

Photo Guide to Northeastern United States Silvopasture



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Cover Photo: Beef cattle in an apple silvopasture on North Branch Farm in New York.

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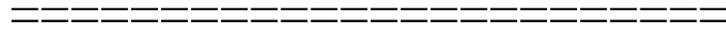


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Introduction

The practice of silvopasture is relatively unknown in the Northeastern United States. Pasturing livestock in woodlands is common in the region, but the practice typically lacks appropriate management and results in soil degradation and tree mortality. **Silvopasture, the sustainable production of livestock, trees, and forage on the same unit of land**, provides an alternative to poorly managed woodland livestock paddocks.

This guide was developed as a photographic resource for farmers, foresters, and extension professionals to utilize when considering silvopasture practices in the region. Photos in this document are the result of research by the authors into silvopastures on farms in New York and New England. Fifteen farms, self-identifying as practicing silvopasture, were included in this research. A total of 23 unique silvopastures were inventoried and categorized by tree type and spacing. Areas not intentionally producing one of the three silvopasture components (trees, livestock, or forage) were not classified as silvopasture. The only exception to this were outdoor living barns, which serve as a unique form of silvopasture and hold their own section of this guide.

This guide has been prepared for a general audience, and it is not intended to be a comprehensive guide to all aspects of managing a silvopasture. All photos were taken on farms in New York and New England. A complete, and scientific documentation of the research behind this guide is available online:

Orefice J, Carroll J, Conroy D, and Ketner L (2016) Silvopasture practices and perspectives in the Northeastern United States. *Agroforestry Systems* () 1-12. DOI 10.1007/s10457-016-9916-0

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Forest conversion to silvopasture, residual tree spacing

Uniform tree spacing



Uniformly spaced oak and maple silvopasture on a Northeastern United States farm. This silvopasture was converted from a closed canopy northern hardwood forest approximately 20 years prior to when this photo was taken. Note the consistent forage layer and the persistence of hay-scented fern in the foreground of this image. Beef cattle were rotationally grazed on approximately one week rotations with longer recovery periods in this system.

Forest conversion to silvopasture, residual tree spacing

Uniform tree spacing



This silvopasture was created from a mature stand of northern red oak two years prior to when this photo was taken. Residual trees were left based on crown and stem quality. The area was stumped and pigs were rotationally grazed through the area during the establishment year. The area was then seeded to cool season grasses and legumes. In the 2nd year this silvopasture was rotationally grazed with dairy and beef cattle. Note the epicormic branches on many of the residual trees' stems. These are likely due to stress resulting from a combination of stem exposure to light and root damage during the stumping and pig grazing process.

Forest conversion to silvopasture, residual tree spacing

Patch tree spacing



Silvopasture created from a forest comprised of oak and maple on a Northeastern United States farm. Residual trees were retained in groups to create a mosaic of small gaps between groups of trees. Location of residual tree patches were determined by areas of high concentrations of straight stemmed maple and oak. Forage production was lower within patches of trees than in open gaps. Beef cattle were rotationally grazed on approximately one week rotations with longer recovery periods in this system.

Forest conversion to silvopasture, residual tree spacing

Irregular tree spacing



Variable density oak and maple silvopasture converted from a forest on a Northeastern United States farm. Residual trees were retained based on species and a desirable (straight) stem form. The natural variation of desirable stems in the original forest resulted in an irregular spacing of residual trees. This silvopasture has been rotationally grazed with beef cattle for approximately 15 years.

Hardwood plantation silvopasture



This former open pasture was planted with black walnut seedlings approximately 20 years prior to when this photo was taken. The understory of this Northeastern United States silvopasture is comprised primarily of orchardgrass. Forage was productive despite the high density of trees. This is likely due to the low foliage density of black walnut canopies and infrequent grazing pressure by dairy cattle.

Hardwood plantation silvopasture



Black locust silvopasture with a small component of black walnut on a Northeastern United States farm. This plantation was established from an open field approximately 20 years prior to when this photo was taken and has been commercially thinned twice for black locust fence posts. This silvopasture has been rotationally grazed with beef cattle, and occasionally meat goats, for the past ten years (approximately).

Softwood plantation silvopasture



Mixed conifer plantation used for shelter during extreme winter weather events on a Northeast farm. The sparse forage layer is likely due to low light availability from high tree density, thus resulting in poor recovery of forage after grazing pressure from beef cattle.

Orchard silvopasture



This apple orchard silvopasture has been periodically grazed by sheep on a Northeastern United States farm. The orchardgrass in the foreground is one component of a cool season grass and legume forage layer. It is important to note that United States Department of Agriculture (USDA) organic standard prohibits livestock grazing within 90 days prior to harvesting fruit. The concern is bacterial contamination of fruit by livestock manure, although no research exists which has investigated the degree of this risk in silvopastures. This regulation only applies to USDA certified organic farms but the Food Safety and Modernization Act has restrictions related to livestock manure on farms of a certain scale. Readers of this photo guide are encouraged to investigate the risk and legality of selling fruit from a silvopasture orchard. This guide should not be interpreted as representative of any current laws or regulations.

