



Grazing Livestock in Woodlands

Benefits, Detriments and Management Recommendations

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Disclaimer: *Grazing livestock within woodlands is not inherently wrong, but may not be ideal in all situations. This publication seeks to inform livestock producers about the benefits and detriments of grazing livestock in woodlands, and should be used to aid in determining if grazing in woodlands will or will not benefit an operation.*

Woodlands and pastureland are innate to the Tennessee landscape, and the production of both livestock and timber are vital to Tennessee's commerce. Tennessee's landscape, with its rolling hills, is well-suited for the production of both livestock and timber commodities. There are an estimated 3.5 million acres of pastureland (USDA NASS, 2018) and 14 million acres of forestland (Oswalt, 2012) in Tennessee. Over 50 percent of our agricultural land is used for one or the other, and sometimes these lands are used simultaneously to produce livestock and timber. Although there are some benefits of this multiple land use, care should be taken to avoid or prevent any problems that may result from grazing livestock in woodlands.

This publication has been developed to address concerns of grazing livestock in woodlands and to offer considerations and general management recommendations that will help to meet the needs of livestock producers while protecting woodlands and timber assets.

Benefits of Grazing Livestock in Woodlands

In most cases, woodlands are grazed simply because the trees are present as part of the farm or operation. Even though fencing some of the woodland for protection from livestock could decrease the overall amount of boundary fence to be maintained, doing so requires an obligation of time and financial resources and limits the landmass on which livestock have access to graze, each of which can be scarce. In other situations, livestock are used strategically to minimize undergrowth and reduce competition for nutrients from other plants. Additionally, some operations may choose to utilize silvo-pastoral techniques to capitalize on the investment in landmass, while focusing on both livestock and tree enterprises. Nonetheless, the two primary reasons why livestock managers purposefully graze preexisting woodlands in Tennessee include *access to additional forages* and *protection from environmental stress*.

Access to additional forages — Cattle, sheep and horses are generally *grazers*, which means that they desire to feed on grasses and legumes and do so in a manner that

is not very selective. *Browsers*, such as deer and goats, are opportunists and feed on a variety of ground-level and high-growing vegetation, but choose very specific parts of the plant to consume. When grazers have access to woodlands, they often browse portions of plants that they would not ordinarily have access to in a pasture setting. Through doing so, they often consume and/or trample a portion of the undergrowth, and in a sense, help to minimize competition for nutrients between these and desirable woodland species. When compared to improved pasture, woodland forage alone is often substandard in protein and energy. However, a number of the portions of plants that livestock browse in woodlands often contain greater or equal amounts of these nutrients when compared to unimproved and improved pastures, respectively. For some forages, the nutrient content has been shown to increase as a function of partial shade, when compared to similar forages grown in full sunlight (Garrett and Kurtz, 1983; Kephart and Buxton, 1993).

Production benefits or losses are difficult to quantify, but at best, woodland forage production is estimated to be only 10 percent that of the mass of improved pastures (McQuilkin and Scholten, 1989). Typically, 10 to 40 acres of woodland are required to provide the same cow days of grazing as does 1 acre of improved pasture (Johnson, 1952; Dewitt, 1989; McQuilkin and Scholten, 1989) when woodlands alone provide the animal with all of its grazing and browsing opportunities. However, when paired with additional pasture or grazing opportunities, woodlands may reduce overall pasture requirements or help to conserve pasture forages without a resulting decrease in productivity. Nonetheless, the effects of grazing combined pasture and woodlands versus pasture alone on livestock performance remain to be quantified and are expected to be situationally dependent, as they would be impacted by a number of factors.

Protection from environmental stress — An additional aspect of grazing woodlands that has not yet been quantified is the effect of protection from weather. Cold weather, including rain and wind, are not uncommon occurrences during the calving season. Woodlands, particularly dense woodlands composed of Eastern redcedar, can provide protection to cattle throughout the calving season. However, woodland calving can also make it difficult to observe cattle throughout this period of time or move cattle to working facilities when assistance is required (Hopper et al., 1994). The perceived benefit of the added protection during the calving season

should always be weighed against the management difficulties that may potentially arise as a consequence.

