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.

PURPOSE
Silvopasture is used:
- To provide forage for livestock and the production of wood products.
- To increase carbon sequestration.
- To improve water quality.
- To reduce erosion.
- To enhance wildlife habitat.
- To reduce fire hazard.
- To provide shade for livestock.

HOW IT HELPS THE LAND
Overall, silvopastures 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.

WHERE THE PRACTICE APPLIES
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.

WHERE TO GET HELP
For assistance in planning a silvopasture system, contact your local Natural Resources Conservation Service or Conservation District Office.

APPLYING THE PRACTICE

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 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. Table 1 is an abbreviated list of suitable tree species.

| TABLE 1 |
|------------------|------------------|------------------|------------------|
| **Uplands**      | **Bottomlands**  |
| Black oak        | Quercus velutina | White oak        | Quercus alba     |
| Red oak          | Quercus rubra    | Mockernut hickory| Carya tomentosa  |
| Black walnut     | Juglans nigra    | Persimmon        | Diospyros virginiana |
| Shortleaf pine   | Pinus Echinacea  | Sugar maple      | Acer saccharum   |
| Persimmon        | Diospyros virginiana | Black walnut | Juglans nigra     |
| Silver maple     | Acer saccharinum | Pecan            | Carya illinoinsis |
| Swamp white oak  | Quercus bicolor  | Bur oak          | Quercus macrocarpa |
| Green ash        | Fraxinus pennsylvanica | hickory        | Carya           |

Tree planting stock
Tree planting stock should be at least 16 inches tall with at least a 1/4 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 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** – To maintain grass vigor, plant no more than 400 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 double or triple row sets with alleys 15’ or 20’ apart. Plant trees 8’ or 10’ apart within each row and the distance between rows should be 8’ or 10’.

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.

**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. Conifers are not really palatable to livestock but most likely will 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 sometime be limited by removing a few problem animals. 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 grazed like all other pastures.

**Table 2**

<table>
<thead>
<tr>
<th>Grasses</th>
<th>Native</th>
<th>Introduced</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Big bluestem</strong></td>
<td><em>Andropogon gerardii</em></td>
<td><em>Kummerowia striata</em></td>
</tr>
<tr>
<td><strong>Little bluestem</strong></td>
<td><em>Schizachyrium scoparium</em></td>
<td><em>White clover</em></td>
</tr>
<tr>
<td><strong>Switchgrass</strong></td>
<td><em>Panicum virgatum</em></td>
<td><em>Trifolium pratense</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Grasses</strong></th>
<th>** Introduced**</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tall fescue</strong></td>
<td><em>Festuca aruninacea</em></td>
</tr>
<tr>
<td><strong>Smooth bromegrass</strong></td>
<td><em>Bromus inermis</em></td>
</tr>
<tr>
<td><strong>Legumes</strong></td>
<td><strong>Native</strong></td>
</tr>
<tr>
<td><strong>White prairie clover</strong></td>
<td><em>Petalostemon candidum</em></td>
</tr>
<tr>
<td><strong>Leadplant</strong></td>
<td><em>Amorpha canescens</em></td>
</tr>
</tbody>
</table>

| **Kobe lespedeza**  | *Kummerowia striata*        | *White clover*              |
| **Alfalfa**         | *Medicago sativa*           | *Trifolium pratense*        |
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

REFERENCES

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


Pine silvopasture system established in existing pastureland.

Grasses established under trees that have been thinned to less than 400 per acre.

Management: Understanding and taking advantage of tree, forage and livestock interactions.