Chapter 4: Silvopasture

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Cattle graze among Missouri pecan trees in this well-managed silvopasture practice.

Defining Silvopasture

Silvopastoral practices intentionally integrate the management of trees, forages, and grazing livestock for a production benefit. It is important to note that allowing livestock to graze in a natural woodland area without active livestock/forage grazing management is NOT considered agroforestry. Silvopasture can be created using two different approaches:

1. Establish trees into existing pasture.
The right choice of tree crop (often matched to soils) allows you to carry on a profitable livestock operation while creating a long-term investment in timber and/or forest products. Young trees allow plenty of light for forage production. Additionally, as the tree component develops, shade and wind protection will enhance livestock performance. Success and longevity of the practice hinges on two primary factors: control of the grass growth around young trees (necessary for early tree development) and proper management of tree densities (necessary for light management and forage long-term production).

2. Establish forages in the woods.
By establishing select forages in an intensively manipulated forest environment, the area can then be jointly managed for grazing and timber production. In most forests, the key to successful silvopasturing will be forage production. Levels of forage production will hinge on two factors: having the light necessary for forage growth and response, and proper rotational grazing. Soil fertility should be adjusted to enhance forage development, and light adjusted by reducing tree density and managing tree spacing. It is important to recognize that long-term timber value and silvopasture viability hinges on keeping trees appropriate for the site and of high quality. Forages should be selected that match grazing objectives and light availability.

General Benefits of Silvopasture

- Diversify farm enterprise
- Improved growth of high quality trees
- Reduced stress and improved animal productivity
- Improved nutrient cycling
- Enhanced wildlife habitat

Properly applied on a landscape, the silvopasture practice can enhance and diversify farm income opportunities, provide environmental benefits and create wildlife habitat. Current research is focused on understanding the dynamics of the silvopastoral practice (i.e., interactions between trees, forages and livestock). The expected outcome is that silvopastoral practices will improve the productivity of the grazing animal, the quality and diversity of forage available to the grazing animal and wildlife, and effectively interpose timber stand improvement across a wide array of forested land.

General Limitations of Silvopasture

- Producer should already be practicing some type of rotational grazing
- Distance and access to water
- Challenges establishing young trees
- Challenges introducing forages to existing woodlands
- Maintaining proper light levels
- Fencing issues

Converting all of a pasture grazing system to silvopastures is unlikely on a wide scale. Many farm managers have a wide variety of existing resources. Choose pastures where tree growth could be ideal and mix with compatible forage(s).

Management Intensive Grazing (MiG) helps to divide the farm into management units. Use the silvopastures strategically to compliment the grazing system. Creating small, fenced paddocks and rotating cattle builds in "recovery periods" for the forage and protects the soil and the trees. Grazing recovery periods can only be achieved when well-designed livestock water supplies and cross fences are used.

Components of Silvopasture

Silvopasture practices are different from other types of agroforestry because they require landowners to manage livestock, as well as trees and forage plants. This three-way interaction means there are three factors to consider when designing your agroforestry practice: livestock, trees, and forages.

The five variables in a silvopastoral practice that can be subjected to management are livestock, livestock grazing practice, tree species, tree density, and forage species. The majority of research conducted has evaluated silvopastoral practices under conifers (mostly pine) with only limited evaluation of hardwood-based practices. Most hardwood research has been conducted with either oak species or nut-bearing species (e.g., black walnut, pecan). In certain instances under deciduous tree stands, forage production has been reported to be equal or even greater than in open exposure to sunlight. Fescue and orchardgrass production has been shown to be greater under a 35-year-old walnut canopy than in open pastures.

Managed grazing practices, similar to open pastures, should be developed and implemented to maximize forage production in a silvopastoral practice. The increased forage production under a canopy would result in increased stocking rate potential and greater productivity per unit of land.

