral soil and weather conditions are not favorable for seed germination when a good seed year occurs, the site often becomes overgrown and not receptive for seed in future years. The seed tree regeneration method for shortleaf pine often fails because favorable seed years and disturbances do not coincide.





Figure 2: One-year sprout growth of topkilled shortleaf pine seedlings after prescribed burning. Author notes height of the dead stem. Cumberland County, TN on the Cumberland Plateau. Credit: Wayne Clatterbuck, University of Tennessee

Shortleaf pine is one of the few pine species with the ability to sprout from dormant buds located on a basal crook when the stem is killed.² Burning will allow resprouting (Fig. 2) from the basal crook which may give shortleaf pine a growth advantage and a survival mechanism compared to other species. However, most hardwoods also sprout and can compete with shortleaf pine. The tradeoffs between pine and hardwood establishment, growth and development in mixed stands are poorly understood, even though these stands were widespread before fire suppression activities. Burning certainly had a role, but how burning impacted the mixed composition of these stands is not known.

Future Research Needs

Research, information and procedures in establishing shortleaf pine-hardwood stands are inadequate, especially when a shortleaf pine seed source is no longer available.

Thus, specific guidelines or recommendations based on research are absent on how to establish these mixed stands. A few of the questions that are being investigated include:

1. What is shortleaf pine seedling survival rate with prescribed fire? Does the time or season of the year affect sprouting and survival? Preliminary results indicate the survival rate of 1- to 3- year-old seedlings is 40 to 45 percent and that season of burning had little effect on survival.¹ These results suggest that if burning is used to promote shortleaf pine seedling establishment, more of than half of the seedlings die and thus planting rates should be doubled to achieve the prescribed number of seedlings.

2. What is the best site preparation method to establish planted shortleaf pine among naturally regenerating hardwood species: burning, herbicide, or combinations of burning and herbicide? How does shortleaf pine grow and develop compared to hardwood sprouts of various species? Burning and herbicide treatments will have different impacts on different hardwood species.

3. Is it possible to establish shortleaf pine seedlings not only in even-aged stands with hardwoods, but in residual hardwood stands that have an open overstory component, i.e., creating a two-aged stand? How does shortleaf pine establish and develop in such conditions? Two-aged stands provide some overstory presence and mast potential for wildlife while establishing both planted pine and natural hardwood regeneration in overstory openings.

Although the answers to these questions at this time are not available in the literature, historically these stands were present and provided varied management scenarios based on ownership objectives. One of the most common scenarios was to have a mixed stand where the pine could be harvested early to provide an intermediate income leaving the hardwoods for longer rotations. However, the opposite could also take place, harvesting the hardwood for fiber markets and leaving the shortleaf pine for quality sawlogs or poles. Mixed species gives landowners many options, especially on marginal or cutover forest land that is presently poorly stocked or with degraded residual trees of limited value or habitat.

References

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