MISSISSIPPI STATE UNIVERSITY EXTENSION

Trees for Pasture-Based Livestock Systems in the Southeastern U.S.

Figure 1. Goats grazing under a mixed woody plant area.
Photo by Joshua J. Granger

Natural shade provided by trees can help ease heat stress in livestock systems in the southeastern United States (Figure 1). For example, shade provided on feeders increased the feeding time and feed intake of female goat kids. In a study on West African hair sheep, shade reduced solar radiation by 92.6 percent and significantly lowered their respiratory rate and body temperature compared to animals without shade.

While artificial shade (i.e., provided by built structures) can be effective, it can sometimes trap humidity and increase heat load depending on construction materials and weather conditions. Average temperatures reported were 75.7°F without shade and 75.9°F under the tarp shade, and relative humidity was 77.8 percent without shade versus 85.9 percent under the shade. Alternatively, natural shade (i.e., shade provided by trees) has been shown to improve heifer weight gain and lower the cost of gain compared to artificial shade. High summer temperatures and humidity in the southeastern U.S. can cause heat stress in ruminants. Sheep and goats may experience heat stress when the temperature humidity index (THI) is as low as 82; dairy and beef cattle can experience heat stress with a temperature humidity index as low as 70.

Trees are a low-cost, effective solution that can provide relief from heat and humidity, as well as additional forage for ruminants, even considering the time it takes for trees to establish before livestock can use the shade. However, not all tree species are suitable for pastures or livestock. This publication provides information on eight U.S. native tree taxa that can be effectively integrated into ruminant grazing systems throughout the southeastern U.S. They are honey locust, black locust, common persimmon, sugarberry, black walnut, hickories, white oak, and eastern cottonwood.

Honey Locust

Honey locust (*Gleditsia triacanthos*) is a deciduous tree that has gray-brown, plate-like bark and feathery, compound leaves that provide dappled shade (Figure 2). Wild honey locust trees have clusters of large, barbed thorns, but thornless cultivars are commonly available. Its long, reddish-brown pods are highly palatable to livestock and wildlife, including sheep, goats, cattle, deer, squirrels, rabbits, hogs, opossums, and raccoons. However, complete use of pods by sheep, cattle, and horses often requires mechanical processing. The small, yellow flowers can be a source of nectar for bees, which gives the tree its common name. As a nitrogen-fixing species, honey locust is well suited to silvopasture, providing shade, soil enrichment, wind protection, and compatibility with many forage crops. The wood from the honey locust is dense, strong, and durable, making it suitable for small-scale posts and pallets. Honey locust is fast-growing and well-adapted to full sun and well-drained soil.

Figure 2. Honey locust leaves and pods.

Black Locust

The black locust (*Robinia pseudoacacia*) can be toxic for some livestock, including cattle, horses, and poultry (Figure 3). Specifically, the bark, seeds, and new leaves contain toxic proteins that can cause diarrhea, weakness, paralysis, and death. While toxicity can be an issue, it should still be considered for silvopasture in most cases. It is important not to confuse the honey locust with the black locust. Honey locust is considered non-toxic; it fixes nitrogen, has higher nutritive value (i.e., crude protein concentration), and has more rot-resistant wood. Black locusts have larger leaflets, smaller thorns and pods, and bigger, white flowers compared to honey locusts. Pastures with livestock that are not susceptible to black locust, such as goats, can be used to provide black locust trees for forage or rot-resistant fence posts. Black locust is generally considered a more efficient nitrogen fixer than the honey locust.

Figure 3. Black locust leaves and flowers. *Photo by Leslie J. Mehrhoff, University of Connecticut, Bugwood.org*

Common Persimmon

Common persimmon (*Diospyros virginiana*) has large, oval leaves and dark brown to black bark with blocky plates. It produces highly nutritious fruits that are sweet when ripe, but somewhat tart due to tannins (Figures 4 and 5). Persimmons have separate male and female trees, so both are needed on the same site to produce fruit, which can take up to 10 years to come into full production. The leaves and fruits can provide good-quality forage for livestock. Common persimmon is also an appreciated timber crop, easy to grow, and suitable for many regions in the U.S. It grows best in well-drained, sandy soils in full sun to partial shade, though it can tolerate hot, dry conditions, poor soils, and wind. This species can also be used in silvopastoral systems because its dense canopy allows forage to grow beneath it.

Figure 4. Common persimmon bark is dark brown with blocky plates. *Photo by Ashley Schulz*

Figure 5. Common persimmon leaves and sweet, orange fruit.