A. Livestock

Cattle and sheep are primarily used in silvopastoral practices. Animal performance can be enhanced via use of silvopastoral practices. This occurs from reduction of heat stress and improved forage availability and nutritional quality. However, there may be instances where browsing livestock, such as species of goats, can be used to eliminate undesirable understory vegetation. In these instances, the livestock receive forage benefits from the woodland, and the woodland is enhanced when invasive or undesirable vegetation is eliminated. Selecting appropriate livestock will help landowners to achieve their objectives.

The greatest difference between silvopastoral and "open" management of cattle or sheep is the contrasting environmental conditions. In the open, such as a conventional pasture or range, radiant heat can be much more intense than in a shaded environment. Shade has been shown to improve animal performance, with primary emphasis placed upon heat stress amelioration. Research with cattle has shown that compared to unshaded or sparsely shaded pasture, uniformly distributed shade results in maximum grazing time.

Heat and cold stress can adversely affect cattle throughout much of the temperate zone in North America. Protection from cold can be important for livestock in northern climates. Properly positioned trees and shrubs can provide much needed protection for pastures, feedlots, and calving areas. Reducing wind speed lowers animal stress, improves animal health and increases feeding efficiency of livestock.

It takes careful management to ensure livestock do not damage young trees. Success will depend on your understanding of livestock behavior.

Grazing Considerations

- **Grazing - early stages:**

Protect trees from livestock in early stages of growth. Electric fencing works well. Once tree limbs are out of reach of stock, there is less to worry about.

- **Grazing - later stages:**

Tree growth likely to reduce annual forage production annually once a full canopy develops. Choosing a shade tolerant forage is important. More aggressive forages are less of a problem. Fit silvopasture practices into the overall grazing "system".

Special Water Considerations for Silvopasture

- Consider using portable water tanks
- If installing permanent tanks, consider concrete tanks
- Consider using tank covers on permanent tanks
- Consider installing water within 600 feet travel distance

Animals acquire water through drinking and from the moisture in the forage they eat. As air temperature increases water requirements also increase. This becomes especially critical as air temperatures exceed 77 degrees F. The need for available drinking water is compounded because forages become drier at higher temperatures. At 90 F, a 600 pound growing steer needs about 13 gallons of water per day. At 60 F, that need falls to eight gallons per day. One distinct advantage of a silvopasture system is that shade is distributed throughout the pasture and greatly reduces high temperature stress on livestock.

Water requirements vary for the kind, size, age, and breed of livestock. For example, *Bos taurus* breeds of cattle (European types) generally consume more water than *Bos indicus* breeds (such as Brahman-influenced breeds). Dairy breeds need significantly more water than beef breeds. The rule-of-thumb used by some livestock managers is one gallon of water per day per 100 pounds of body weight per animal. Water use also varies considerably depending upon the animal's health, air temperature, water temperature, stage of lactation, and other environmental factors.

Water Distribution

Daily intake of water increases when travel distance is less than 600 feet. Water consumption may be 15 percent higher in small paddocks with water in every field (less than 600 feet of travel) than in similar systems with water available at a single source (where cattle may travel between 600 and 2,000 feet to water). When water is located close to the forage resource, the herd's "social structure" is modified such that animals tend to water more frequently as individuals. This tends to keep the herd dispersed throughout the paddock and results in a greater portion of time spent grazing.

Of course, it is not always possible to install the "ideal" water system and many successful grazers utilize water in pastures larger than 32 acres with travel distances to water greater than 600 feet. Dedicated travel lanes have been successful to allow cattle to travel to central water locations. This approach, however, is best suited to level terrain and locations with only slight erosion hazards. To compensate for less than ideal situations special care must be taken to monitor grazing impacts on trees and forages. Adjusting the stocking levels and grazing rotation periods can help protect both the forage and the trees in a silvopasture practice with water distribution problems.

Water supply options for silvopasture include wells, creeks, ponds, springs and even municipal or rural water systems. Ponds can provide a good reliable source of drinking water for livestock and wildlife, as well as providing other benefits. Consider utilizing portable livestock tanks that can be removed during tree management or harvesting operations.

