

BMPs FOR SILVIPASTURE

Silvipasture refers to the introduction of trees into a traditional pasture system or the controlled grazing of a recently established forest plantation. Silvopasture areas can be established:

- in an open field through planting trees and establishing forage in the understory, or
- by planting trees into an existing pasture.

With appropriate management, this system can be expected to have a combined yield (through, nuts, wood, fibre, livestock, etc.) greater than if each were managed separately.



Trees planted in pastures offer livestock shelter and shade.



The presence of trees on a farm increases the visual appeal of the farm and may reduce conflicts between farmers and non-farm rural residents. A different and pleasing landscape may also attract additional customers if farmgate sales are part of the operation.

Done properly, silvipasture can:

- diversify income
- improve structure and nutrient characteristics of the soil
- enhance source water protection
- increase animal comfort and productivity by reducing environmental extremes
- decrease a farm's greenhouse gas emission levels
- increase a farm's ecological diversity and aesthetics.

All trees sequester carbon from the atmosphere. Individual fast-growing Hybrid Poplars can remove approximately 25 kg of CO₂ per year from the atmosphere. If trees are planted in a 10x10-m grid, there would be 100 trees per hectare which, in combination with the pasture production, can remove 2.5 tonnes of carbon per hectare per year. Pasture alone can remove approximately 1 tonne of carbon per hectare per year.



CONSIDERATIONS

LAND SUITABILITY

The following land uses and conditions are suitable for silvipasture:

- improved pastures
- forage/pasture systems
- fragile lands – erodible soils that would benefit from permanent cover
- marginal lands – steeply sloping cropland, irregular topography and ravines
- riparian zones where access to open watercourses is restricted.

FORAGE PRODUCTION AND REQUIREMENTS

Introducing trees into your pasture will affect the amount of forage (browse) produced. As the trees grow, the amount of available light needed to grow the understory forages decreases.

Carefully consider the impacts on forage production before you plant your pasture land. Here are some key impacts:

- young trees will have no immediate effect on the amount of forage produced
- forage production declines with the increasing shade from growing trees, and more shade-tolerant pasture species will start to dominate
- the number of trees planted per hectare as well as the species of tree will greatly influence the amount of forage produced
 - ▷ most conifers and hardwoods pruned to maintain a compact canopy will have less of an impact on forage production than trees with a broad, dense canopy
- management-intensive grazing practices are well-suited to silvipasture establishment (see the BMP book *Streamside Grazing* for more information).

SOIL, NUTRIENT AND WATER MANAGEMENT

Trees benefit soil nutrients, contaminants and water movement. This can improve the soil's overall productivity with no additional effort required on your part.

Tree **roots**:

- reach down below the rooting zone of most crop species to improve internal drainage and soil structure
- capture nutrients and contaminants that may otherwise filter into the groundwater or move into streams and ponds
- promote microbial populations that can use potential contaminants, pesticides and excess nutrients, as a source of food
- recycle nutrients through root turnover.

Tree **leaves**:

- recycle nutrients through leaf fall and decay
- release these nutrients slowly.



It's important to ensure there is an even distribution of shade. Otherwise, one area of the pasture will suffer from excessive grazing and compaction. This area may also receive an excessive amount of nutrients in the form of manure and urine. It may not recover within the normal rotation period and require additional rehabilitation efforts.

ANIMAL WELFARE

Trees may provide many benefits to the pasture's microclimate. Trees can improve the survival, comfort and health of young animals in particular, for these reasons:

- on cold nights, the tree canopies can act as an insulating blanket, reducing heat loss
- trees interrupt windflow and may help to reduce convective heat loss from the pastured livestock
- on hot days, trees provide shelter from the direct sun.

OPTIONS

BIOENERGY

Planting fast-growing, short-rotation trees for *bioenergy* production can reduce the cost of silvopasture while still providing some of the benefits.

Hybrid Willows and Poplars are most commonly used for biomass plantations. Trees are harvested on a three- to five-year cycle to provide regular and predictable revenue.