Sugarberry

The leaves of sugarberry (*Celtis laevigata*) are round at the base, taper to a point at the top, and sometimes have serrations along the edges. Its distinctive warty bark is a key identification feature. Sugarberry also produces small, sweet fruits that are often eaten by livestock, songbirds, wild turkey, and deer, in addition to the leaves and fine twigs (Figures 6 and 7). Sugarberry can often outcompete other plants because it releases mild toxins into the soil that prevent other plants from growing. These plant toxins are not toxic to animals. Sugarberry grows best on moist sites but can tolerate a wide variety of growing conditions.

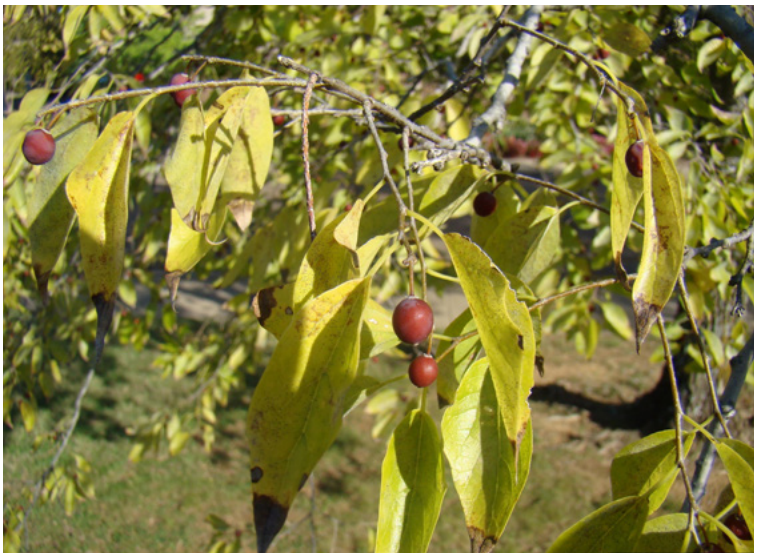

Figure 6. Sugarberry leaves and fruits. *Photo by Franklin Bonner, USFS (ret.), Bugwood.org*

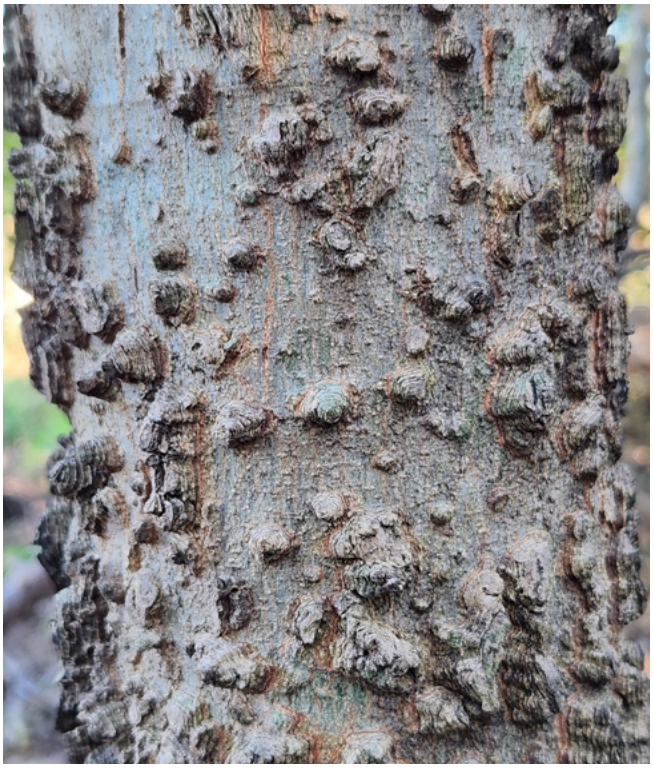

Figure 7. Warty bark of sugarberry. *Photo by Ashley Schulz*

Black Walnut

Black walnut (*Juglans nigra*) has long, compound leaves with up to 24 leaflets. The bark is brown, ridged, and sometimes has a rough diamond pattern. The roots and decomposing leaves produce a toxin called juglone, which seeps into the soil and can suppress the growth of some herbaceous and woody plant species. Black walnut produces nuts in green husks that split open, leaving the edible nut inside (Figures 8 and 9). It provides shade for cattle and small ruminants, but its leaves, fruit, and wood are toxic to horses. Black walnut shavings are toxic to horses as bedding. The innermost wood of black walnuts is toxic when ingested or touched. Bedding containing as little as 20 percent fresh black walnut shavings, whether from old or new wood, can cause toxicity. Black walnuts are very valuable for timber and nut production and grow well in moist areas near creeks or ponds.

