

# AGROFORESTRY NOTES

Photo Credit: Adam Downing,  
Virginia Cooperative Extension

## Considerations for Establishing Silvopastures on Wooded Sites

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### Introduction

Silvopasture management is the intentional integration of trees, forage, and livestock on the same piece of land. Establishing silvopastures is generally achieved through one of two approaches: (1) adding trees to pastures or (2) removing trees from forests and seeding or supporting forages. This publication focuses on the second approach and addresses some key considerations when evaluating a particular woodland for silvopasture management.

Just like any conservation or production practice, silvopasture management is not the right fit for every site or land manager. Examining the following questions can help identify the most suitable sites for silvopasturing: (1) Is the site worth the financial investment, and (2) will the site be enhanced by silvopasture management?



*Silvopasture established in an area reclaimed from invasive shrubs. Courtesy photo by Brett Chedzoy, Cornell Cooperative Extension*

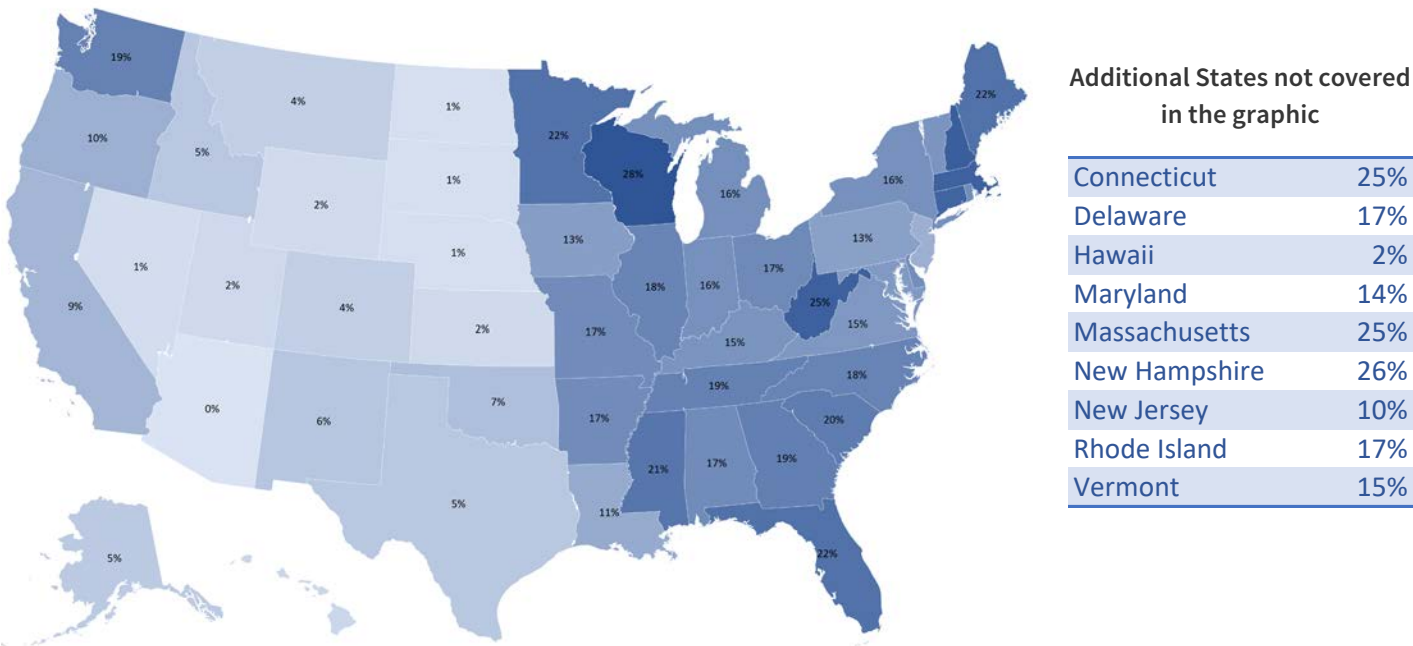
Unmanaged or poorly managed sites can benefit from silvopasture management. Examples of such sites include woodlands that are understocked because of forest pests and diseases, woodlands that are overstocked because of lack of management, woodlands with undesirable species composition, woodlands with storm damage or past mismanagement, or former agricultural land that is reverting to forest, often dominated by invasive shrubs and/or with low quality or quantity of desirable tree species. This comprises a large number of woodlands across the United States, including regions where there is significant interest in establishing silvopastures.

