The Sustainable Farming Association of Minnesota is conducting an education, demonstration, and outreach project on silvopasture, a practice that can increase soil health and build a regenerative agriculture system on farms and working landscapes. In partnership with allies, SFA is hosting field days, workshops, webinars, and other events, providing information to farmers, landowners, forestry professionals and conservationists on the hows, whys and wherefores of silvopasture. Silvopasture is a practice used in other regions of the country and across the globe, and shows promise here in Minnesota as a sustainable farming practice. This fact sheet provides information on how to design and establish a silvopasture system.

Where to Begin

Silvopasture intentionally combines trees, livestock, and forage into a single system on one site. The forage, trees, and livestock are managed and integrated to complement one another to increase productivity of the site. As a dynamic, symbiotic, and intensively managed grazing system, silvopasture is the sustainable (long-term) production of timber, forages, and livestock on the same lands.

Regardless of the method of establishing silvopasture in your farm, you would need to assess the suitability of your site and your resources whether silvopasture is right for you. Refer to SFA Factsheet “Silvopasture Assessment Tool” to help you in the site assessment process.

During the establishment and design of your silvopasture system, make sure to address sensitive areas within your site including areas where wet soils exist that are prone to pugging, and other erodible slopes and soil in your farm.

Fencing, water systems, and paddocks design and layout in silvopasture systems follow and apply the same principles as that of open pasture establishment and management. Refer to your grazing management plan.

Cost-share programs or financial assistance may be available for you for practices associated with establishing and managing silvopasture through USDA-NRCS. Visit your county’s USDA service center.

Useful resources

Relevant documents and resources available to download and/or view on the SFA Soil Health Portal:

- Silvopasture Handbook
- Beginning Grazer Handbook
- Silvopasture webinars
- Fact Sheet: Silvopasture in Minnesota

These and much more available at sfa-mn.org/soil
FROM FOREST TO SILVOPASTURE: Establishing forages in the woods

Reduce Tree Density

Allowing light to penetrate the ground to favor forage growth is key to establishing silvopasture into existing woodlands. Employ appropriate silvicultural practices to thin the trees, favoring the “best” individuals. Remove less-desirable trees and concentrate on the growth of the “best” individuals to optimize the value and health of the silvopasture’s timber component over time. General activities to reduce tree density will include:

• Conduct tree inventory and mark the trees you want to keep in your silvopasture system, and the trees you want to cut to reduce the density of your forest. Work with your local forester to perform tree inventory and tree marking, if necessary.

• Employ Crop Tree Management method (CTM). CTM is a thinning technique used to promote the growth of trees that you want to favor through removal of less desirable trees. CTM increases the health and present value of a stand and also enhances the stand’s future value by concentrating growth on the most desirable trees.

• Choose crop trees that have high economic, wildlife or aesthetic value. Economically valuable trees need healthy crowns (preferably those trees that are dominant or codominant, meaning taller trees), few or no epicormic branches.

• Tree stocking and spacing: There is no specific requirement as to the number of trees to cut and the tree spacing required in silvopasture. Keep in mind that adequate sunlight is necessary for forage production and establishment. Increased forage production will occur around 30-50 percent of full sunlight.

• Things to consider when determining the number of trees needing to be removed and the final tree spacing after establishment include: intended or likely species of livestock grazed in the system and desired forage species, tree size, canopy density, initial site conditions, and producer goals. In forest settings where large, hardwood trees are present, maintaining a tree every 50-80 feet can serve as a general target spacing. Individual tree crown should not be overlapping with the other tree crown.

• When opening a dense wooded pasture, caution must be given to potential impacts of winds on standing trees. To avoid wind damage, you may need to employ several stages of silvopasture establishment: 1) thin about half of the trees you want removed, then establish forage; 2) perform a second thinning several years later allowing the trees to adjust in the current environmental condition.

• Work with a logger to harvest those trees of saleable values based on your tree inventory. Smaller diameter trees can be harvested for firewood.

• Remove slash, debris, and shrubs for efficient seeding and to allow movement of livestock freely.

Establish desirable forage plants in the understory

• Prepare the site for seeding as soon as possible after thinning so undesirable herbaceous vegetation does not have a chance to invade the site. Seed immediately to give forage seed an advantage over unwanted weeds.

• Employ seeding in Fall or before ground freezes. Use broadcast seeding. Using grass, traditional establishment techniques may not be appropriate for silvopasture. Use of diverse mix of species and varieties is recommended.

• Grazing the area with high livestock density to incorporate the seeds into the soil after broadcast seeding. Some forage species will struggle to germinate in a heavy, undisturbed leaf litter, thus soil scarification and incorporation methods may be necessary to employ. An example is to drag treetops across snow free ground during establishment.

• A low-cost alternative to seeding involves carefully introduced livestock grazing to stimulate the latent seed bank. During the first few years of forage establishment, the timing, duration and intensity (stock density) of grazing can be carefully managed to promote forage establishment.

