



Silvopasture Establishment and Management

Conservation Practice Information Sheet **(IS-MO381)**

Silvopasture: Integrating Trees, Forages and Livestock

What is Silvopasture?

Silvopasture is an agroforestry practice that is specifically designed and managed for the production of trees, tree products, forage and livestock. Silvopasture results when forage crops are deliberately introduced or enhanced in a timber production system, or timber crops are deliberately introduced or enhanced in a forage production system. As a silvopasture practice, timber and pasture are managed as a single integrated system.



Silvopasture practices are designed to produce a high-value timber component, while providing short-term cash flow from the livestock component. The interactions among timber, forage, and livestock are intensively managed to simultaneously produce useful timber products, quality forages and profitable livestock operations. Overall, silvopastures can provide cost-effective economic returns while creating a sustainable system with many environmental benefits. Well-managed silvopastures also offer a diversified marketing opportunity that can help stimulate rural economic development.

Planning Considerations

Before a new silvopasture practice is established, implications of merging forestry and livestock systems should be explored thoroughly for economic and environmental considerations. In addition, local land use, zoning, cost-share programs and tax regulations should be investigated. Forest and agricultural land may have separate zoning and land-use regulations accompanied by divergent tax assessments. Environmental requirements (e.g., planting trees, stream-side protection, wildlife habitat maintenance) may also vary with land use.

Plants

When making tree and forage crop selections, consider potential markets, soil types, climatic conditions, equipment needs, and species compatibility. On marginally productive lands, conifer trees are well-suited for silvopastures because they can adapt to diverse growing sites, respond rapidly to intensive management and may permit more light to reach the forest floor than hardwood trees. Select and use trees and planting/harvesting patterns that are suitable for the site, compatible with planned practices and provide desired economic and environmental returns. Clovers or other pasture legumes are often seeded into grass pastures to provide highly nutritious food for livestock and to convert atmospheric nitrogen into an organic form which plants and animals can use. Competition between trees and pasture is reduced by selecting pasture plants which either grow at a different time of year, or are more shallowly rooted than trees. For example, cool season grasses (such as orchard grass or timothy) and legumes (such as ladino or



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red clover) can be seeded into pine stands with little detrimental impact upon growth of either trees or pasture plants.

Trees in pasture provide shelter for livestock during periods of inclement weather. This can significantly improve animal performance during particularly hot or cold times of the year. Trees provide evaporative cooling, reduce radiant heat loss at night, and reduce wind speed. These buffered environmental conditions allow animals to spare energy for growth, particularly under hot conditions. Increased gain, milk yield, and conception rates have been reported for cattle or sheep grazing pastures with trees in warm environments. The tree/timber component should be capable of providing the desired products and be:

- marketable,
- fast growing,
- native (if possible) and
- compatible with the site (soil, temperature, precipitation, planted forages).

Forage growing under the shady, low wind environment near trees tends to mature more slowly and, therefore, be lower in fiber and more digestible than that growing out in the open.

The forage component should be a perennial crop that is:

- suitable for livestock grazing,
- compatible with the site (soil, temperature, precipitation, planted trees),
- productive under partial shade and moisture stress, and
- responsive to intensive grazing management.



Species selection for trees

Tree species should be used from an approved list for silvopasture species. Native trees should be favored where ever possible. The following table is an abbreviated list of suitable tree species.

Table 1. Examples of trees suitable for use in silvopasture			
<i>Uplands</i>			
Black oak	<i>Quercus velutina</i>	White oak	<i>Quercus alba</i>
Red oak	<i>Quercus rubra</i>	Mockernut hickory	<i>Carya tomentosa</i>
Black walnut	<i>Juglans nigra</i>	Persimmon	<i>Diospyros virginiana</i>
Shortleaf pine	<i>Pinus Echinacea</i>	Sugar maple	<i>Acer saccharum</i>
<i>Bottomlands</i>			
Persimmon	<i>Diospyros virginiana</i>	Black walnut	<i>Juglans nigra</i>
Silver maple	<i>Acer saccharinum</i>	Pecan	<i>Carya illinoeinsis</i>
Swamp white oak	<i>Quercus bicolor</i>	Bur oak	<i>Quercus macrocarpa</i>
Green ash	<i>Fraxinus pennsylvanica</i>	Shellbark hickory	<i>Carya laciniosa</i>

Tree Planting Stock

Tree planting stock should be at least 1-2 feet tall with at least a ½ inch caliper. The large initial size is required to facilitate their protection from fire, reduce competition from grass, and damage from livestock. Seedlings may be planted by hand or machine. Soil should be firmly packed around seedling



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roots. Newly planted seedlings should be protected until their height growth is above the browse reach of livestock.