In many regions of the United States, people give livestock unmanaged access to woodlands and mistakenly call this silvopasturing. For more information on this topic, see Agroforestry Notes, No. 46, ["Forest Grazing, Silvopasture, and Turning Livestock into the Woods."](#)

The 2017 Census of Agriculture identified that 6 percent of pastures across the United States were woodland pastures. In some regions, such as the Midwest and Northeast, this percentage was much higher. For example, in Connecticut, Massachusetts, New Hampshire, West Virginia, and Wisconsin, more than 25 percent of all pastured acres were woodland pastures in 2017 (Diagram 1). Many landowners are already grazing their woods. Silvopasture management, with its focus on managing trees, forage, and livestock together, would likely improve management and productivity of these sites.

Diagram 1:

Percent of pastureland acres that are woodland pastures. Data Source: 2017 Census of Agriculture - Table 8: Farms, Land in Farms, Value of Land and Buildings, and Land Use



In addition, data from the USDA Forest Service Forest Inventory and Analysis shows that 39 percent of forests in the United States are impacted by invasive plants, including 45 percent of sites in the Northeast, 52 percent of sites in the North Central region, and 39 percent of sites in the Southeast. Active management through silvopasturing may help address this challenge.

According to the National Woodland Owners Survey (Caputo and Butler 2021), only 11 percent of family forest owners with 10 acres or more have a management plan. This represents 24 percent of acres owned by family forest owners, and not all these owners have taken steps to implement their management plans. This also leaves over 181 million forested acres that do not have management plans. Advancing silvopasture management on these sites increases opportunities for active forest management and planning.

This publication provides a set of considerations when evaluating a particular woodland for silvopasture management. Detailed information addressing silvopasture benefits, planning considerations and development, and livestock and forage management can be found in the “Additional Resources” section of the publication or at the [USDA National Agroforestry Center](#) website.

## **Team and Roles**

Silvopasture establishment requires careful preparation as well as significant investments of time, labor, and capital, with outcomes unfolding over long time horizons relative to most agricultural practices. Because few individual producers or land managers have all the skills needed for establishing and managing a silvopasture, the best approach is to build a team (Diagram 2). Teams should include everyone who is already engaged in land management at the site, such as extension agents, foresters, and technical service providers, as well as those who routinely perform tasks on the farm or ranch (including family members, hired workers, and companies or professionals who spread fertilizer, spray chemicals, or do other custom work on the site). At a minimum, the team should include a forester and grazing specialist, even if they have not been consulted in the past. Depending on the producer’s goals, the team can also include other expertise, such as a wildlife biologist, agronomist, or others. The USDA Natural Resources Conservation Service, state department of natural resources, or the local extension office or conservation district can help identify foresters, grazing specialists, and other experts and may be able to provide financial assistance for those services.

Teams can assist in developing and assessing goals, determining site suitability, and making plans over short- and long-term time horizons. Involving everyone in the planning process engaging with a team to advise on issues and specific techniques improves the likelihood of optimal outcomes. In the end, the landowner is the ultimate decision maker.

Admittedly, it can be challenging to find team members. Lack of familiarity or an institutional culture against mixing trees with livestock leaves many natural resource professionals reluctant or resistant to supporting silvopasture adoption. Widespread poor management of woodland grazing gives rise to valid concerns. Reduced tree density can lead to decreased biodiversity, including the loss of some non-timber forest species, and blowdown. Unmanaged livestock can damage trees.

