Stocker cattle graze in a loblolly pine-based silvopasture in central Virginia. Photo courtesy of Greg Frey.

Silvopastures – Some 'whats' and 'whys'

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What is silvopasture?

For good communication, right understanding rests upon clear, agreed-upon definitions. Interestingly, it's often easier (or even necessary) to define something by what it's not rather than by what it is. Three such "what-it's-nots" readily come to mind in the case of silvopastures.

Silvopasture may appear to be a new practice, but it's probably safer to say this is an old practice that we're re-learning. Cattle grazing under locust trees is a reasonable representation of practices that were common on Eastern farmsteads several decades ago. Trees were a source of poles, posts, fuel and fodder; leguminous trees such as locusts also were an important source of nitrogen in a world without industrial fertilizers.

The two other "what-it's-nots" of silvopastures discussed here are critical to understanding these systems in a management context. First, silvopasture is not turning livestock loose in the woods, nor is it a single tree standing in a pasture. In both cases, when livestock have uncontrolled access to trees with little to no management, several negative outcomes are likely. So if it is not these things, what then is silvopasture?

Silvopasture is the term most commonly used to describe integrated tree, forage and livestock management systems. "Silvo" references the tree or forest component, and "pasture" encompasses the forage and livestock elements. Silvopasture systems can be created by planting trees in pastures or by establishing forages under thinned trees. Each of these approaches has unique demands and opportunities, but in both cases, the systems rely on the "four i" principle, in which management is intentional, integrated, intensive and interactive. All components of the system – trees, forages and livestock – are combined and under active management in order to create beneficial relationships and optimize the system's outputs and outcomes.

Silvopastures most commonly are managed so that the trees provide long-term economic returns while the livestock generate annual income. However, tree crops and products also can improve the short-term economic output of the farm system. Fruits, nuts, pods (e.g., see **Table 1**) or browse can have value for human or livestock consumption – and, in the case of pines, baling needles for straw mulch may provide added farm income.

> **"Forages under trees often green up sooner in spring because of the buffering effects trees have on the forage microclimate. Trees also can have energy-sparing effects on forages; cooling from shade reduces the costs of maintenance during periods of excessive heat or during large swings in temperature."**

Other desired functions or outputs of silvopasture management may include shelter or heat stress abatement for livestock, improved resource use through greater light and nutrient capture, reduced erosion, wildlife food and habitat, and risk reduction (through farm diversification). Whatever the rationale for implementation – and whatever system is implemented – management is the fundamental requirement for success.

Silvopasture in resource optimization

Questions often arise regarding negative interactions that can occur when trees and forages compete for the system's resources, especially light, water and nutrients. The following sections address some of the resource issues and explain system functions in relation to these resources.

Light

From the latitudes of the mid-south and northward, cool-season grasses are the primary species for forage livestock systems. Although species differ in productivity in response to shade, all cool-season grasses are light-saturated at less than full sun. If managed with available light in mind, adding trees to pasture systems does not have to "tank" forage production, and in some cases, moderate shading can even increase forage yield. Tree species selection and management play important roles in these dynamics.

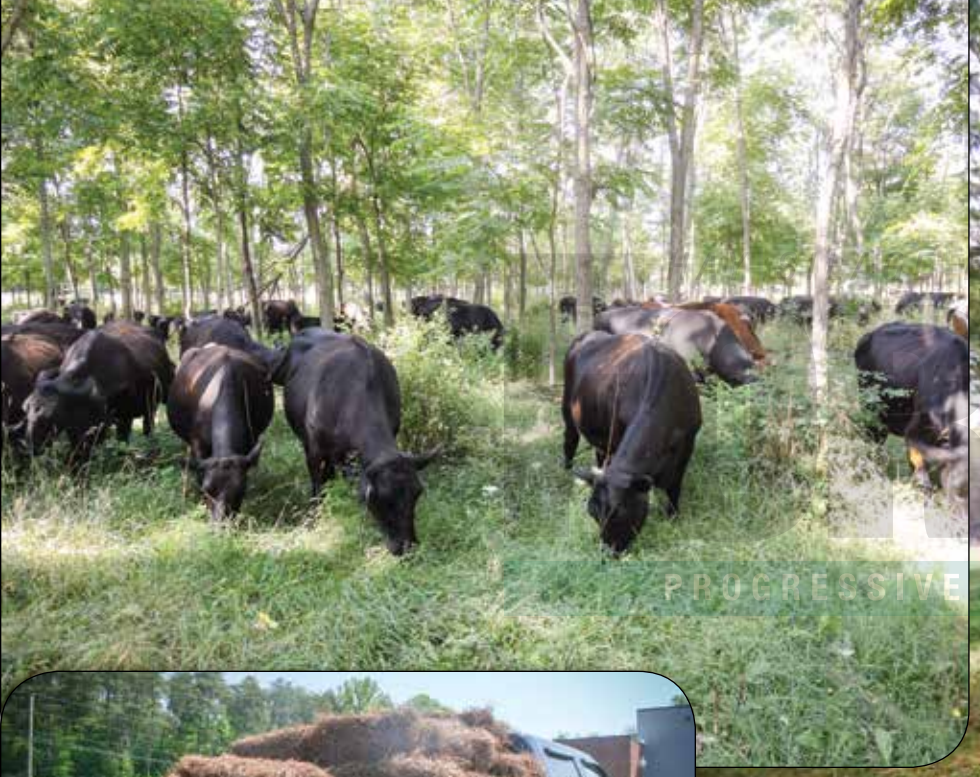
Temperature

Although trees may reduce available light to the forage canopy, there can be positive trade-offs. Forages under trees often green up sooner in spring because of the buffering effects trees have on the forage microclimate. Trees also can have energy-sparing effects on forages; cooling from shade reduces the costs of maintenance during periods of excessive heat or during large swings in temperature. In this way, effects of