Temperature extremes, whether excessively high or low, stress livestock. High temperatures and humidity, particularly when combined with alkaloids produced by endophyte-infected tall fescue, increase the animal's susceptibility to heat stress. Atmospheric temperatures in the woodland during summer months can be several degrees cooler than in open pasture and provide livestock with a source of shade, which helps to further alleviate heat stress.



Shade offers protection from high temperatures and places less stress on livestock.



Shade is a major benefit of trees, but sometimes shading can be achieved outside protective fence.

In contrast, cold, wet weather, when combined with high wind, results in cold stress, which increases the animal's nutrient requirements for maintenance. Nutrient deficits caused by cold stress that are left uncorrected (i.e., when livestock are not supplemented to fill the nutrient void caused by increased nutrient requirements) will decrease livestock

performance. Nonetheless, woodlands can provide shelter to livestock and help to avoid some of the negative consequences of extreme temperatures.

Detriments of Grazing Livestock in Woodlands

Natural woodlands operate in repeating patterns called cycles. Cycles may be simple or complicated, fast or slow (Mercker, 2016). Cycles in woodlands include the water cycle, plant cycle, carbon and nitrogen cycles, and wildlife cycles. As woodlands proceed through vegetative changes, even intrinsic values such as aesthetics can “cycle.” Woodland grazing, particularly as intensity increases, affects these cycles. Over-grazing should be expected to impact long-term woodland forest composition and may lower the market value of timber. The potential detriments of grazing to woodlands should be strongly considered and generally fall into three categories: *forest productivity*, *toxic plants* and *the environment*.

Forest productivity — Timber production requires the input of natural resources, specifically sunlight, water and soil nutrients. Although sunlight is generally not an issue, the availability of water and nutrients can be limited in grazed woodlands. The latter of these are affected by soil compaction and erosion.

Livestock exert considerable pressure on the soil surface. An animal weighing 1,000 pounds, with four hooves of 20 square inches each, would exert approximately 12.5 pounds per square inch (psi). As livestock walk and two hooves are lifted off the ground, the exertion increases to 25 psi. This is four times the amount of pressure exerted on the soil by the average human. Soil compaction makes it difficult for small, life-sustaining feeder roots to permeate topsoil in order to procure water, nutrients and oxygen. In a sense, excessive soil compaction leads to a non-natural drought-like condition, thereby stressing trees. Further, both water and nutrients have difficulty penetrating compacted soil. Rather than permeating the topsoil, rainwater remains on the surface and is quickly carried off. Along with the water, organic matter washes away and, ultimately, erosion may result (Smith, 2007). If not properly managed, livestock can alter the forest ecosystem by reducing the cover of vegetation and organic matter, compacting soil, lowering moisture infiltration rates, and increasing erosion (Belksy and Blumenthal, 1997; Smith, 2007).

Another area of concern is the destruction of understory seeds, seedlings and saplings. Forest regeneration is continually occurring with new seedlings and saplings germinating and occupying the forest floor. These smaller trees serve as “the trees of tomorrow” by replacing larger



Soil compaction, erosion and root and bark damage (particularly with heavy grazing) can slow tree growth, affect tree health and lead to mortality.

trees that either die or are harvested. Without protection or planned grazing, livestock will consume tree seeds and seedlings and trample the forest understory, which may impede the plant cycle. Without younger trees, older ones will not exist.

Table 1 provides a summary of livestock browsing preference by tree species. When given the opportunity, livestock will selectively graze and browse and prefer some woodland plants over others. Foresters regularly observe higher preference of livestock for many of the more valuable tree species, including oaks, maples, ashes and poplar. In contrast, tree species that are traditionally considered lower value and less desirable, such as Eastern redcedar, American hornbeam and locusts, are often passed over by livestock. In time, as larger trees die or are harvested, these undesirables become the replacements and, as a consequence, dominate the population.



Desirable oak seedlings are browsed, even under light grazing.



Eastern redcedar seedlings are rarely browsed, even under heavy grazing.