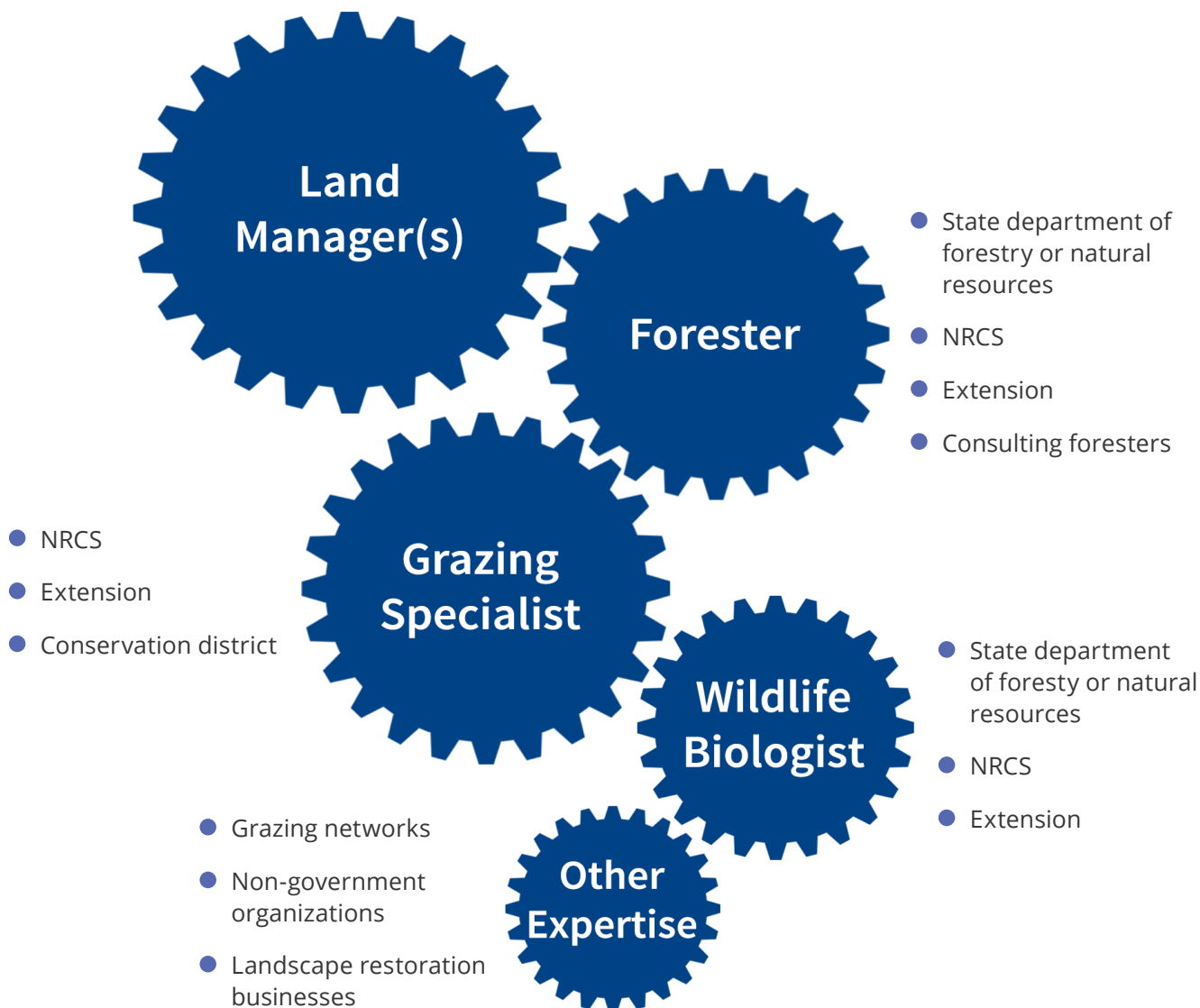
However, the goal of silvopasture is to use superior management practices, such as timber stand improvement and intensive rotational grazing, to improve the overall function on sites that are suitable for the practice. Silvopastures are managed for the success of livestock, trees, and forage. Silvopasture management can improve water and soil quality, biological diversity, and the productivity and health of trees, shrubs, and forages. It can reduce erosion and enhance wildlife habitat. An open and respectful conversation that asks about and acknowledges resource professional concerns can help overcome initial resistance and open the door for a discussion of why silvopasture management is being considered and how it differs from traditional grazed woodlands in management and environmental outcomes.