Table 1 **Nutritional profile of Millwood honeylocust seedpods from studies in Virginia and a comparison with whole ear corn.**

Pod component or corn	NDF	ADF	ADL	CP	In vitro digestibility
	%				
Husk	27.3 ± 5.3	19.3 ± 4.0	6.3 ± 1.5	6.2 ± 1.0	78.7 ± 5.0
Seed	13.2 ± 1.3	7.5 ± 0.9	–	20.4 ± 1.6	96.3 ± 1.9
Whole Seedpod	23.5	16.1	6.3	9.9	83.3
Whole Ear Corn[1]	28.0	11.0	2.0	9.0	–

[1]NRC 1989. Nutritional requirements of dairy cattle.



TOP LEFT: Cattle graze under black locust trees in a New York silvopasture. BOTTOM LEFT: Depending on species, trees can provide both long-term and annual returns; this pickup carries bales of pine straw marketed by an agricultural supply company. TOP RIGHT: Trees for silvopasture can be planted into pastures, or pasture can be established under a thinned tree stand, as in this picture. Photos courtesy of Brett Chedzoy, John Fike and Greg Frey, respectively.

lower light can be partly offset by lower plant respiration. Lower temperatures can also have positive effects on forage nutritive value and digestibility.

Moisture and nutrients

Tree-forage interactions often are assumed to be negative in terms of soil moisture and nutrients. However, the nature of these interactions depends on multiple factors, including aspect (the direction the slope faces), soil type and depth, tree and forage rooting depths, and tree and forage water and nutrient use efficiencies.

The lower temperatures and reduced wind speeds caused by trees decreases evaporation and transpiration losses. Trees also play an important role in nutrient cycling, accessing nutrients deep in the soil and moving them to the surface via leaf drop. Trees also can increase the system's nutrient use efficiency by capturing nutrients such as nitrogen that are readily leached below the forage root zone – and this in turn supports more rapid tree growth.

Animal production from silvopastures

Many studies have shown that tree shade improves livestock performance and behavior, but data on animal gain in actual silvopastures where trees are broadly distributed are few, particularly in temperate deciduous systems. Animal performance was not reduced in an early stage mixed pine-walnut silvopasture system in Missouri, despite a 20 percent reduction in forage production, and we have seen similar results in Virginia. Increased forage nutritive value and energy-sparing effects of a more comfortable environment likely are the primary factors that support comparable rates of gain between systems where forage yield reductions are observed.

Environmental outcomes

Silvopastures provide opportunity to make environmental gains, whether by planting trees or thinning stands. Thinning existing stands can be a path to rehabilitating forests degraded from past abuses – whether through high-grading harvest practices ("taking the best and leaving the rest") or animal mismanagement. Timber stand improvement practices can be used to select and manage for preferred species and to remove reservoirs of non-native invasive tree and shrub species. Adding forages to the understory can heal eroded lands scarred from years of unmanaged livestock access. Similarly, planting trees provides opportunity to reduce runoff and erosion, and the added comfort for livestock can reduce their use and degradation of surface waters.

The system as a whole

Managing trees, forages and livestock on the same piece of ground represents a set of challenges and opportunities beyond that found in monocultural ("forage-livestock" or "tree-only") systems. Even if joining these production systems results in some reduction of each component, the overall combined output of the system can be greater than systems managed as monocultures. Additionally, silvopasture management can be strategically deployed as a part of the whole-farm system to mitigate stresses to livestock or improve environmental outcomes with an eye toward greater profitability over the long term.

Producer adoption and the long view

Silvopastures are not for everyone. They require new skill sets and greater management inputs than needed for typical forage systems. They also require a long view. A common first reaction to the idea is, "I'm not going to harvest those trees, so why should I plant (or manage) them?" This can be answered both from economic and "land ethic" bases. First, the value of a tree can be sold or bequeathed, whether a tree is ready for harvest today or tomorrow. Second, as with Johnny Appleseed (who planted trees for others), our goal as stewards should be to leave the land better – the woodpile higher – for those who will follow. Silvopastures present such an opportunity, and growing interest in these systems is an indicator that more land owners and managers are recognizing it. ***FG***

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The four-I principle of silvopasture

Intentional

Trees, crops and livestock can be specifically chosen for use together in farming systems due to their compatibility and potential synergies. Systems are designed and components are managed together to generate added products and services for the farm enterprise.

Intensive

Silvopasture systems present opportunity to increase the overall output, but this requires a high degree of management. One example involves rotational grazing, which is beneficial for increasing forage utilization and simultaneously reducing potential pressure for browsing trees.

Integrated

Silvopastures are managed across space and time with consideration for how the component pieces fit together. Summer-growing crop trees that provide shade for livestock and forages in cool-season pastures may in turn yield food or fodder in fall.

Interactive

Each of the components of a silvopasture system is managed with the other components in mind, taking advantage of the effect of one on another. Thus, silvopasture management is a continuous optimization process with the manager working to ensure that sufficient resources – light, water, nutrients – are available in the system to support the whole system.