Browsing

Poorly managed livestock can cause two types of damage to trees: browsing and trampling. Livestock preferences are predictable; they will choose grass before they browse conifer trees. However, conifers are attractive to livestock when they are flushing in spring, so that is a good time to keep animals and trees apart. In hardwoods/deciduous trees, livestock browse can be a problem at anytime. When available, livestock will seek out nutritional forage. The browsing of terminal shoots by domestic or wild animals will result in deformity and loss of tree growth. It is therefore desirable to have physical protection around hardwood seedlings. Wire cages, or a single strand of high tensile electric wire along both sides of a seedling (usually 3 feet from seedlings), or seedling row, have been shown effective at reducing browse damage.

Fencing

Proper pasture rotation provides "recovery periods" for the grazed forage, minimizes soil compaction, and protects trees in a silvopasture system. There are several key components in an effective and easily managed fencing system:

Fencing, placed approximately 3 feet from tree seedlings, is effective at reducing browsing damage from livestock.

- An energized fence is primarily a psychological barrier and can only be effective if the fence carries enough current to deliver a "deterrent" shock. Alternating current (AC) powered units are generally the best choice for energizing a fence if 220- or 110-volt power is available. For remote areas, battery powered systems with solar recharge may be necessary. In a silvopasture practice, the potential for malfunction increases with the risk of falling branches or trees damaging the system.
- To assure effective operation, the energized fence should have a proper-sized energizer. Generally one-joule output per mile of fence is sufficient. Be properly grounded with a minimum of three feet of ground rod per joule output. Be protected from lightning by installing a surge protector at the power source, a lightning choke at the fence, and an additional ground rod every 3,000 feet of fence.
- High tensile wire is recommended when using energized fences for border areas and is also used for cross fencing. The number of strands depends upon the type of livestock being grazed. Generally, a minimum of four- to six- strands is recommended for border fencing and one to three strands for cross fencing cattle. Other types of livestock often require special considerations such

as distance above the ground of the bottom wire, and distance between wires for smaller livestock like goats and sheep.
- Polywire or polytape can be used for temporary or portable cross fencing to create smaller paddocks for intensive grazing or to allocate stockpiled pastures for winter grazing. This enhances the manager's ability to provide optimum, forage recovery periods.
- Fencing, placed approximately 3-feet from tree seedlings, is effective at reducing browsing damage from livestock.

Trampling damage

The damage livestock do by stepping on (or against) a seedling, as well as rubbing off the bark, is the number one cause of tree seedling death. Generally, trees are most susceptible when less than 16 inches tall, and during the period of rapid growth in early spring. Trampling damage causes deformation and weakening of the stem, and may also provide an entry point for pests and disease.

You can also use obstacle planting to create patterns that will help control livestock movement. When planting trees, it's important to visualize where animals could be encouraged to walk. With that in mind, you can use a tractor to position small logs or logging debris in rough lines to guide the livestock and keep them away from seedlings. Unlike a standard planting grid pattern, obstacle planting in a row creates a 'fence' that steers animals on pasture pathways between and around tree seedlings.

B. Trees

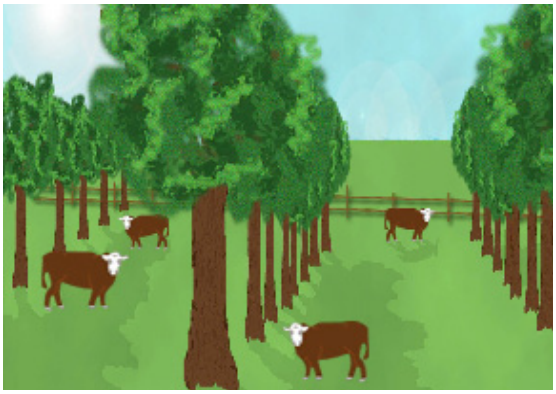
Typically, reforestation is designed to produce quality trees for wood production. Consequently, initial planting densities do not often coincide with producing good livestock forage. Even where good forage is available, supply decreases dramatically once the canopy closes past 50 percent. If trees are planted at 12-foot intervals, then, depending on site condition, that may happen after only 5 to 10 years.