Including multiple resource professionals early in the planning process increases their opportunities to provide valuable support, perspectives, and expertise. Conveying the land manager's commitment to long-term, actively engaged management is key to the success of the team.

## Diagram 2:

*Because few individual producers or land managers have all the skills needed for establishing and managing a silvopasture, the best approach is to build a team. Potential organizations to contact to identify these team members are included in the diagram.*



USDA Forest Service Graphic by Josh Bundy

## Natural Resource Considerations

Not all sites capable of growing trees and forages are suitable for silvopasture establishment and management. Establishing these systems requires significant investments that need to be compensated with sufficient productive outputs. Marginal sites may be limited in productivity and may be more susceptible to negative grazing impacts, reducing production over time. This section discusses common examples of topographical and site quality features that may limit a site's potential.



*Variable density oak and maple silvopasture converted from a forest with irregular tree spacing from using residual trees. Courtesy photo by Joe Orefice, Yale University.*

## Soils

Pastures and woods are commonly associated with sub-prime soils. However, these soils can normally support adequate tree and forage growth under intensive rotational grazing. Some exceptions are erosion and compaction-prone soil types, especially when coupled with excessive slope or frequent saturation. In those situations, the site may be grazeable under ideal conditions, but the outputs are unlikely to offset the investments required to establish and manage the silvopasture.

Locations with many springs and seeps, wetlands, or riparian zones should be avoided. Sites (with or without trees) that have highly erosive silt-loam soils on stream banks should be avoided; even light grazing during dry ground conditions can reduce stability and exacerbate erosion issues. Stream banks also present potential hazards for livestock.

## Slopes

Grazing can occur on slopes, but grazing duration and intensity should be adjusted according to slope steepness, soil type, soil moisture, and livestock characteristics. When slopes are combined with other factors, such as gullies, springs, and poor paddock design, grazing may contribute to unacceptable levels of erosion and site degradation. Outcroppings, gullies, and escarpments also pose considerable hazards to livestock that, when hungry, may push too close to the edge of these features. When in doubt, fence it out.

## Invasive and toxic plants

In many locations that are suitable for woodland silvopasture, the starting condition is associated with agricultural abandonment, fire suppression, or historical overharvesting, and often exhibits an understory rife with invasive and nuisance species. Creating silvopastures presents opportunities to manage the understory and prevent the spread of invasive species. However, as a site is transitioned to woodland silvopasture, thinning the selected area initially creates more physical and ecological growth opportunities and may “release” aggressive unwanted species.

Mitigation techniques include ensuring the team is familiar with and prepared to combat the species as needed and setting up a good forage stand under the tree canopy to limit opportunity for unwanted species to get established. Livestock can further help through trampling, grazing, or browsing. Management of invasive and nuisance species is a continual effort that can be improved with silvopasture.

Toxic plant species must also be considered when grazing livestock. Toxic species differ based on location and pose different risks depending on the kind of livestock and the amount and types of other forages available. Natural resource professionals can provide information on toxic plants that may be present in a silvopasture. Depending on the circumstances, options include removal of the plants or exclusion of livestock from the vicinity. For example, cherry leaves pose a toxicity issue for ruminant livestock when they are wilted, but not when they are green. Therefore, animals may be rotated away from the trees ahead of or immediately after an event that induces wilting (such as an early frost or storm). However, these leaves are always toxic for horses, and caution should be taken when grazing where these leaves are present. In general, if livestock are hungry they are more likely to eat toxic plants. If they have access to good forage that they are experienced with, they will generally just taste toxic species or leave them alone.