Tree establishment

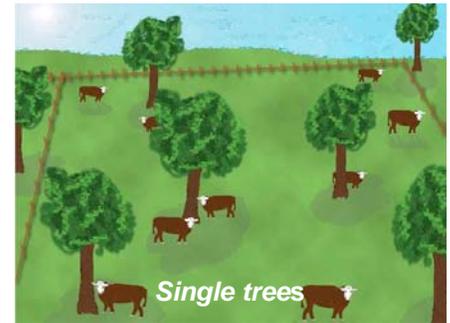
Tree establishment in existing grass fields can be difficult. Items to consider for tree establishment include:

- Site preparation – On sites that have been in pasture and are subject to compaction ripping the soil surface down or adjacent to the planted tree rows before planting will improve growth and survival.
- Weed control – At a minimum, vegetation should be controlled in a three-foot diameter around each tree or row for 2 to 3 years.
- Number of trees – Pine are usually planted at a rate of 200 to 400 trees per acre and hardwoods are generally planted at a rate of 100 to 300 trees per acre.
- Protection – Protect the trees from grazing during establishment utilizing protective measures such as fencing or by utilizing the field for hay until the trees are tall enough and strong enough to withstand grazing pressure.

Tree layout

Spacing distance between woody plants and row sets should be based on landowner objectives, tree and shrub environmental requirements, light requirements and growth periods of the forage, and machinery width needs.

Plant trees in single, double or triple row sets. Cluster plantings may also be used. When multiple row woody planting sets are used, stagger within row plantings (See diagrams below).



For existing forest plantations/stands, reduce stocking levels to at least a 50% stocking level for the normal stand or adjust the canopy density to accommodate the needs of the forage species. Trees should be as uniformly spaced as possible for even shade distribution.

Species selection for grass/legumes

Forage species should be used from an approved list for silvopasture species. Grasses and legumes should be favored that are tolerant of partial shade and moisture stress, and responsive to intensive grazing management. Suggested examples of possible grasses and legumes for silvopasture use are listed in Table 2.



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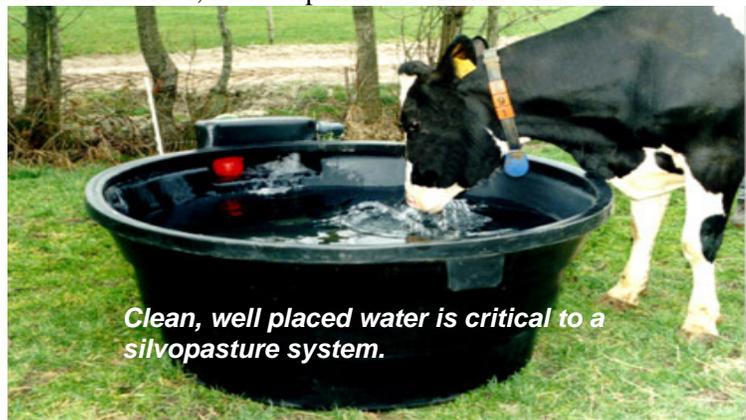
Table 2. Examples of grasses and legumes suitable for use in silvopasture

Grasses			
<u>Native</u>			
Big bluestem	<i>Andropogon gerardii</i>	Canada wildrye	<i>Elymus canadensis</i>
Little bluestem	<i>Schizachyrium scoparium</i>	Eastern gamagrass	<i>Tripsacum dactyloides</i>
Switchgrass	<i>Panicum virgatum</i>	Virginia wildrye	<i>Elymus virginicus</i>
Indiagrass	<i>Sorghastrum nutans</i>	Canada wildrye	<i>Elymus canadensis</i>
<u>Introduced</u>			
Tall fescue	<i>Festuca aruninacea</i>	Orchardgrass	<i>Dacthlis glomerata</i>
Kentucky bluegrass	<i>Poa pratensis</i>	Timothy	<i>Phileum pretense</i>
Smooth brome	<i>Bromus inermis</i>	Ryegrass	<i>Lolium perenne</i>
<u>Legumes:</u>			
<u>Native</u>			
White prairie clover	<i>Petalostemon candidum</i>	Roundhead lespedeza	<i>Lepedeza capitata</i>
Leadplant	<i>Amorpha canescens</i>	Showy tick trefoil	<i>Desmodium canadense</i>
<u>Introduced</u>			
Kobe lespedeza	<i>Kummerowia striata</i>	White clover	<i>Trifolium repens</i>
Cody alfalfa	<i>Medicago sativa</i>	Red clover	<i>Trifolium pratense</i>