Table 1. Preference for livestock browsing of various tree species¹

Readily browsed under light grazing	Browsed under moderate grazing	Browsed only under heavy grazing	Rarely browsed, even under heavy grazing
Yellow-poplar*	Black oak*	Shagbark hickory	American hornbeam
White ash*	Scarlet oak	Dogwood	Eastern hophornbeam
Sugar maple*	Bur oak*	Black walnut*	Common persimmon
Red maple	Pignut hickory*	Honeylocust	Pawpaw
American basswood	Bitternut hickory*		Eastern redcedar
Northern red oak*	Shellbark hickory		Osage-orange
White oak*	American beech		Hawthorns
American elm	Black cherry*		Devils-walkingstick
Red elm	Sassafras		
Blackgum	American sycamore		
Redbud			

¹McQuilkin and Scholten, 1989

*Denotes higher monetary value species

Livestock can also damage overstory timber, which is the portion of trees that form the upper crown cover in woodlands (Mercker, 2018). These are the larger trees, generally of marketable size (or nearly so). Even with their size, larger trees are not immune to the effects of livestock. Sharp hooves can damage roots that have been exposed by soil compaction and erosion. Root injuries subsequently become entry points for decay organisms, which in turn lead to staining of the wood. This damage, referred to by the timber industry as “mineral stain,” often results in a lower price paid for timber products. Further, for reasons already noted, timber growth rate slows in grazed woodlands, often leading to crown die-back, rotten wood and eventual mortality. Growth reduction is difficult to quantify and varies according to the tree species present and soil

type, as well as timber maturity and stocking density. Reduction in the growth rate of timber of grazed versus ungrazed woodland has been estimated at 30 percent to 50 percent (Johnson, 1952).

Poisonous plants — Deciduous hardwood woodlands contain more than 100 woody plants and herbaceous species that can be poisonous or toxic to livestock (McQuilkin and Scholten, 1989). Many poisonous or toxic plants are not palatable and are thus avoided by livestock, but many may be consumed, particularly during times of drought or limited forage resources. Some of the primary poisonous plants common to deciduous hardwood forests that are of concern are summarized in Table 2.

Table 2. Forest plants poisonous to livestock

Common Plant Name	Notes
TREES	
Wild black cherry	Leaves produce cyanide when wilted or bruised.
Oaks	Unripe acorns and young leaves can result in tannin poisoning.
Black locust	Leaves, pods and seeds are poisonous.
Ohio buckeye	Leaves, pods and seeds are poisonous.
HERBACEOUS PLANTS	
White snakeroot	Can cause “trembles,” a fatal condition for cows and calves.
Pokeweed	Varies by plant growth stage and the part of plant consumed.
Black nightshade	Unripe green berries are poisonous.
Bracken fern	Very common in moist woodlands.
Spotted waterhemlock	Very abundant and extremely toxic.
Dutchman’s breeches, Squirrelcorn, and Dwarf Larkspur	Collectively known as “staggerweed” because of the effect on cattle.

Images of poisonous herbaceous plants can be found on pages 8 and 9.

The environment – Aside from the environmental effects that have been referred to in the prior sections, woodland grazing also may affect the environment through influencing wildlife, aquatics and aesthetics/recreation. The extent of the adverse effect on each of these is directly related to the extent of grazing. Seasonal, rotational or low-intensity grazing minimizes the effect on the environment when compared to year-round or long-term intensive grazing.



Grazing, when excessive, can affect the quality of wildlife habitat.

Fundamental requirements for wildlife survival include food, habitat and water. Woodland grazing affects each of these components and may reduce wildlife diversity and abundance. Grazing eliminates some food sources and can limit others, particularly for ground vegetation. Further, nesting habitat is often impacted, as is escape cover. Excessive woodland grazing can also influence aquatic ecosystems. Specific concerns include the loss of streamside vegetation, sloughing of streambank soils, increase of stream turbidity due to suspended soil and organic matter, loss or alteration of aquatic habitat, and increases in bacteria from manure. Aquatic habitat degradation is a principal concern of the fisheries profession, and woodland grazing can be a contributor (Armour et al., 1991). Increased aquatic temperatures due to the loss of streambank vegetation can be harmful (and eventually lethal) to some fish by adversely influencing spawning success.

For some individuals, the aesthetic and recreational value of woodlands may change with the introduction of livestock. This change may be influenced by effects on wildlife and flowering plant populations and the modification or loss of aquatic habitat. However, some forms of recreation might be enhanced.

