Shortleaf Pine INITIATIVE

Silvopastural Management Using Shortleaf Pine

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Silvopastural management systems integrate forage and/or livestock production with growing trees for forest products (Fig. 1).[4] Although management of silvopastures is more complex than conventional forests and pastures, there are economic and environmental advantages to silvopastures. Silvopastures that are actively managed to maintain a balance of growing space for forages and trees have shown better financial performance than either plantation forestry or cow-calf pastures over a wide range of conditions.[3,9] The diversification of products associated with silvopastures provides protection from unfavorable market conditions, weather, and/or agricultural policy changes.[11] The product diversification and greater utilization of growing space also improves the financial feasibility of producing timber and livestock on relatively small land areas.[9]

Figure 1: Silvopastural management system under slash pine. Credit: Natural Resource Conservation Service

There are several environmental benefits of silvopastures. With silvopastures, chemical or mechanical measures to control competing vegetation between trees are reduced due to cattle grazing. Tree fertilization is also not necessary within silvopastures because fertilization of forage is beneficial to trees as well. The even distribution of shade in silvopastures protects livestock from summer heat and winter chill, and prevents waste "hotspots" that result from cattle congregating in isolated shady areas within conventional pastures.[9] Pastures store over 90% of carbon below-ground as soil organic matter, and forests often store carbon above-ground as woody plant tissue and coarse debris. Silvopastures have both characteristics, making them more efficient than pastures and forests at sequestering carbon.[12] Silvopastures are also relatively efficient at capturing and recycling nutrients, which improves groundwater quality. Tree root systems within silvopastures can capture nutrients that leach below the rooting zone of forages. Nutrients captured by trees are recycled which increases soil nutrient retention and reduces nutrient runoff.[7]

Silvopasture is the most common form of agroforestry in the Southeast United States,[14] with management practices that have been developed over decades of research. Southern pines are often managed in silvopastures due to their economic significance and adaptation to a wide array of site conditions. Loblolly pine (*Pinus taeda L.*) and slash pine (*Pinus elliottii Engelm.*) have the greatest amount of research-based silvopastural management information among the southern pines due to their growth capacity, but it is possible to manage viable silvopastures with shortleaf pine (*Pinus echinata Mill.*) as well.

Figure 2: Silvopastural management system using Loblolly pine and bermudagrass, at a Southeastern Coastal Plains site: LSU AgCenter Hill Farm Research Station. Credit: Terry Clason

Management Considerations

Silvopastures can be established by either planting trees (Fig. 2) into existing pastures or by establishing forages under trees. Tree spacing is an essential component of silvopastural management due to its influence on forage yields via shading. Tree spacing and configuration is also a determinant of forest product yields.

Generally southern pine silvopastural planting densities range from 100 to 400 trees per acre.[10] Planting density is based on management objectives (such as forage crop, grazing intensity, and forest products desired) and equipment constraints.[10] There are many possibilities of tree configurations that fall within the optimum range of planting densities for silvopastures. Single rows of trees spaced greater than 12 ft. apart have high potential for optimizing the balance between livestock and timber production (Fig. 3).[2] For regions with good pulpwood markets, planting multiple closely-spaced rows (6 to 12 ft.) alternating with wide spacing (25 ft. or more) fosters greater pulpwood production.[2] However, planting in a configuration with more than two closely-spaced rows results in slower growth of trees in the interior rows because outer-row trees grow faster due to their greater access to light and soil resources. Grazing should be delayed for two to three years (or until terminal buds are above reach of livestock) after trees are planted to prevent trampling and browsing injuries by cattle; the silvopasture can be used for hay production during its initial years.[8,10] Alternatively, high tensile electric wire on each side of seedling rows can be installed to protect seedlings and allow for earlier grazing.[13]

Establishing silvopastures in forests begins with thinning trees to improve light availability for forages. For example, a thinning regime for loblolly pine may consist of thinning the stand to 100 trees per acre at age 20 and then reducing stand density by thinning half the stand every five years until age 30.[4] Final harvest is conducted at age 35. Forage crops are established after the first thinning by first using prescribed burning or disking and herbicides to reduce woody debris and non-crop trees in the understory. Forage crops are then planted by broadcast seed or sprigging, followed by fertilization.

There are several grass options for silvopastural management (Table 1).[5] Cool-season grasses can be selected to reach peak production in the spring when temperatures are moderate; generally such grasses should not be grazed below three inches in height.[13] Two cool-season grasses that have been tested in silvopastural systems with shortleaf and loblolly pine are tall fescue (*Festuca arundinacea Schreb.*) and orchardgrass (*Dactylis glomerata L.*).[1] Orchardgrass managed as monoculture and as a binary mixture with tall fescue can be viable cool-season forages for silvopastures in northwestern Arkansas[1] and other northern regions of the Southeast U.S. (northern Arkansas, Tennessee, Kentucky, Virginia, West Virginia). Warm-season grasses can also be managed in silvopastures. Generally warm-season grasses are grazed no shorter than eight inches within the growing season, but there is variability in this grazing height depending on forage species and site conditions.[13] Bahiagrass (*Paspalum notatum Flüggé*) and bermudagrass (*Cynodon dactylon L.*) varieties are viable warm-season forages for southern pine silvopastures.[4]