Levels of management for livestock

- **Optimal:** Timing livestock access to the area to maximize positive interactions with the forages and minimize negative interactions with tree seedlings. Frequent rotation to optimize forage health.
- **Improved:** Moving livestock when forage supply is starting to decline and seedling trees have minimal damage.
- **Poor:** "Dumping" livestock on an area and leaving for extended periods of time, causing overgrazing of forages and damage o trees obstacle planting in a row creates a 'fence' that steers animals on pasture pathways between and around tree seedlings.

However, with the selection of appropriate tree species and changes in planting design, it is possible to grow more than 300 trees per acre while maintaining good forage for a longer period. As an example, this can be accomplished by planting at a 8-foot intervals between trees with 18 feet between rows.

Conventional planting is done on a grid pattern. However, by using different configurations, such as the planting scheme mentioned above, or by establishing tree clusters across a paddock, the time between required thinnings may be increased and the area available for forage growth may be maximized. Much wider spacing between tree rows is feasible and depends upon the landowner's objectives. In all but the most widely spaced initial plantings, such as 40 feet by 40 feet, thinnings will at some point be necessary in order to maintain light levels sufficient for forage production.



Tree arrangement on the land

The proper design plan of any silvopasture practice should consider the spacing between select trees and shrubs, both within a tree/shrub row and between tree/shrub rows. Tree arrangement, either during tree establishment in pastures or as a result of thinning trees within managed forested stands, can vary greatly among trees in single, double or multiple rows; individual widely spaced trees; and/or clustered or grouped trees.

Desirable characteristics of an agroforestry tree species

- **Marketable.** This includes both the wood itself and other products such as nuts or fruit, which would provide another source of income.
- **Compatible with the companion crops or forage you choose.** Some trees produce growth-inhibiting chemicals which may effect what you can grow.
- **High quality.**
- **Fast growing or of such a high value that a species of medium growth rate is acceptable.**
- **Deep-rooted** so the trees do not compete with the crops or forage for moisture.
- **Have rapidly decomposing foliage.**
- **Be properly matched to the site.** Site tolerant, suited to either a wet or dry site.
- **The leaves should produce a light, rather than a heavy shade.** This will be especially important as the trees mature and the canopy closes. The lighter the shade that is produced, the longer you can grow crops or forages.
- **Capable of producing the products you desire.**

Advantages of single and multiple row plantings

Single Row

- Better crown space for nut production
- Maintenance is simplified (such as mowing)
- Diversified landscape is created
- Farm production is enhanced

Multiple Row

- Enhanced erosion control
- Better growth of trees for timber
- Improved wildlife value
- Greater diversification of farm products

An aerial view of the Horticulture and Agroforestry Research Center shows a silvopasture research area pattern. Double rows of tree plantings are shown on the left; triple rows are on the right. Multiple rows provide large volumes of wood without overly sacrificing forage production.

Differences exist between the results that can be expected from each tree arrangement. Landowner objectives will determine the best

arrangement of trees and the forages to be used, and it must be remembered that silvopasture management is intensive and dynamic over time.

There are several key factors to keep in mind when establishing the practice on a given site and determining the width of the alley between rows of trees. Key factors include equipment size, forage, changes through time and thinning and pruning.

Factor 1: Equipment Size
A silvopasture design that plans for occasional forage removal by mechanical means, must provide space between the trees so that equipment can move freely. The alley between tree rows should be wide enough to allow clear passage of the widest piece of equipment and should be organized so that full passes of the equipment are utilized. Ultimately, the design should recognize the branch and crown development which will occur over time for a given tree species and that may be associated with products desired from those trees. For example, when planting trees for nut production, where large crowns are desirable, wider space between tree rows should be planned.

