



Silvopasture

Photo Credit: Ben Russell

Agroforestry fact sheet #4

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Trees, shrubs, and other woody perennials can help protect livestock, crops and infrastructure from adverse weather conditions. When trees are incorporated in livestock grazing systems, a natural refuge from excessive heat, precipitation, and wind is created. Silvopasture is wide ranging in its definition and outcomes, requiring deliberate planning and integrated management to succeed. Although any form of tree(s) on pasture can provide numerous benefits to livestock and the surrounding environment, a minimum density of 200 trees/hectare is recommended to achieve the full range of benefits from a silvopasture project. This provides additional comfort for livestock, and, when effectively managed, can increase forage and timber quality. The added below and above ground biodiversity supports ecosystem and soil health by creating habitat and sequestering additional carbon (fig.1). Additional soil carbon can bring direct and indirect benefits to the operation, while harvested biomass can also diversify

Site selection

Many combinations and styles of tree cover can be implemented depending on the needs and goals of each farm. There are two main types of silvopasture projects: trees planted on established pasture, or forest which is selectively thinned for forage production. Each has their benefits and setbacks, with pasture conversion allowing for more species selection and design options, while taking considerably more time to establish. Natural, wooded edges of established pastures can also be expanded or fenced into the paddock, which can be a less intensive way to start implementing silvopasture principles on farm. Like most agroforestry operations, establishment costs require significant financial and labour investments in the first few years. Site selection, preparation, fertility, seed, and saplings, along with the constant fencing and water requirements must be taken into account.

Pasture conversion

When assessing established pasture for silvopasture, consider how mature trees can limit and/or alter your day-to-day operation, especially as it pertains to accessibility, containment, and water. This may help in determining any spacing constraints for the future stand. Intensively managed silvopasture systems require additional decision making and more consistent labour (pruning, livestock rotation), so a realistic plan based on available resources is crucial to a successful operation. When selecting a site, avoid low lying, wet or excessively steep areas of the pasture that may discourage sapling establishment or increase erosion potential. If possible, planning for rows perpendicular to prevailing winds will improve livestock protection. On sloping land, rows should be oriented on the contour to prevent soil erosion within the tree rows during establishment.

When planting in rows, aim for 3-4m of space between trees and at least 10m between rows to ensure easy equipment access for hay cuts with adequately dense stands. Individual trees planted in blocks should be spaced slightly farther apart to allow for grazing access. Mature block plantings may require more diligent pruning to limit shade and provide enough access and ground for forage, especially if conifer based.

Single row, multiple rows, and tree islands allow for easier access and grazing than block style plantings, while blocks maximize timber biomass and limit tree-tree competition. Block style plantings can be difficult for operations that require heavy equipment but can provide more lucrative perennial returns (e.g. Christmas trees, large timber, orchards). When converting pasture, be sure to confirm a source for your trees early in the process.

Forest conversion

Thinning forest land is a much quicker way to establish silvopasture, however careful planning and site selection is still integral to success. As much of PEI's prime forest land has been logged and converted long ago, remaining

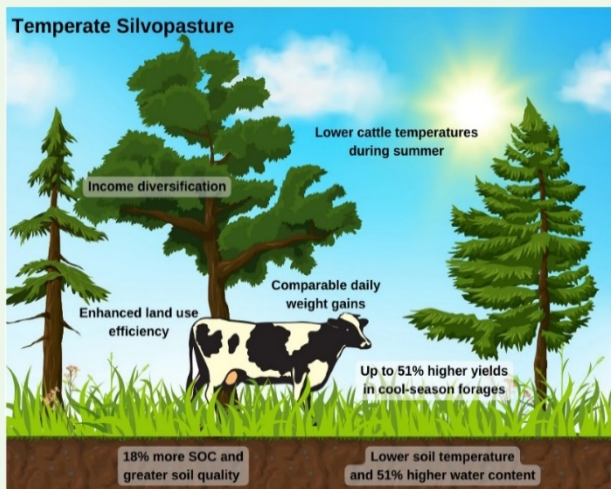


Fig. 1. A selection of beneficial outcomes when implementing silvopasture practices (Amorim et al)

income streams (in the form of lumber, pulp, or firewood). When compared to both pasture and plantation systems alone, successful silvopasture operations have the potential to offer a higher rate of financial return than either single operation.

forest land is often marginal and limited in its accessibility, fertility, or slope. These marginal lands are often not ideal for silvopasture establishment, as the potential for soil erosion, poor establishment, and/or livestock injury is high. Some examples of ideal land for conversion include mature coniferous plantations or previously abandoned farm fields which have grown into early successional forests.

