CONVERSION OF AN OAK SEED ORCHARD TO OAK SILVOPASTURE

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Abstract—The potential of hardwood silvopasture has yet to be realized in the Southeastern United States. The decommissioning of the Stauffer Nursery, Opelika, AL, provided the opportunity to intensively research hardwood silvopasture using various oak species. Average crown diameter ranged from 5.9 feet in white oak (*Quercus alba*) to 10.7 feet in Nuttall oak (*Q. nuttallii* Palmer). Nuttall oak trees had significantly larger diameters, greater heights, and clear stem lengths than any of the other measured species, while white oak trees have the lowest values. Willow oak (*Q. phellos* L.) and cherrybark oak (*Q. pagoda* Raf.) averages are comparable.

INTRODUCTION

Land ownership patterns have shifted dramatically in the Southern United States. Large tracts of forested acreage have changed hands (Wear and Greis 2002), and long-term ownership may no longer be the norm (Clutter and others 2007, Wear 2007, Wear and others 2007). Changes in population growth and demographic patterns, i.e., urbanization, within the Southeast have resulted in subsequent changes in land valuations, with traditional forestry often a poor second to real estate development. Forest landowners are increasingly diverse in expectations of forest lands and forest experiences. These changes impact the ability of State and Federal Agencies to provide southern forest landowners and managers with viable land management alternatives and income from forests.

Many forested acres in the United States are stocked with an overabundance of small-diameter trees (Compass Magazine 2005). In areas in the Southeast where row cropping, grazing, or pulpwood markets are no longer viable or where there is a threat of tree insect and disease epidemics, silvopasture is an increasingly attractive land use alternative. Silvopasture combines intensively managed timber with pasturing and offers the opportunity to simultaneously accrue multiple benefits such as high-value timber products, livestock forage, wildlife habitat, other agricultural crops, and biofuel crops.

The potential of hardwood silvopasture has yet to be realized in the Southeastern United States. Whereas the concepts are not new, hardwood silvopasture is little used in this region. These systems require intensive management to maximize economic returns (Garrett and others 2004), and, in the Southern United States, such investments are usually focused on plantations of loblolly (*Pinus taeda* L.) and slash pine (*P. elliottii* Engelm.) which in the past have realized a respectable return on investment. However, the overabundance of high-density, low-quality loblolly pine stands may provide managers seeking alternate income sources an unprecedented opportunity to convert such stands to pine silvopasture through intensive thinning or to hardwood silvopasture on lands less suited to high-quality softwood production. Fike and others (2004) stress the importance of choosing species that are marketable, have high-quality wood and rapid growth, that are deep rooted and drought tolerant, and that produce additional products, such as nuts.

The decommissioning of one of Alabama's State nurseries, the Stauffer Nursery, in Opelika, AL, has provided a chance to intensively research hardwood silvopasture using various oak species. Many species of southern oaks have high-quality wood in addition to producing hard mast, a valuable food for wildlife. This makes the oaks a potentially good choice for establishing hardwood silvopasture. The objective of this study was to demonstrate silvopasture alternatives for managers and private landowners in hardwood systems, using various oak species.

MATERIALS AND METHODS

The study site at Stauffer Nursery was planted 10 to13 years ago with various oak species on a 30- by 30-foot spacing, now ideal for studying hardwood silvopasture systems. No one species was planted in a single year; rather, over the 3-year span, individuals selected from the wild were dug up and planted as mother trees. The planted species are valuable oaks, namely Nuttall oak (*Quercus nuttallii* Palmer) or Texas red oak (*Q. texana* Buckley), willow oak (*Q. phellos* L.), cherrybark oak (*Q. pagoda* Raf.), white oak (*Q. alba* L.), Shumard oak (*Q. shumardii* Buckley var. *shumardii*), and swamp chestnut oak (*Q. michauxii* Nutt.). All trees were planted in separate blocks and there are no replications, making the results applicable only to this particular site. We measured tree height, diameter at breast height (d.b.h.), number of epicormic branches over 3/8 inch in diameter, average clear stem, live crown ratio, and crown diameter in two directions (north and west). Live crown ratio is the live crown length divided by total tree height. Simple t-tests were performed to make between-species comparisons of the measured variable means. Future plans include determining log value of trees, influence of cattle on discoloration of sapwood, and use of the system by wildlife.

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Table 1—Average tree parameters for the studied species at Stauffer Nursery

Oak species	Trees	D.b.h.	Height	Clear stem	Crown diameter	Live crown ratio
	number	*inches*	---------- *feet* ----------			
Nuttall	132	8.9	34.6	8.6	10.7	0.7
Willow	163	7.1	26.8	6.8	9.3	0.7
Cherrybark	136	6.7	26.0	6.7	8.2	0.7
White	127	4.8	18.4	3.8	5.9	0.8
Shumard	104	6.1	24.4	4.4	7.7	0.8
Swamp chestnut	104	5.9	21.3	3.9	7.4	0.8

D.b.h. = diameter at breast height.

Table 2—T-test probability values for d.b.h. of six oak species at Stauffer Nursery

Oak species	Willow	Cherrybark	White	Shumard	Swamp chestnut
Nuttall	0.0001	0.0001	0.0001	0.0001	0.0001
Willow		0.1146	0.0001	0.0003	0.0001
Cherrybark			0.0001	0.0175	0.0001
White				0.0001	0.0001
Shumard					0.2767

Table 3—T-test probability values for height of six oak species at Stauffer Nursery

Oak species	Willow	Cherrybark	White	Shumard	Swamp chestnut
Nuttall	0.0001	0.0001	0.0001	0.0001	0.0001
Willow		0.1885	0.0001	0.0004	0.0001
Cherrybark			0.0001	0.0009	0.0001
White				0.0001	0.0001
Shumard					0.0001

Table 4—T-test probability values for clear stem length of six oak species at Stauffer Nursery

Oak species	Willow	Cherrybark	White	Shumard	Swamp chestnut
Nuttall	0.0001	0.0001	0.0001	0.0001	0.0001
Willow		0.6054	0.0001	0.0001	0.0001
Cherrybark			0.0001	0.0001	0.0001
White				0.0001	0.1026
Shumard					0.0001

RESULTS AND DISCUSSION

Six species of oaks were measured for baseline information at the Stauffer Nursery. Average crown diameter ranged from 5.9 feet in white oak to 10.7 feet in Nuttall oak (table 1). Epicormic branches were recorded for only three of the species, Nuttall oak (2.6 per tree), willow oak (0.6 per tree), and cherrybark oak (0.6 per tree), as they were the only species that had been pruned. Nuttall oak trees had significantly larger d.b.h., greater heights, and clear stem lengths than any of the other measured species (tables 2, 3, and 4; $P \leq 0.05$), while white oak trees have the lowest values. Willow and cherrybark oak averages are comparable.

A well-managed silvopasture system provides economic and environmental benefits to the landowner and to society (Shrestha and Alavalapati 2004). While the trees themselves are a long-term investment if utilized for timber, the livestock, understory crops, nuts, and wildlife can provide more constant, reliable, and immediate sources of income for the landowner. The potential for using a silvopasture system to produce biofuels and/or carbon credits has yet to be determined but will no doubt be thoroughly researched by those engaged in conserving open spaces and productive land resources for future generations. Future research at the Stauffer Nursery has the potential to provide information to landowners and natural resource managers on alternative forest management strategies to meet the changing land use objectives of today's forest owner.

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