Factor 2: Forage
Closer tree spacings may be designed for forages which are more shade tolerant, keeping in mind equipment requirements. However, most forages need a minimum of 50 percent light, so plan to manage tree densities to produce adequate light for forage growth.

Factor 3: Changes through time
Increased shading occurs as trees mature. As this happens, a change toward a more shade tolerant forage will be necessary to maintain suitable yields. These changes can also be offset by timely thinning of lower quality trees and through prunings that reduce branch density in a tree's crown.

Factor 4: Thinning and pruning
Timely thinning can be used to maintain semi-open crown conditions. While used as a tool to manage the light available for forage production, thinning also serves to increase the resources (light, water, and nutrients) available to the remaining higher value trees and therefore, should enhance their growth rate.

Another dual purpose management practice is pruning. Proper pruning of the lower branches, to develop a high-value butt log, can increase log value and increase the space available for operation of equipment. At the same time, this also increases sunlight available to the forage.

Finally, crown management through pruning may be beneficial if the desired tree product is nuts. An open crown not only allows more light to reach interior branch tips (necessary for flowering and fruiting), but also will allow increased light to filter through to the forage.

A single row of pine and fencing allows for managed paddock grazing based on forage response to grazing.

C. Forage

As feed for livestock, forage is a vital component of silvopasture practices. Choose forage(s) that will do well in the level of shade produced by the tree cover and meet the nutritional needs of the chosen livestock. Tree size, density, and pattern all influence understory forage production. Typically, combined canopy coverage must equal or exceed 35 percent before it significantly impacts forage production. How-

Special Considerations for tree spacing

Within a Row

- *Federal/State subsidy program requirements*
- *Production vs. conservation benefits*
- *Wood production vs. other tree products*
- *Grafted vs. seedling planted stock*
- *Markets for small-diameter material*

Between a Row

- *Production vs. conservation objectives*
- *Wood production vs. other tree products*
- *Light requirement of forage*
  Duration of grazing regime
- *Width of farm equipment*

ever, many cool season grasses and legumes perform well in 50 percent shade. Recognize that shade produced by the canopy will increase over time as the trees mature.

Establishing pastures in the forest

1. Prepare your site for seeding as soon as possible after thinning (crop tree) or harvesting (selection cutting or improvement harvest) from the forest, so native vegetation doesn't have a chance to respond to canopy removal and invade the site.

2. Seed immediately after site preparation (light fire or disking, and necessary soil amendments like lime or fertilizer) to give domestic forage the jump on native competitors.

3. Lay out pastures and fencing for rotational grazing.

4. Install water supply to meet livestock requirements.

Annual rye and timothy grass grow well in shaded environments, as shown here under 8-year-old walnut grown between rows of pine.

Forage growth and interaction

The forage component of a silvopastoral practice can be either competitive or complimentary with your trees. Your management decisions will influence which way the practice develops. As the select forage begins to develop and fill an area, it may be beneficial for tree growth to eliminate the forage that would otherwise grow directly adjacent to the tree. It is desirable to use a weed mat, herbicide or some other form of control to eliminate grass growing within two to three feet of seedlings for up to five years. Tree growth will greatly benefit.

Cool season forages have their peak production in the spring when temperatures are cool. Later they are harvested or allowed to become dormant during the summer. These forages should be grazed no shorter than three inches and should be six inches in height at the end of the growing season.

Cool season plants tend to:

- Be competitive for spring soil moisture
- Be less competitive for water in the summer months when moisture may be limiting to tree growth
- Many perform reasonably well under partial shade

Warm season grasses should be grazed no shorter than 8 inches during the growing season and by the end of the growing season, the last grazing rotation should leave the forage with a height of 10 inches. These grasses achieve most of their growth in the summer months.

Warm season plants tend to:

- Be less competitive in the early spring when many trees are beginning their annual growth
- Be more competitive for water during the summer months when trees are putting on the majority of their diameter growth
- Most warm-season grasses native to Missouri do not perform well under partial shade

Can forage be grown in the shade?