To be economically successful, obviously a local market is preferred. If no local market exists, much of the woody biomass can be used on the farm as fuel for crop driers or heating buildings or as bedding material. There may also be a market for planting stock (cuttings) from the established plantation.

FRUIT AND NUT PRODUCTION

It's possible to grow fruit- and nut-producing trees in a silvipastural system, although there are a number of precautions that may make it incompatible under most circumstances:

- ▶ requirements for pesticides and fungicides may be incompatible with livestock
 - ▷ in a pesticide-free or organic cultural system, this is not an issue
- ▶ fruits or nuts that fall to the ground should not be collected and marketed for human consumption
- ▶ livestock should be excluded during establishment.

SPECIES SELECTION

As always, selecting appropriate species is key to success. Here are some pointers.

CONIFERS

- ▶ conifers may lower pasture production
- ▶ Pine and Spruce tend to be less palatable feed, and will usually suffer less browsing
- ▶ some conifers will maintain live foliage at or near ground level; therefore, regular pruning is required to raise the crown and improve future wood value
- ▶ branches should be removed from the pasture

HARDWOODS

- ▶ may provide alternative browse for livestock
- ▶ casual browsing can reduce the future value of a tree
- ▶ trees should be protected until they've grown beyond the animals' reach
- ▶ Honey Locust is an excellent choice for a silvipasture system because the sparse canopy allows maximum light to penetrate to the ground level, and seed pods are an excellent feed supplement



Conifer trees in silvipasture are not heavily browsed.



Tree shelters provide some protection for hardwoods in inter-cropped plantings.



Black Walnut and Ash species also allow significant amounts of light to reach the ground.

IMPLICATIONS FOR LIVESTOCK

A number of tree species are known or suspected to be incompatible with some species of livestock – largely due to the toxins that are produced by the species listed below.

TREE AND LIVESTOCK INCOMPATIBILITY					
SPECIES	PIG	SHEEP/ GOAT	DAIRY	BEEF	HORSE
WALNUT/BUTTERNUT (<i>Juglans spp</i>)					X
RED MAPLE (<i>Acer rubrum</i>)					X
CHERRY (<i>Prunus spp</i>)	X	X	X	X	X
BLACK LOCUST (<i>Robinia pseudoacacia</i>)	X	X	X	X	X
OAK (<i>Quercus spp.</i>)			X	X	X

ESTABLISHMENT AND MAINTENANCE

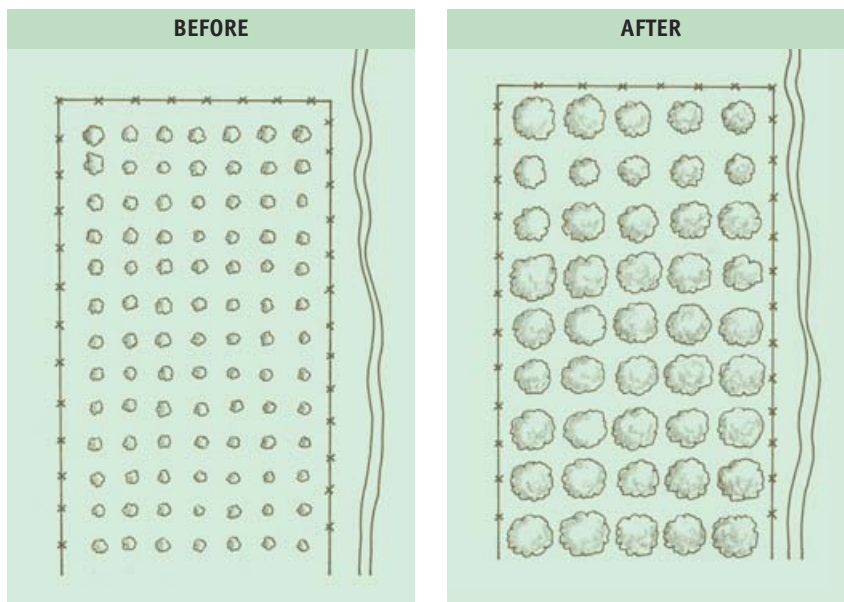
LAYOUT

- ✓ **Plant hardwoods at densities of 200–600 trees/ha** (80–250 trees/ac) to minimize pasture production losses.
- ✓ **Plant conifers at higher densities**, because they have more compact crowns.
- ✓ **Ensure an even distribution of shade** to avoid problems associated with animals standing and grazing in one area – planting pattern may be random or follow a grid layout.
- ✓ **Thin plantations over time to a final density of 100–300 trees/ha** (40–125 trees/ac).