Management Recommendations to Minimize the Effects of Grazing on Woodlands

As mentioned previously, livestock and timber industries are both vital to Tennessee's economy. Livestock and timber are commodities that each generate income. The highest level of productivity for each can be expected by managing them as separate enterprises when the opportunity exists. However, this is not always possible, and sometimes the two converge. When this happens, management plans should be developed that incorporate aspects of the entire ecosystem and livestock production, while considering the many natural resource attributes of woodlands, including timber, soil, water, wildlife, fisheries and recreation. The following general management recommendations were designed to assist stockmen with developing management practices that protect the forest while meeting the needs of a livestock operation:

- 1. Identify woodland areas that should and should not be grazed.** Seek the assistance of a professional forester and grazing specialist in order to identify the areas that should and should not be grazed. Areas where grazing should be avoided include those with better quality timber and highly sensitive riparian zones. Riparian zones pertain to the areas along banks of a river, stream or lake that normally offer some protection from damaging activities (Mercker, 2018). Be mindful of specific areas that contain plants that are known to be poisonous or toxic when consumed by livestock. These areas should not be grazed unless these plants have been eliminated.
- 2. Fence to protect woodlands.** Fence construction can be expensive, but is generally a long-term investment that can be deducted as a capital expenditure. Interior fences do not necessarily need to have the strength of boundary fences, which helps to reduce fencing costs. Multiple interior fences that separate grazing areas can be used for rotational grazing, which will help to minimize the impact of grazing to the woodland. Temporary fencing can be an effective and economical means of creating temporary interior boundaries that can be moved when necessary to avoid long-term damage.
- 3. If needed, retain some woodland for grazing.** Select small areas with relatively flat terrain and poor quality or more mature timber that has high wind-block and shade values. It is imperative that livestock grazing in these areas have access to water and that movement to working facilities is not overly complicated.



Small patches of woodland can be strategically left for livestock benefit, whereas larger woodlands can be protected.

- 4. Reduce grazing intensity.** When fence construction is not an option, reduce the animal stocking density and duration of grazing to minimize effects to woodlands.



Forage and trees can be grown simultaneously when trees are spaced far enough apart to allow sunlight to reach the surface.

- 5. Limit access to streams.** Use fencing and large stone (as a base) to create watering areas that direct livestock to specific portions of streams and other water bodies, while preventing livestock from loafing or spending excessive amounts of time in the water. Another (preferred) option is to completely restrict livestock from accessing these bodies of water and to provide a more reliable (and clean) water source. This is the most effective way to eliminate damage to stream banks and its associated erosion, which will require the manager to provide livestock with another source of water. Sources might include water troughs, water bladders, or gravity-fed or solar-powered water sources.
- 6. Where applicable, utilize cost-share programs.** The problems associated with livestock grazing in woodlands that are outlined in this publication are generally universally recognized. Both the

federal government through the Natural Resource Conservation Service (NRCS) and the state government through the Tennessee Department of Agriculture (TDA) offer cost-share incentives that encourage livestock producers to protect woodlands from grazing. Contact your local NRCS and TDA representatives to learn about current cost-share opportunities that may apply to grazing woodland

Concluding remarks

Livestock and timber production have and will continue to contribute in a sizable way to the commerce of Tennessee. This publication was developed to inform livestock producers of the benefits and detriments of grazing woodlands. The management suggestions included within the publication offer insight on factors that should be considered when designing a management program that allows for the simultaneous production of livestock and timber. For additional information or assistance, contact your county Extension office.

Common and Latin Names of Plants Poisonous to Livestock



White snakeroot
(*Nabulus albus*)
Photo credit: B. Eugene Wofford



Common pokeweed
(*Phytolacca americana*)
Photo credit: Edward W. Chester



Black nightshade
(*Solanum ptychanthum*)
Photo credit: B. Eugene Wofford



Eastern bracken fern
(*Dennstaedtia punctilobula*)
Photo credit: A. Murray Evans



Spotted waterhemlock
(*Conium maculatum*)
Photo credit: John R. Evans



Dutchman's breeches
(*Dicentra cucullaria*)
Photo credit: Marty Silver



Squirrel corn
(*Dicentra canadensis*)
Photo credit: Thomas G. Barnes



Dwarf larkspur
(*Delphinium tricorne*)
Photo credit: Edward W. Chester

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