Maple sugarbush silvopasture



This maple sugarbush has been grazed by beef cattle during dry periods of the summer for over 25 years on a Northeastern United States farm. The farmer intentionally set sap lines high off the ground to be above the height of cattle. Cattle are only incorporated for short periods once or twice a summer. Note the sparse availability of desirable forage and dense forest canopy. The primary source of revenue from this silvopasture is maple sap for syrup production, and cattle are used as a tool to keep the understory low.

Open field edge silvopasture



This silvopasture was created from a forest that had encroached over time into an open field. The farmer left a gradual increase in residual tree density from the open field portion to the fence line in a closed canopy forest. The high density of trees by the fence line (in the background of this photo) was to reduce understory plant grounding of electric fencing. The overstory is comprised of eastern white pine and the understory is a mixture of cool season grasses and sedges. When livestock are introduced, in this case dairy goats and beef cattle, paddocks are created to include both open field and silvopasture.

Outdoor living barn



Outdoor living barn of balsam fir bounded by eastern white pine on a Northeastern United States farm. Outdoor living barns are silvopasture systems in which tree density is maintained at an abundant level to maximize the amount of shelter that trees provide to livestock, typically during cold winter storms. High density of trees causes little to no forage availability in these areas, and management of livestock must take this into account to prevent soil degradation. We recommend that livestock are only allowed into outdoor living barns for short periods when soils are frozen or dry to prevent site degradation. This area was being maintained as summer shelter for beef cattle from biting flies and heat. It was also being used for timber production. The two eastern white pines were retained for aesthetic purposes.

Tree regeneration strategies

Many tree regeneration strategies exist for establishing the next stand of trees in a silvopasture. The major challenge of regenerating trees in silvopastures is preventing livestock damage when trees are young and most vulnerable. This can be achieved by periods of livestock exclusion from an area or with individual tree protection. Both planting and natural regeneration systems have potential, and a balance must be found between establishment costs and future revenues.



Non-electrified electric fencing being used to protect a planted tree seedling from dairy cattle. Note the heavy grass competition around the base of the planted tree seedling. Grass competition will prevent growth of young trees and should be controlled.



Individual tree fencing being used to protect a young fruit tree from sheep in a Northeast silvopasture. Note the mulch to prevent grass competition. A downspout from a gutter system protects the tree's stem from rodent damage.



Black locust coppice system being utilized to regenerate black locust silvopastures. The high stocking rate of stems which will encourage straight, clear wood but may require pre-commercial thinning to optimize growth of preferred stems.

Forages in silvopastures

Cool season grasses and legumes comprise the majority of forages in Northeastern United States silvopastures. These include native species such as red top and introduced species such as orchardgrass, timothy, and clovers. Forages should be established immediately after initial timber harvesting in silvopastures created from forests. This is the best window of opportunity as it is when there is the most site disturbance and least amount of understory competition. Invasive alien plants on a site can be a major inhibitor to forage production. These should be controlled prior to silvopasture establishment.



This silvopasture image shows a broadcast planting of orchardgrass on the left and an area without grass establishment. Orchardgrass was broadcast seeded in the late summer 2 years prior to when this photo was taken, and immediately after the forest was converted to silvopasture. Note that the area without grass establishment is dominated by blackberry, sedges, and goldenrod.



Winter hay feeding is an effective way of establishing forages in silvopastures while reducing undesirable plant competition. Round bales of hay placed on the ground will smother undesirable plants while at the same time fertilizing and seeding the area. Be sure to use hay with live seeds of desirable forages, and accept that this will “waste” more hay than if it were provided from a feeder.

Fencing options

Many fencing options are available for pasture systems. Here we highlight a few unique fencing considerations with silvopasture applications. It is generally a poor practice to use living trees as fence posts, but when a living tree has little timber value and the fastener system allows the fence to move with the tree the use of living trees for fence posts can be acceptable.



These compression springs allow the fence to flex and recover during damage from falling trees or limbs. Additionally, compression springs allow the fence to stretch as tree stems move during wind events.



Batten strip used to secure high tensile electric fence to living tree. It is best not to use sawlog quality trees for living fence posts because of loss of quality and merchantability of the log. In this example a fender washer with a spike is used to allow the tree to push out the batten and pull the nail as it grows.



These EXPAND fence insulators allow a living tree to be used as a fence post without causing any damage to the future log. Rubber rope secures the plastic insulator to the tree, and it expands with growth. These insulators work excellent on line trees but should not be used on corners or sections with high tension in the up or down direction. More information can be found at:

<http://www.expandfarmproducts.com/>

Fencing options

Portable electric fencing works well in silvopastures, especially for dividing paddocks within a stronger, and more permanent, perimeter fence.



Portable electric netting is a valuable tool for rotationally grazing many species of livestock, and protecting them from predators. In a silvopasture setting, stumps and downed branches can cause serious frustrations when moving or picking up netting. We suggest ensuring that areas where electric netting is to be placed are cleaned of sticks, stumps and other debris. Setting up a road/path system that aligns with paddocks is an effective way to maintain clear fence lines.