## Tree Thinning

Establishing silvopastures on wooded sites usually involves some level of tree removal, and teams can help the land manager fully consider the implications of thinning woodlands. Working with a team increases the likelihood that the stand will be thinned correctly and that the resulting silvopasture will function well within the larger farm operation. When transitioning to a woodland silvopasture, it is necessary to consult a professional forester. Unlike traditional forestry, silvopastures are generally maintained with lighter and more frequent thinning and/or burning events, and the amount of initial thinning depends on the starting conditions of the woodland.

The initial forest inventory process should select desirable species to conserve and protect, invasive or undesirable species to reduce or eliminate, and basal area and stocking density to target at onset. The plan should reflect producer priorities. For example, a site with good timber potential might be thinned differently than if there are not good timber trees or no local markets for timber. The plan also might consider a producer’s interest in maximizing shade, tree fodder, wildlife habitat, syrup production, or other priorities.



In general, silvopastures are thinned to a lower stocking rate than other forestry prescriptions. The thinning pattern should also be considered. Standard crop tree thinning with trees scattered evenly throughout the site may make mowing, fencing, and other management activities more complicated, but avoids creating edges where livestock will congregate. Having open areas with patches or strips of trees may make management easier, but can lead to uneven use of the paddock. The team should also decide on the thinning strategy, which can either involve completing the thinning all at once or gradually thinning to reduce systemic shock to the remaining trees and potential blowdown or epicormic branching. The plan should also account for management of thinned tree material.

### Tree Management

Regeneration can be a challenge in many forest types and management approaches. Active forest management, such as silvopasture, provides an opportunity for and encourages planning for regeneration. Woodland silvopastures are not static and must be managed continually with thought toward future conditions. Planning for recruitment of younger trees to replace those lost through natural attrition, maintaining a range of variable-aged trees after thinning, and protecting planted or natural replacements from grazing animals are important considerations for silvopasture management.

Some wooded areas may contain tree species high in economic or conservation value. Consideration should be given on how best to manage this type of silvopasture for producer priorities. Slow-growing hardwood trees, such as black walnut and many oak and maple species, are valued for their grain, color, and strength, but take a long time to reach harvestable age and provide economic returns. Silvopasture management can be one path to timing harvest to maximize the economic value of these trees and may include regular pruning to reduce knots and epicormic branching. Other producers may manage their trees for wildlife and biodiversity (including economic returns from hunting leases), shade, supplemental forage, or other characteristics.



*Silvopastures can have significant benefits to ecological and livestock health. Courtesy photo by Brett Chedzoy, Cornell Cooperative Extension*

If the current stand is understocked with desirable tree species, yet there is interest in cultivating these tree species in the woodland silvopasture, the addition of livestock may offer short-term income to offset the longer wait for return on investment in the trees. Upfront measures that prevent damage to trees and seedlings from livestock and wildlife can result in long-term returns that will provide both economic and ecological benefits to the system.