• Correct soil pH and fertility, if necessary, to promote forage growth. Work with your local NRCS grazing specialist for appropriate fertilizer rate application in your silvopasture system.

• Work with your grazing specialist or agronomist for appropriate forage use in your site. Generally, grasses, forbs and legumes being used in traditional pasture may be used in silvopasture.

FACT SHEET: SILVOPASTURE DESIGN & ESTABLISHMENT

Forages suitable for silvopasture in Minnesota

Big bluestem, Fringed Brome, Canada Wildrye, Slender Wheat Grass, Virginia Wild Rye, Little Bluestem, Indiana grass, Smooth Bromegrass, Orchardgrass, Tall Fescue, Timothy, Kentucky Bluegrass, Red Clover, White Clover
Ensure natural regeneration

Protect young scattered seedlings from browsing and trampling by livestock using fence, seedling tubes, block cages, or removing livestock until new trees are at a size and height that can withstand livestock pressure.

Use portable energized fencing to facilitate grazing based on forage plant recovery, protecting tree regeneration, and adaptive management of sensitive areas. Adaptive management requires careful observation of conditions within the grazing unit and adjusting livestock access based on those observations and the land manager’s goals.

FROM PASTURE TO SILVOPASTURE: Planting trees into the pasture

Prepare the site

- Prior to planting tree, reduce other plant competition in the site. Specific methods to use may include tilling, mowing, or use of herbicide. Weed barriers such as “tree mats” are also an option to consider.
- Determine the level of compaction in your site using a penetrometer. If the site has substantial compaction, sub-soiling may enhance tree establishment and growth. Perform sub-soiling only on areas where tree planting will take place.
- Using an auger or trench planter may lead to greater seedling success.
- Determine fencing and water needs for that particular site.

Select the tree species based on your ultimate goal for that tree(s)

- Select the species of tree you want to plant in your open pasture. Your choice of species should be based according to your long-term goal for that tree (e.g., high quality timber, nut production) and should be based on local soil types, site characteristics and limitations, canopy characteristics, marketable value, and moisture requirements.
- Some trees suitable for silvopasture in Minnesota include black walnut, butternut hickory, northern red oak, white, oak, black maple, silver maple, sugar maple, paper birch, green ash, red pine, and white pine.
- Things to consider when selecting trees: marketability of the wood, compatibility with the chosen forage and livestock, medium to fast growing, deep roots systems minimizing competition with forage for moisture, rapidly decomposing foliage, and canopy characteristics that match forage production goals.

Plant the seedlings/trees

- Purchase seedlings in advance through state-operated or commercial nurseries to ensure quality.
- Select seedlings with well-established root systems. Plant taller and vigorous seedlings, if possible. Planting bare-root seedlings in the spring generally leads to better seedling survival. If possible, water the trees during the planting year, especially if the growing season brings prolonged drought.
- Work with your local forester to determine the appropriate tree spacing for the tree species chosen. Planting rates are typically from 200-400 trees per acre.
- Plant the seedlings based on your ultimate goal for that tree: timber vs nut production as planting design and layout may vary depending on your objective.
- Plant trees/seedlings at a suggested spacing of 8-12 feet within the row, and at least 50 feet between rows, depending on your objectives, spacing needs of the species and the equipment to manage the forage.
- When planting trees, refer to the following guidelines for management of your species of choice from planting to maintenance: http://www.dnr.state.mn/treecare/index.html
Protect the seedlings

- Maintain a “competition free” zone around the seedlings for several years until the trees are established. You may use tree mat, mowing, herbicide (band application).
- Protect seedlings from livestock (or deer) browsing and trampling. Use seedling tubes or cages, or use energized or wire fencing, or allow seedlings to grow first, and get established, prior to introducing the livestock. Seedlings should be protected from livestock until they grow several feet above the browse line.
- Rotate livestock frequently and try to keep livestock from trees.

General management considerations

- Regardless of the methods of silvopasture establishment, management of the practice is the same. During the operations, manage for continued growth of all system components.
- Maintain healthy, high quality forage plants by employing an adequate recovery (fallow) period. Dominant grasses should exhibit 3 new green leaves per stem before regrazing.
- Remove livestock before they have taken 50% of the above ground forage biomass to protect the plant root system and provide ample leave area so that the forage plant can photosynthesize energy for a quicker recovery.
- Perform thinning or pruning when trees start to cast deep shade to maintain sufficient forage productivity.
- During the early stages of grazing, protect trees from livestock browsing and trampling using energized fence or other methods.
- Consider choosing a shade tolerant forage at the later stages of grazing in silvopasture when trees have grown, casting greater levels of shade.
- Ensure that your watering and fencing systems are working. Remove trees and branches that fall on the fence.
- Well-managed grazing will discourage the growth of undesirable plant species.
- Use silvopasture areas as part of your rotational grazing plan (right). Avoid using silvopasture areas during the same time and same way every year.

For more information about silvopasture, visit sfa-mn.org/silvopasture-agroforestry

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References:
USDA-National Agroforestry Center. Silvopasture: An agroforestry practice