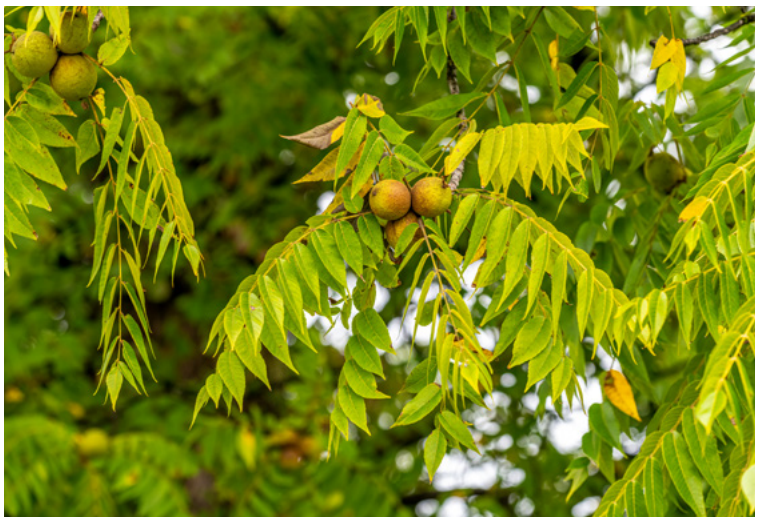

Figure 8. Black walnut leaves and walnuts with green husks.

Figure 9. Nut inside the green husk of the black walnut.

Hickories

Many hickory (*Carya* spp.) species would be suitable for livestock. Two options include pecan (*Carya illinoinensis*) and shagbark hickory (*C. ovata*). Pecan trees have large, compound leaves that offer exceptional shade for livestock in pastures with moist, well-drained soil and full sun (Figure 10). In addition to supporting livestock, pecans can provide a second source of income through pecan nut production. Grazing ruminants can provide a significant reduction in pecan orchard mowing costs.

Shagbark hickory can be identified by its compound leaves with, most commonly, five leaflets, as well as its distinctive shaggy bark when mature (Figures 11 and 12). It grows well in full sun to part shade on well-drained sandy and clay loams in the northern parts of Mississippi and Alabama, though it is largely absent from the Gulf Coastal Plain and lower Mississippi Delta areas. The nuts of shagbark hickory are often consumed by wildlife, including black bears, foxes, mice, chipmunks, squirrels, rabbits, and birds, and are suitable forage for livestock. Unfortunately, it can take shagbark hickory trees 40 years to produce a nut crop, but they live for a long time, so they will have many years for nut production after they start producing.

Figure 10. Pecan trees have big compound leaves to provide shade.
Photo by Ashley Schulz

Figure 11. Shagbark hickory seedling showing two compound leaves.
Photo by Ashley Schulz

Figure 12. Shagbark hickory nut with green husk peeled away.
Photo by Paul Wray, Iowa State University, Bugwood.org

White Oak

Open-grown white oak (*Quercus alba*) has a big, round canopy with lobed leaves that provide excellent shade. Livestock can eat white oak foliage, but it can be toxic if consumed in large quantities (Figures 13 and 14). Compared to other livestock, goats are less susceptible to tannin toxicity, potentially due to their gut microbes, high urea recycling, and salivary secretions. The leaves, buds, twigs, and green acorns of oak trees contain tannic acid, which can make some livestock sick. Symptoms of oak poisoning include depression, loss of appetite, emaciation, nasal discharge, and constipation, followed by diarrhea. The leaves, buds, twigs, and acorns of many oak species are toxic, and all of them produce similar clinical signs and lesions when consumed as more than 50 percent of the livestock's diet. Cattle are most often involved clinically, but sheep, horses, rabbits, and guinea pigs are also susceptible.

Figure 13. White oak leaves have deep sinuses and long lobes. *Photo by Ashley Schulz*

The green leaves and acorns are the most toxic parts of the plant, so all material, including material left after trimming the trees and after storms, that animals can access should be removed. Poisoning can be worse when these materials are available to livestock with very few herbaceous plants to graze and in poor body condition. White oak grows well in a wide range of conditions, ranging from dry to moist soils in full to partial sun. White oak is also a highly valued timber tree, with its wood used to make furniture, musical instruments, and whiskey and wine barrels.

Figure 14. White oak acorns have a warty cap and are green when young, turning brown when mature. *Photo by Paul Wray, Iowa State University, Bugwood.org*

Eastern Cottonwood

Eastern cottonwood (*Populus deltoides*) is a fast-growing species with large, triangular leaves and silvery-gray bark (Figure 15). The fast growth can result in weak wood that is sometimes susceptible to wind and ice damage. Livestock and wildlife can eat the bark and leaves of seedlings and saplings. The leaves contain high protein and amino acid content.

Eastern cottonwood quickly resprouts from established root systems and stumps and is often used as a short-rotation woody crop for biomass production. Female trees produce big plumes of cottony seeds that are consumed by birds, but also quickly disperse and establish new cottonwood trees. It can also grow new stems through root suckers, so it is sometimes considered a problem in areas where grazing does not help control seedling growth. It grows well on moist sites in full sun, adjacent to creeks and ponds, and tolerates pollutants well.