When thinning a forest stand for silvopasture, prioritize the removal of stunted or diseased trees, as well as those competing with others for sunlight. Healthy, evenly spaced trees will provide more shade per tree, and will mature into more valuable timber. Prescribed burning

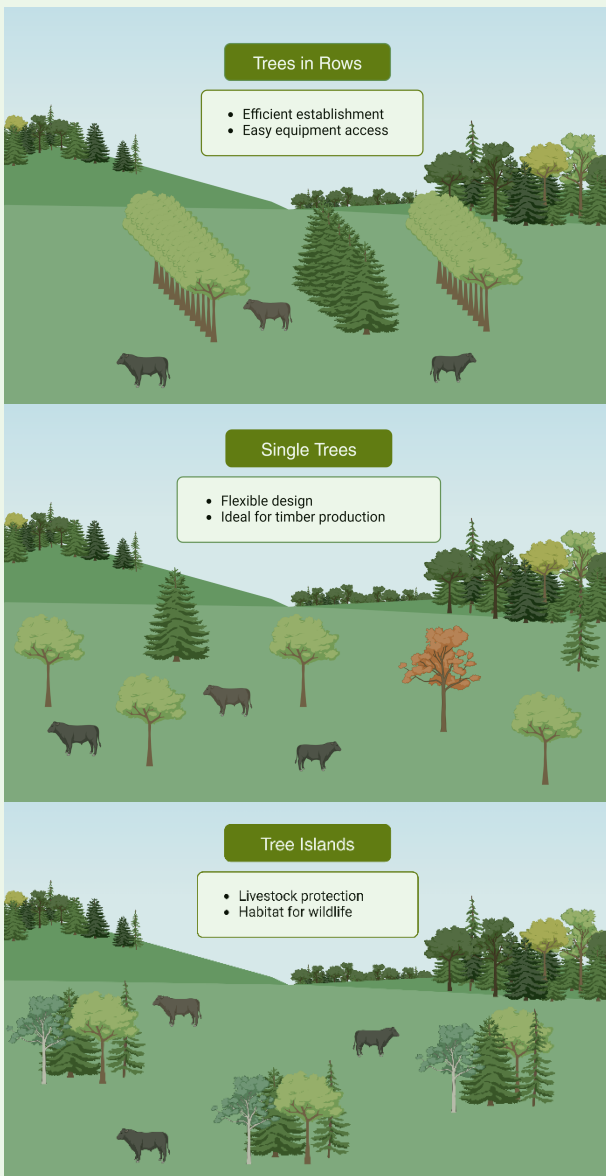


Fig.2 Benefits of various silvopasture designs

can be a convenient option to clean up debris and understory competition prior to cultivation of forage, although stump removal may also be necessary for

equipment accessibility in larger operations. Be sure to always follow fire safety protocols and adhere to provincial fire regulations when burning. When ready to establish forage, choose blends that are susceptible to lower pH values (such as tall/meadow fescue, birdsfoot trefoil, and vetch), and consider incorporating lime as PEI's primarily conifer-based forest land is generally acidic.

Forage/Livestock mgmt.

Regardless of establishment style, a balance between shade and sunlight is needed to properly establish forage under canopy. When planting trees on pasture, it's recommended to establish a minimum of 200 trees per hectare, with some actioners planting over 400 trees/ha. As the stand continues to establish, selective thinning and pruning allows for continued management of spacing and shade. Although location, tree, and forage species may vary, a canopy cover with over 50% shade can limit production, so aiming for an even distribution of shade and sunlight during the growing season is preferable.