Portable fence posts with polywire work as well in silvopastures as they do in open pastures. The challenge is that this type of fence will not work for all varieties of livestock.

Livestock

Livestock best management practices in silvopastures are not much different than best management practices in open pastures. Short rotations of livestock with long recovery periods is ideal. We generally suggest rotations of 5 days or less for grazing animals, and recovery periods of at least 25 days. Silvopasture practitioners should use forage availability as a measure of when to introduce and when to remove livestock. Forages should never be grazed below 3” in height.

In silvopastures a challenge is to avoid damage to trees and soil because one day of damage can result in the loss of decades’ worth of tree growth. Trees are at the greatest risk to damage from livestock when their roots are growing in the spring and fall and when soils are wet. Additionally, when sap is flowing in the inner bark during the early part of the spring and in the fall, livestock may be increasingly tempted to girdle standing trees. Bored and/or hungry livestock are also a major threat to tree health. Always remember that one of your major goals in silvopasture is growing and caring for trees.

Every species of livestock has a different impact on a site. It is up to the silvopasture practitioner to recognize the risks their livestock pose to the site. Livestock should be managed in a proactive way and not reactively in response to site or tree degradation.



Sixteen beef cattle are grazing this 1 acre silvopasture for 1 day. They will reduce the forage height from 8” to 3” in that time. The overstory include black cherry, a species that is toxic to livestock when leaves are wilted. Farmers should use caution around unknown and toxic plants.

A special caution about pigs

Pigs are destructive by nature. Their instinct, and pleasure, is to root and disturb the soil. This is a major challenge when incorporating them into silvopasture systems. One day of rooting by a pig can destroy the root system of a decades old tree. Rooting also puts soils at significant risk to erosion and degradation. Trees are not able to rapidly recover from root damage the way grasses can, and loss of roots by trees to pigs can kill a tree. What many farmers do not realize is that trees with root damage will live off stored energy reserves for years until they finally succumb. What this means is that damage done to a tree's root system today may not be realized until years later when the tree runs out of energy. Roots should be seen as a critical component of a tree's anatomy and farmers should never let livestock damage them directly or indirectly (through soil compaction). Pigs have been used in European silvopastures for centuries to collect mast, but this is very different than allowing pigs to root. An acorn is far more appealing than a root, but without acorns the root is a pig's prime target. Rooting \neq masting.



This photo from a Northeastern United States farm depicts the differences between continuous pasturing of pigs (left) and rotational grazing of cattle (right). While neither system can be defined as a silvopasture due to lack of tree management, lessons regarding grazing management are evident. The destructive nature of pigs dictates that they be moved on extremely short rotations. We suggest leaving pigs in an area of silvopasture for no more than 24 hours. We also suggest farmers set up all pig paddocks in a silvopasture prior to introducing pigs, this ensures that pigs can be easily moved every day and not allowed the time to root.

A special caution about pigs



These pigs were being pastured in woodlands on a Northeastern United States farm. The farmer identified this as a form of silvopasture but we consider it a wooded livestock paddock, and definitely not silvopasture, because of the lack of tree management and excessive soil degradation. Improvements to this system would require shorter (less than 24 hours) rotations of pigs and allowance of recovery periods for the ecosystem (more than 25 days). Additionally, the trees in this system should be thinned to allow enough light to the understory for grass growth. A forage layer in silvopastures will help to buffer tree roots from livestock compaction while also providing livestock with a source of food.

Additional silvopasture resources

This document should not be seen as a comprehensive guide to silvopasture management. Silvopasture is a complex farming venture and it requires knowledge of trees, livestock, and forage management. We encourage the use of silvopasture in the Northeastern United States but we hope practitioners will rely on foresters, agricultural extension professionals, and experienced silvopasture farmers for support. The following resources are useful when considering the practice of silvopasture.

Regional to the Northeastern United States:

- Silvopasture Network by Cornell Cooperative Extension <http://silvopasture.ning.com/>
- Forest Connect by Cornell Cooperative Extension <http://www2.dnr.cornell.edu/ext/forestconnect/>
- Orefice J, Carroll J, Conroy D, and Ketner L (2016) Silvopasture practices and perspectives in the Northeastern United States. *Agroforestry Systems* () 1-12. DOI 10.1007/s10457-016-9916-0 <http://link.springer.com/article/10.1007/s10457-016-9916-0>

National

- USDA National Agroforestry Center <http://nac.unl.edu/>
- Center for Integrated Natural Resources and Agricultural Management, University of Minnesota <http://www.cinram.umn.edu/>
- Center for Agroforestry, University of Missouri <http://www.centerforagroforestry.org/>

Global

- Association for Temperate Agroforestry <http://www.aftaweb.org/>
- European Agroforestry Federation <http://www.agroforestry.eu/>
- World Agroforestry Centre <http://www.worldagroforestry.org/>

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