## Planning Approach

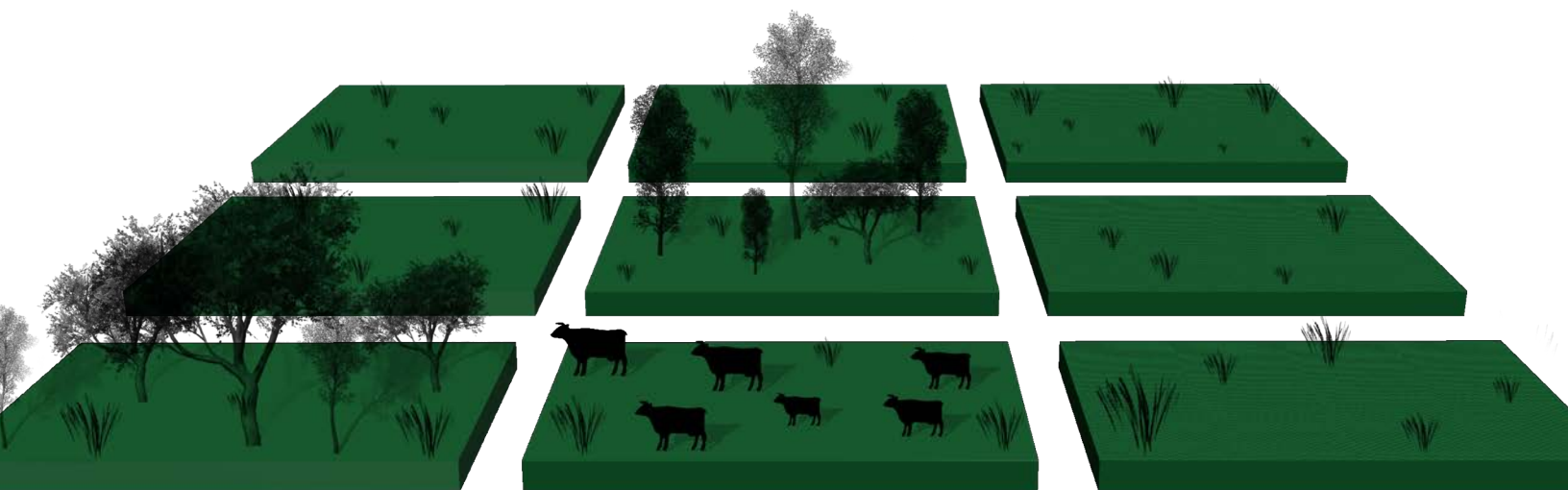
Producers also need to manage trees in silvopastures to maintain access lanes and fences. Trees drop branches and occasionally break or fall, and even a very small branch can ground the current in an electric fence. Other trees may need to be cleared to maintain access. However, fallen trees that do not pose a danger to livestock or fences or block access can be left on site.

With the wide range of considerations to address, careful planning is required to ensure the transition and management strategy will be successful and degradation of the woodland avoided. A consulting and planning team of professionals should work together with the land managers to better understand the site, determine the ideal strategy for transition, and develop a plan that includes the following:

- Detailed soil survey of the prospective site; note areas of wet soils where compaction and erosion could be an issue.
- Plant survey and woodland inventory; identify prevalence of invasive species, high-value trees, forest stocking density, diseased or damaged trees, and any sensitive species requiring protection. This will also help identify any sub-ecosystems that should be protected.
- Thinning strategies; thinning can be carried out in one fell swoop or more slowly to reduce systemic shock to the trees. This decision may depend on tree species, age/size, and other factors, as well as producer goals, markets for wood, and the willingness of loggers to carry out smaller jobs.
- Planting or over-seeding strategy for forage; depending on the presence of native forage species, grasses, and forbs may naturally return to the site over several growing seasons, but will likely delay livestock integration. Alternately, seed can be broadcast or drilled into the silvopasture site to speed forage establishment. However, the ease and utility of drilling are more sensitive to site characteristics, and use of equipment

## Diagram 3:

*This diagram suggests the movement of livestock through paddocks over time. For most producers, most grazing takes place in open pastures, with woodland silvopastures only providing one component of the grazing plan. Silvopasture paddocks can be reserved for hot, sunny weather or stockpiled for winter shelter. Open pasture provides excellent grazing in cool weather and cools off more quickly at night. Trees in silvopastures can have many different arrangements, including even spacing, rows or clumps of trees, and partial silvopasture/open pasture arrangements.*



USDA Forest Service Graphic by Josh Bundy



may increase soil compaction. A soil test will help determine if lime or fertilizer is needed prior to seeding. Grazing rolled out bales of seedy hay has also been used to enhance forage establishment.