Research at the UMCA has shown that many cool-season grasses and legumes, when planted under 50 percent shade, will perform equally to or better than open grown plants. Better performance means overall growth will improve (better yields) and often means that quality will improve, as well as digestibility.

Why?

Tree canopies modify the ground level climate. The combination of modified climate and change in light levels, causes many grasses and legumes to both, increase growth (due to modified climate and moisture), and have less lignin in their leaves (improved quality).

Summary

Always use managed grazing principles with the silvopasture practice. As a part of grazing considerations, do not forget to supply adequate water for the livestock. As a rule, keep livestock within 600 feet of water.

As a part of a farms grazing system, the silvopasture practice can be a nice addition. It offers many opportunities to enhance livestock productivity through both the modified climate it provides and the improved forage it is capable of producing.

Advantages of a Silvopasture Practice:

- *Trees improve climate for grazing*
- *Complements ongoing pasture operations*
- *Shade enhances growth of some forages*
- *Livestock address short-term cash-flow*
- *Problems of forestry*
- *Improved nutrient cycling*
- *Nitrogen-fixing forage crops also benefit trees*

Disadvantages of a Silvopasture Practice:

- *Fencing cost may be increased*
- *Management intensive grazing is required*
- *Equipment operation may be more difficult*

Major factors influencing forage production

- Tree species
- Tree spacing
- Tree age
- Forage shade tolerance
- Forage selection

If you live where it's dry...

Forage can compete with trees for scarce moisture. Seed at lower rates and have livestock available to graze before the forage becomes competitive. By taking these precautions and matching tree and forage selections, your results should be:

- More palatable forage
- More efficient grazing
- More vegetation removal

Success Story

Jim Wilson

Pecan and walnut silvopasture practice near Nevada, Mo.

"Ever since we've been in nut production we've used cattle to control the height of the grass. We also benefit from the value of the beef that we sell in the fall, in addition to the nuts that we harvest.

We chose cattle to run in here because we fertilize these trees with nitrogen and it causes the grass to grow. By grazing, it gives us extra profit from the beef. And it also helps where we don't have to mow as much."

"Another thing that we like about the trees is that it's cooler on a hot summer day. It's at least ten degrees cooler down here, and the cattle are just scattered out everywhere grazing."

2003 SARE Highlights

Good Bedfellows: Cattle, pecan trees in an environmentally sound mix, Haydon Farm, Okemah, Okla.

Oklahoma ranks second in the nation for native pecan production and third for its forage-based beef industry, so it's no surprise that cattle and pecans co-exist on about 50,000 acres. They make good companions. Cattle gain weight on grass that otherwise would require mowing, return nutrients through manure, and prune the lower limbs of pecan trees. In return, orchard shade encourages cattle to graze and gain weight in hot weather. There's room for improvement in that symbiotic relationship, however, says Oklahoma State University (OSU) extension horticulturist Dean McCraw, who is using a SARE grant to refine the system. While most pecan/beef cattle operations use commercial fertilizer and follow a "typical" orchard spray program, "research has shown that profits and environmental impacts can be improved by replacing the purchased nitrogen with legume pastures and developing a customized pest management system based on scouting and weather monitoring," he said. "We are looking at how all these components interact on real farms."

Legume pastures planted in the orchards increased daily weight gain for the steers, improved soil health by reducing grazing compaction, reduced nitrogen runoff and increased habitat for beneficial insects. Over the three-year project, native pecan trees in plots with legume pastures averaged nearly 700 pounds of pecans per acre and over 250 pounds of beef gain per acre without any added nitrogen fertilizer. The result: a savings of nearly $30 per acre in fertilizer cost while essentially eliminating fertilizer runoff potential. The benefit of legumes was most dramatic in flood-prone plots, where legumes prove tough enough to withstand excessive water and out-compete other vegetation.