Figure 15. Eastern cottonwood leaves are triangular and high in protein. *Photo by Paul Wray, Iowa State University, Bugwood.org*

Pines

In the southeastern U.S., all four southern pine (*Pinus* spp.) species are suitable for livestock: loblolly pine (*Pinus taeda*), longleaf pine (*P. palustris*), shortleaf pine (*P. echinata*), and slash pine (*P. elliottii*). Ground pine bark can be used as a feed ingredient for goats and sheep to help control internal parasites and coccidian infection (Figure 16). Cattle may eat pine needles, especially during winter or drought. All four pine species can be commercially valuable, though loblolly pine is the most cultivated species for timber production in the southeastern U.S. Combining timber and livestock production on the same land in a silvopastoral system can be financially feasible and environmentally beneficial. Trees sequester carbon and improve groundwater quality (Figure 17).

When planting trees for silvopasture, wider spacing can make it easier to access the area with equipment and allow the grass to grow longer. Denser spacing can help the trees grow better. Slash pine self-prunes better than loblolly pine, and it has fewer limbs. Longleaf pine grows slowly, so cattle should not graze in areas with longleaf pine until the trees are at least 4 feet tall. Loblolly pine and shortleaf pine are most suitable in the northern part, and longleaf pine and slash pine are most suitable in the southern part of the southeastern U.S. All pines can grow well on upland sites in full sun, but loblolly pine and longleaf pine can also grow well in flatwoods with well-drained soils.

Figure 16. Pines can be distinguished by the number of needles in a bundle and the length of the needles. From top to bottom: shortleaf pine, slash pine, loblolly pine, longleaf pine. *Photo by Ellie Fowler, University of Georgia, Bugwood.org*

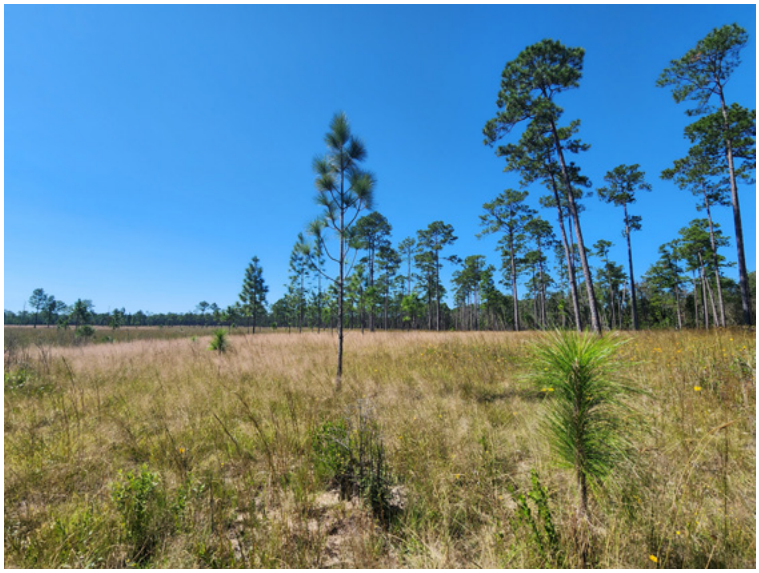

Figure 17. Longleaf pine trees are tolerant to wind, fire, and drought because they put a lot of energy into building a strong root system. *Photo by Ashley Schulz*

Tree Management

Continual, unrestricted livestock management can negatively affect browsing, reducing forest productivity and diversity, lowering biomass, and, if not closely monitored, leading to high overstory tree mortality from girdling. Damage from livestock to trees can include branch and trunk breakage, excessive leaf browsing, and bark stripping, which can cause severe damage, increase risk of disease, and/or lead to tree death. Table 1 shows how quickly these tree species grow before they can be exposed to livestock without damage. When livestock are used to control weed infestations, using the correct stocking rate and rotational grazing provides periods of rest that can promote tree growth, minimize tree damage, and limit soil compaction while also maintaining acceptable livestock performance.

Table 1. Time to grow before exposure to livestock (years) for the different tree species.

Common name (Scientific name)	Time to grow before exposure to livestock (years)
Common persimmon (*Diospyros virginiana*)	3 to 5
Eastern cottonwood (*Populus deltoides*)	3 to 5
Black locust (*Robinia pseudoacacia*)	4 to 6
Honey locust (*Gleditsia triacanthos*)	5
Sugarberry (*Celtis laevigata*)	5 to 7
Black walnut (*Juglans nigra*)	7 to 10
White oak (*Quercus alba*)	7 to 10
Hickories (*Carya* spp.)	8 to 10+

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