- Year-round grazing strategy; particularly in the beginning stages of transition, it is critical to have a livestock feeding plan that includes alternative grazing spaces and forage supplements throughout the year. Usually, woodland silvopastures form only one small component of a grazing plan; most grazing still takes place in pastures (Diagram 3). A synthesis of surveys of people who have silvopastures found that 96 percent of U.S. silvopasture adopters use a combination of silvopasture and open pasture. Additionally, rotational grazing management within the silvopasture system is essential to prevent overgrazing and compaction; this survey synthesis also found 98 percent of silvopasture adopters were using rotational grazing (Smith et. al. 2022.). This rotational grazing plan will require infrastructure such as water systems and fencing.

## Legal Considerations

An important consideration inherent to the approach of establishing a silvopasture from a woodland is whether this change in management will have any legal or tax implications. In general, state property tax incentive programs (current use programs) are specific to agricultural or forested lands. While some programs allow grazing in areas enrolled in a forestry current use program, others do not. Additional considerations to investigate before establishing a silvopasture include the existence of conservation plans and agreements, as well as the location of wellhead protection areas.

## Conclusion

Like other conservation and production practices, silvopasture management is not the right fit for every site or every land manager. High quality woodlands with high native species diversity are generally not a good starting point for silvopasture establishment. However, silvopasture provides an opportunity for active forest management on other sites that have been neglected or poorly managed with undesirable species composition, invasive species concerns, and other challenges. In some situations, silvopasture management can be used to aid in ecosystem restoration or fuels mitigation. The land manager and others in the silvopasture team should consider natural resource issues highlighted in this publication when evaluating the site, developing the plan, and managing the silvopasture.

## Additional Information

Evaluating the Potential of a Site for Silvopasture Development:

<https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/d/5957/files/2015/03/Silvopasture-Site-Assessment-2017-2eceouq.pdf>

Creating Silvopastures: Some Considerations When Thinning Existing Timber Stands:

[https://www.pubs.ext.vt.edu/content/dam/pubs\\_ext\\_vt\\_edu/CSES/CSES-155/CSES-155-PDF.pdf](https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/CSES/CSES-155/CSES-155-PDF.pdf)

Agroforestry Notes #8: Silvopasture: An Agroforestry Practice::

<https://www.fs.usda.gov/nac/assets/documents/agroforestrynotes/an08s01.pdf>

Agroforestry Notes #18: From Pine Forest to a Silvopasture System:

<https://www.fs.usda.gov/nac/assets/documents/agroforestrynotes/an18s03.pdf>

Agroforestry Notes #29: Silvopasture Water and Fencing Systems for Cattle:

<https://www.fs.usda.gov/nac/assets/documents/agroforestrynotes/an29s07.pdf>

Working Trees Brochure: Silvopasture: An Agroforestry Practice:

<https://www.fs.usda.gov/nac/assets/documents/workingtrees/brochures/wts.pdf>

## References

Working Trees Information Sheet: What is Silvopasture?: <https://www.fs.usda.gov/nac/assets/documents/workingtrees/infosheets/WhatIsSilvopastureInfoSheetMay2013.pdf>

Working Trees Information Sheet: Mitigating Heat Stress in Cattle: <https://www.fs.usda.gov/nac/assets/documents/workingtrees/infosheets/HeatStressCattleInfoSheetMay2013.pdf> (Also available in Spanish: [https://www.fs.usda.gov/nac/assets/documents/workingtrees/infosheets/HeatStressCattle\\_Spanish.pdf](https://www.fs.usda.gov/nac/assets/documents/workingtrees/infosheets/HeatStressCattle_Spanish.pdf))

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Agroforestry Notes #46: Forest Grazing, Silvopasture, and Turning Livestock into the Woods: <https://www.fs.usda.gov/nac/assets/documents/agroforestrynotes/an46si09.pdf>

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Oswalt, Christopher M.; Fei, Songlin; Guo, Qinfeng; Iannone III, Basil V.; Oswalt, Sonja N.; Pijanowski, Bryan C.; Potter, Kevin M. 2015. A subcontinental view of forest plant invasions. *NeoBiota*. 24: 49-54. 6 p. <https://www.fs.usda.gov/treesearch/pubs/48489>

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