MAINTENANCE

Weed control is generally not required due to livestock grazing.

- ✓ **Use fencing and tree shelters** to protect young trees from livestock.
- ✓ **Prune regularly** to increase the future value of the trees.



Hardwoods can be planted at lower densities to minimize pasture production losses, and later thinned to remove poorer quality trees.

POTENTIAL PROBLEMS

- reduced forage production may require changing grazing management practices
- some tree species are incompatible with some livestock – consult with your veterinarian before planting
- tree protection can be costly
- livestock may congregate – leading to greater risks of disease

Protect trees from grazing, rubbing and trampling (especially young trees) using electric fencing, plastic tree shelters or a repellent.



SILVIPASTURE CASE STUDY

A farmer with 100 ewes sectioned off 20 hectares of pasture and divided this into four 5-hectare paddocks suitable for rotational grazing. An additional 10 ha of pasture was available but not planted with trees.

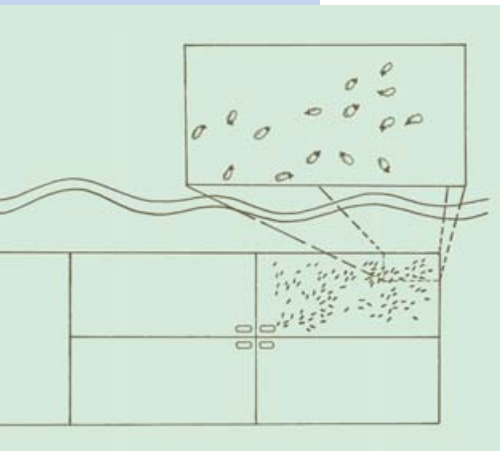
The White Spruce was planted at a density of 400 stems per ha (5x5-m spacing) with an expected final density of 200 stems per ha. The hardwoods (Sugar Maple and White Ash) were planted at 250 stems per ha (5x8 m spacing) with a planned final density of 100–125 stems per ha. The planting site was carefully laid out with each planting spot clearly marked. Two weeks prior to planting, each tree location was sprayed with a contact herbicide to eliminate vegetation within a 0.5 m radius. All trees were planted by hand.

In the first year after planting, the animals were not allowed on the land where the hardwoods were planted to avoid browsing and trampling. The forage crop was harvested and fed to the animals as required. The animals were introduced into the paddocks planted to Spruce in late summer. By this time the trees had set bud and the foliage was mature. At this stage, the trees are less palatable to sheep and more tolerant of casual browsing.

The following spring, the young hardwood trees were fenced off with a single strand of electric fence. The sheep were introduced into the first paddock when the ground was firm and not subject to compaction by the animals. The animals were allowed to graze in each paddock until the average height of the pasture was less than 10 cm, then moved to the next paddock. This was done for several years until the tree canopies were above the reach of the animals.

Over the next few years, the trees were monitored for damage, disease and insect problems. Severely damaged or diseased limbs were removed. Once the trees had reached a height of 2–3 m, a regular program of pruning and culling began. Lower branches were removed to one half the height of the tree. This is done every two or three years and no more than 25% of the live crown is removed in any one year.

When the trees mature, there will be a number of potential markets for the products. The Maple trees may be tapped for sap. The Ash will likely be sold to a local saw mill, while the Spruce may be sold or used on farm.



This pasture was divided into four 5-hectare paddocks. White Spruce and Sugar Maple were planted at wide spacings between trees and rows to facilitate grazing and pasture management.