While the orchard/beef combo proves useful in eastern Oklahoma, with its 100,000 acres of native pecan trees, another SARE project is helping ranchers find the system that best suits their own resources. Damona Doye, OSU extension economist, used case studies of cow/calf operations to identify management strengths and weaknesses in animal science, forages, financial management, and herd health. During the course of the multi-state project, more than 100 ranchers in three states identified

potential cost-saving measures of about $3,000 annually each. Doye shared case study findings with other producers during information exchange forums and offered training to veterinarians and accountants so they can better assist their farm clients to improve resource management practices.

Hardwood silvopasture under white oak at the MU Wurdack Research Center.

Frequently Asked Questions:

Does the silvopasture practice have any long-term effects on soil compaction?
Soil compaction is a valid concern, both from the standpoint of optimizing tree growth, and from the potentially negative influence compaction can have on forage productivity. Any pasture may have problems from soil compaction. And, while it may be more challenging to see the effects of compaction on tree growth, it is visible in forage productivity. Therefore, one of the best ways to gauge whether or not the soil is being overly compacted is by the stand of forage being produced. If a forage stand is thin and does not grow back following removal of the livestock, then soil compaction may be a problem (this assumes that drought or lack of nutrients is not the factor limiting production). Always strive to not overuse pasture. Sound management, such as management intensive grazing, is the best method for limiting soil compaction, and will be evidenced by good forage development. Another way to say this is that if the forage in a silvopasture practice is maintaining growth and productivity, then compaction is not likely a problem.

Will rows of trees planted to a pasture develop an open growth form?
There is the potential that trees established in pastures will develop a more open-grown form. This form, wide crowns and increased branching, while not desirable if trees are grown for timber, is more desirable for trees grown to produce a nut crop. However, in either case pruning will likely be necessary to enhance productivity and often quality. Nut trees require pruning in order to ensure that light reaches flowers and results in nut development. Timber trees will likely require pruning for correction to their form and to enhance their quality. If trees are grown for timber, another option may include planting shrubs/trees adjacent to the timber tree in order to shade its trunk and encourage upright growth. Trainer trees will help reduce side branch development and cause the tree to grow up towards better light.

Is the silvopasture practice sustainable?
Sustainability refers to the long-term potential of a practice to continue through multiple harvests. And, yes the silvopasture practice "trees in the pasture" is sustainable. However, it becomes sustainable through proper planning and management. Planning should include an activities schedule that predicts when certain management will need to take place in the life of the practice. For instance, as newly established trees develop and produce increasing levels of shade, when will thinnings need to take place to maintain light levels adequate for forage production? Is it possible to predict this time? I would say yes, at least within a range. You can do this by looking at the forest site-index from the soil survey and judging the trees height development over time, and of course this will also be dependent on the initial planting density. This is just one example, but it illustrates the importance of planning and management (really the thought process of looking out to the future) on creating a reasonably sustainable practice.

Is "pasture in the forest" a proven silvopasture practice?
No. Experimental trials are underway and show promise. However, long-term impacts of cattle on existing trees in a forest stand, potential for cost-effective regeneration of trees and long-term maintenance of forage under forest canopies are under investigation. Finally, landowner willingness to use management-intensive grazing – essential for "pasture in the forest" – is critical.

Additional Resources

Forum/Blog

http://silvopasture.ning.com/

Course

http://www.silvopasture.org/

Video

http://www.youtube.com/watch?v=VJsKmBbtw7Q and http://centerforagroforestry.org/pubs/videomain.php

Silvopasture

Cornell Univ.: http://www2.dnr.cornell.edu/ext/info/pubs/MapleAgrofor/Silvopasturing3-3-2011.pdf

USDA NRCS: Information Sheet http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_010420.pdf

Garrett, H.E. (editor) 2009. North American Agroforestry: An Integrated Science and Practice (2nd Edition). American Society of Agronomy. pp. 105-132. (Chapter 6)

Garrett, H.E., M.S. Kerley, K.P. Ladyman, W.D. Ladyman, L.D. Godsey, J.W. VanSambeek and D. K. Brauer. 2004. Hardwood silvopasture management in North America. Agroforestry Systems 61: 21-33.