Livestock

Potential livestock choices include cattle, sheep, goats, horses, or large game animals such as bison, deer, and elk. The selected livestock system must be compatible with tree, forage, and environmental requirements. In general, browsing animals such as sheep, goats or deer are more likely to eat trees; whereas, large grazing animals such as cattle or elk are more likely to physically break young trees. Younger livestock are more prone to damage trees than older, more experienced animals. Livestock activity is more likely to impact hardwood trees than conifers. Conifers, although not really palatable to livestock, are most likely to be browsed after spring bud break when foliage is still light green in color. Livestock like variety in their diet. They will often consume a small amount of tree foliage each day. This small amount of browsing may accumulate to unacceptable levels when animals are in the silvopasture for prolonged periods. Browsing damage can sometimes be eliminated by removing a few problem animals. Trampling of very young seedlings and livestock rubbing on tree saplings may be a problem, particularly with cattle. Where livestock damage must be avoided, young silvopastures may be hayed, or trees protected from livestock by chemical repellents, electric fences, individual tree shelters or rigid mesh tubes. Once the top branches of trees grow above the reach of livestock and a thick layer of bark has developed, potential for tree damage by livestock browsing is minimal and silvopastures may be managed similar to pastures.



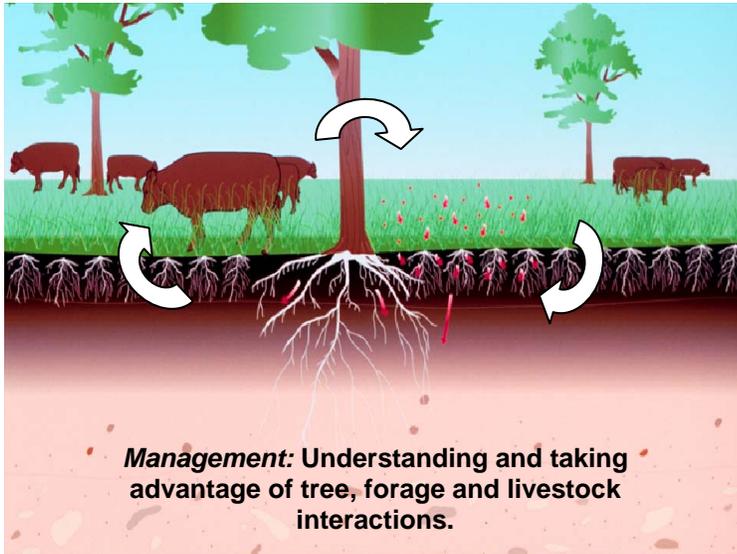
Clean, well placed water is critical to a silvopasture system.



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Management



At a minimum, vegetation should be controlled in a three-foot wide band around each tree for two to three years. Young trees will benefit from vegetation control after planting. Herbaceous plants and many brush species may be effectively suppressed by prescription grazing, mechanical treatment or chemical application. A commonly used approach when planting trees into established pastures is to spray a strip or circle around trees to provide a four to six foot diameter competition-free zone around each tree.

Livestock grazing should be intensively managed. A successful silvopasture requires understanding forage growth

characteristics and managing the timing and duration of grazing to avoid browsing of young tree seedlings or elongating shoots.

Some things to consider when setting up a silvopasture system include the following items:

- Keep livestock within 800 feet of water
- Make paddocks as near to square as possible
- Follow landscape lines for paddock boundaries
- Make paddocks of similar grazing capacity
- Plan lanes for livestock movement

Livestock should be excluded from tree plantings during vulnerable periods. Similar approaches can minimize damage by trampling or rubbing. Improper management of silvopastures can reduce desirable woody and herbaceous plants by over-grazing and soil compaction. When introducing livestock to newly-established silvopastures: 1) have plenty of feed on hand; 2) provide water, minerals, and supplements away from new trees; and 3) be willing to accept some seedling damage. Thus, proper management is the key to success in a silvopasture system.

Available management tools include:

- tree harvesting, thinning or pruning
- fertilization to improve both forage and tree production
- planting legumes for nitrogen fixation and forage production
- multi-pasture, rotational grazing
- rotational burning
- supplemental feeding
- water source development (e.g., stock tanks, photovoltaic pumps, hydraulic rams, etc.)
- locating salt/mineral licks and walkways to encourage uniform livestock distribution
- fencing (e.g., standard or electric), tubing, plastic mesh, repellents, and seasonal livestock exclusion to reduce damage to young seedlings



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Hardwood silvopasture system developed from an existing forest stand.



Conifer silvopasture system developed from an existing grass pasture.

References

The following references have been used in the development of this information sheet.

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For additional information on silvopasture, contact your local USDA Service Center.

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