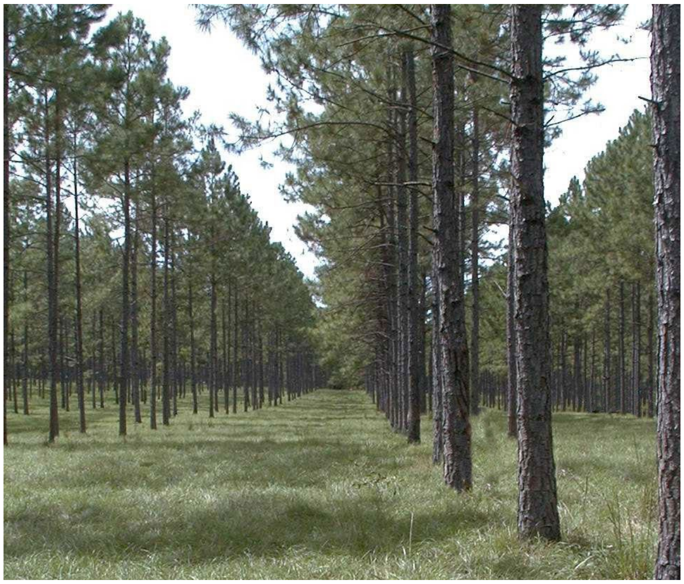

Figure 3: Silvopasture management system using single rows. Credit: Natural Resource Conservation Service

Special Considerations for Shortleaf Pine Silvopastures

There is little research-based information on managing shortleaf pine in silvopastures.[6] Due to shortleaf pine slower growth, seedlings likely require protection from livestock for longer periods than loblolly or slash pine.[6]

Table 1: Forage options for silvopastural management.*

	Cool Season Grasses	Warm Season Grasses
Species	tall fescue orchardgrass	bahiagrass bermudagrass
Minimum Grazing Height	3 inches	8 inches
Peak Production	Spring	Summer
Special Considerations	Use either orchard grass alone or mixed with tall fescue; cool season grasses are generally better-adapted to northern areas of the Southeast (northern and northwestern Arkansas, Tennessee, Kentucky, Virginia, West Virginia)	There can be variability in grazing height depending on species and site; warm season grasses are better-adapted to southern areas of the Southeast (states/regions included in and south of a range spanning west to east, from northern Arkansas to northern North Carolina)

**References (1, 4, 5, 13)*

Shortleaf pine influence on forage growth may differ somewhat from other southern pines because of its smaller needles, which result in canopies that are less dense than those of other southern pines. As such, shortleaf pine has lower shading than other southern pines. Forages with higher light requirements can grow better under shortleaf pine than other southern pines, but forages such as orchardgrass that grow relatively well with shading could have somewhat lower yields under shortleaf pine.[1]

Shortleaf pine area has been declining within its native range for decades. Integrating shortleaf pine into silvopastural management is a means to improve the distribution of the species. The ability to continually produce livestock and/or hay as trees mature can aid in overcoming the longer rotation lengths necessary for shortleaf pine relative to loblolly and slash pine.

References

[1]Burner, D.M. 2003. Influence of alley crop environment on orchardgrass and tall fescue herbage. Agron. J. 95:1163-1171.

[2]Burner, D.M., Dwyer, J.P., Godsey, L.D. 2011. Stocking rate mediates responses of mid-rotation loblolly pine in west-central Arkansas. Agroforestry Systems. 81:287-293.

[3]Clason, T.R. 1995. Economic implications of silvopastures on southern pine plantations. Agroforestry Systems. 29:227-238.

[4]Clason, T.R., Robinson, J.L. 2000. From pine forest to a silvopasture system. U.S. Department of Agriculture, National Agroforestry Center, AF Note 18. 4 p.

[5]Clason, T.R., Sharrow, S.H. 2000. Silvopastoral practices. P. 119-147 In: Garrett, H.E. et al. (eds.) North American agroforestry: an integrated science and practice. ASA, Madison, WI.

[6]Guthrie, K.D. 2012. Overcoming the littleleaf myth: establishing a shortleaf pine silvopasture on redstone arsenal. M.S. thesis, Auburn University.

[7]Jose, S. 2009. Agroforestry for ecosystem services and environmental benefits: an overview. Agrorforest. Syst. 76:1-10.

[8]Lewis, C.E., Burton, G.W., Monson, W.G., McCormick, W.C. 1984. Integration of pines and pastures for hay and grazing. Agroforestry Systems. 2:31-41.

[9]Nowak, J., Blount, A., Workman, S. 2008. Integrated timber, forage and livestock production: benefits of silvopasture. Cir1430. Institute of Food and Agricultural Sciences, University of Florida.

[10]Robinson, J.L., Clason, T. 2000. From a pasture to a silvopasture system. U.S. Department of Agriculture, National Agroforestry Center, AF Note 22. 4 p.

[11]Sharrow, S.H. 1999. Silvopastoralism: competition and facilitation between trees, livestock and improved grass-clover pastures on temperate rainfed lands. In: Agroforestry in Sustainable Agricultural Systems. L.E. Buck, J.P. Lassoie, and E.C.M. Fernandes (eds). CRC Press, LLC. Boca Raton, Florida. 416p.

[12]Sharrow, S.H., Ismail, S. 2004. Carbon and nitrogen storage in agroforests, tree plantations, and pastures in western Oregon, USA. Agroforestry Systems. 60:123-130.

[13]Walter, D. 2013. Silvopasture. In: Gold, M., Cernusca, M., Hall, M. (eds.) Training manual for applied agroforestry practices. University of Missouri, Center for Agroforestry. Available online at: http://centerforagroforestry.org/pubs/training/index.php

[14]Zinkhan, C.F., Mercer, D.E. 1997. An assessment of agroforestry systems in the southern USA. Agroforestry Systems. 35:303-321.