USDA National Agroforestry Center: http://nac.unl.edu/silvopasture.htm

Fike, J. H., Buergler, A. L., Burger, J. A., and Kallenbach, R. L. 2004. Considerations for establishing and managing silvopastures. Online. Forage and Grazinglands. doi:10.1094/FG-2004-1209-01-RV. http://www.plantmanagementnetwork.org/pub/fg/review/2004/silvo/

University of Florida: http://edis.ifas.ufl.edu/fr145 and http://edis.ifas.ufl.edu/fr139

Mississippi State Univ.: http://msucares.com/crops/forages/newsletters/09/4.pdf

Grazing Systems

University of Missouri Extension (Grazing and Watering): http://muextension.missouri.edu/explorepdf/envqual/EQ0379.pdf http://muextension.missouri.edu/explorepdf/envqual/eq0380.pdf

National Sustainable Agriculture Information Service - ATTRA :

Managed Grazing around Riparian Areas: https://attra.ncat.org/attra-pub/summaries/summary.php?pub=116

https://attra.ncat.org/attra-pub/livestock/pasture.html

https://attra.ncat.org/attra-pub/summaries/summary.php?pub=245

https://attra.ncat.org/attra-pub/summaries/summary.php?pub=249

https://attra.ncat.org/attra-pub/summaries/summary.php?pub=244

EXERCISE: REVIEW OF THE SILVOPASTURE PRACTICE

What considerations need to be taken into account in order to develop a successful silvopasture practice?

1. Identify the top three landowner objectives related to creating a silvopasture practice

i.

ii.

iii.

2. What are the three interactive components to consider in design of a successful silvopasture practice?

i.

ii.

iii.

3. What cost-share or incentive programs are available to assist with the silvopasture practice (don't forget to include assistance that might be available to establish managed grazing systems or watering systems)?

i.

ii.

iii.

4. Do you have any major concerns related to integrating the silvopasture practice with the current farm layout (such as access and movement of the livestock)?

5. Are there any conservation agencies or groups that could assist in designing integrated habitat that works with your current farming practices?

i.

ii.

iii.

EXERCISE: REVIEW OF THE SILVOPASTURE PRACTICE

6. What are the two primary ways that livestock can damage trees? And, is there a plan in place to minimize damage should it occur?

i.

ii.

7. What are the four factors that go into planning alley widths for the silvopasture practice?

i.

ii.

iii.

iv.

8. What other considerations are needed to reach the landowner objectives identified in question #1?

EXERCISE KEY

1. Identify the top three landowner objectives related to creating a silvopasture practice Increase acreage available for grazing, Better production from paddocks, Reduced stress on livestock for increased productivity

2. What are the three interactive components to consider in design of a successful silvopasture practice? Forage, Livestock, Trees

3. What cost-share or incentive programs are available to assist with the silvopasture practice (don't forget to include assistance that might be available to establish managed grazing systems or watering systems)? EQIP, SWCD Watering, USDA Rotational Grazing/Fence and Watering Systems

4. Do you have any major concerns related to integrating the silvopasture practice with the current farm layout (such as access and movement of the livestock)? Limiting access to streams and providing alternative watering systems. Protection of young, newly established trees.

5. Are there any conservation agencies or groups that could assist in designing integrated habitat that works with your current farming practices? USDA NRCS, MDC, MU Extension

6. What are the two primary ways that livestock can damage trees? And, is there a plan in place to minimize damage should it occur? Trampling, Browsing, Use single strand of electric fence spaced 3 feet from seedlings.

7. What are the four factors that go into planning alley widths for the silvopasture practice? Equipment size, Forage, Changes through time, Thinning and Pruning

8. What other considerations are needed in order to reach the landowner objectives identified in question # 1? Create a good activities schedule that outlines the process of implementing forest thinning, fencing, forage establishment, creating watering access, etc…

Notes