Extra consideration and care must be given over the first few seasons while saplings mature. Limit grazing in the early spring/late fall as wet conditions are more likely to damage roots from trampling. Livestock should be omitted from accessing the saplings as they establish to prevent browsing. This can include limiting newly established silvopasture to full season hay production, installing temporary fencing, or exclusion cages (fig. 3). Once forages are sufficiently established, monitor silvopasture grazing closely and give plenty of time (preferably an entire grazing season) for the forage to rest. Never allow removal of more than 50% of your forage per grazing event, ensuring high residual biomass to maintain desirable species and palatability. As browsing will increase with stress and nutrient deficiency, high quality forage in sufficient quantities, combined with comfortable livestock and timely rotations are key to limiting damage of young trees by livestock. All these issues are best addressed through intensive rotational grazing principles, which are a must when practicing any form of silvopasture.

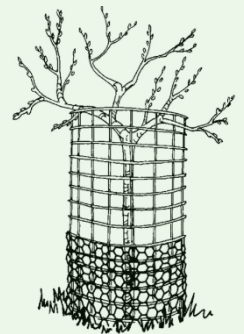


Fig. 3 Grazing exclusion (Texas A&M)

Funding for livestock shade trees is available through the Agriculture Resilience Program, and silvopasture establishment planting is supported through the Agriculture Stewardship Program with compulsory enrollment in ALUS. To learn more, see the remaining agro-forestry factsheets or contact the Dept. of Agriculture at DeptAg@gov.pe.ca or 1-866-PEI-FARM.

References

-Amorim, H., O'Brian, P., Ashworth, A., Runkle, B., (2023) Temperate silvopastures provide greater ecosystem services than conventional pasture systems. Nature. DOI: 10.1038/s41598-023-45960-0
 -Benitz, S., Byrne, J., Chedzoy B., and Wand C. (2023) Silvopasture for Ontario #23-087 available at: <https://www.ontario.ca/files/2024-01/omafra-silvopasture-for-ontario-en-2024-01-11.pdf>
 -Dollinger, J., Shibu, J., (2019) Silvopasture: a sustainable livestock production system Agroforest Syst (2019) 93:1–9 DOI: 10.1007/s10457-019-00366-8(0123456789
 -Hamilton, J. Silvopasture: Establishment and Management Principles for pine forests in the Southeastern United States (2008) USDA National Agroforestry center available at: <http://www.workingtrees.org/>
 -Miller, D (1984) Forage Crops. University of Wisconsin-Madison. ISBN 0070419809.
 -Schneider, G. Richman, R. Dacombe, L. Maclean, K. Shaw S, MacDonald S., Native Trees and Shrubs. Sir Andrew Macphail Woodlot Foundation. Available at https://immediac.blob.core.windows.net/macphailwoods/NativeTreesShrubs_OtherPublications.pdf
 -Sharrow, S., Fletcher, R. (2003) Converting A Pasture to A Silvopasture in the Pacific Northwest USDA agroforestry note 26 available at: <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1025&context=agroforestrynotes>
 -Silvopasture Information Sheet (2018) USDA Natural Resources Conservation Service Missouri Conservation Practice 381 available at: https://www.marincrd.org/wp/wp-content/uploads/2020/03/Silvopasture_Information_Sheet_381-1.pdf
 -Silvopasture Design & Establishment: The How-Tos. Sustainable Farming Association Minnesota. Available at: <https://sfa-mn.org/resources/the-how-tos-of-silvopasture-fact-sheet/>
 -Smallridge, P., Chedzoy, B. (2023) A Framework for Successful Planning and Implementation of Silvopasture Projects-Cornell University Cooperative Extension. Available at : <https://bbp-us-e1.wp.mucdn.com/blogs.cornell.edu/dist/b/5769/files/2023/09/Creating-Quality-Silvopastures-in-Farm-Woodlands-1.pdf>
 -Injury to trees from animals. Texas A&M Forest Service. Available at: https://tfsweb.tamu.edu/uploadedFiles/TFS_Main/Urban_and_Community_Forestry/About_Urban_and_Community_Forestry/Urban_Forest_Information_Sheets/Tree%20Health%20-%20Injury_Grazing%20Animals.pdf
 -Figures created in BioRender.com unless otherwise specified.