

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
SILVOPASTURE ESTABLISHMENT

(Ac.)

CODE 381

DEFINITION

An application establishing a combination of trees or shrubs and compatible forages on the same acreage.

PURPOSE

- Provide forage for livestock and the production of wood products.
- Increase carbon sequestration.
- Improve water quality.
- Reduce erosion.
- Enhance wildlife habitat.
- Reduce fire hazard.
- Provide shade for livestock.
- Develop renewable energy systems

CONDITIONS WHERE PRACTICE APPLIES

Situations where silvopasture establishment applies includes: 1) pasture where trees or shrubs can be added; 2) forest where forages can be added; 3) Land on which neither the desired trees nor forages exist in sufficient quantity to meet the land user's objectives.

This practice may be applied on any area that is suitable for the desired plants.

CRITERIA

General Criteria Applicable to All Purposes

Tree species must be adapted to the site and compatible with planned livestock management.

Forage species must be adapted to the site and compatible with the planned management of the site.

No plants on the Federal or state noxious weeds list shall be planted.

Where trees will be added to existing pasture, site preparation should be based on existing vegetation and soil conditions. (See Tree/Shrub Site Preparation Standard 490.) Trees will be planted at the recommended tree density. (See Tree/Shrub Establishment Standard 612.)

For existing forests, remove a sufficient number of trees and/or prune existing trees to allow adequate light penetration (approximately 50%) for forage establishment. [A final basal area of 40-60 square feet per acre shall be established.](#) Establishment of forage species will be in accordance with Forage and Biomass Planting Standard.

If pesticides are used, follow label recommendations. Refer to Integrated Pest Management Standard 595 for guidance on pest prevention, avoidance, monitoring and suppression strategies.

Only viable, high quality, and adapted planting stock or seed will be used.

The planting shall be done at a time and manner to insure survival and growth of selected species.

Tree/shrub spacing needs to exceed width of equipment to be used in management.

Additional Criteria to Provide Forage for Livestock and the Production of Forest.

The forage species must be identified as suitable for the targeted livestock.

Livestock grazing shall be deferred until the average height of the tree's terminal bud exceeds the browsing height of the livestock or of sufficient size to resist breakage or until suitable use exclusion measures for the protection of the woody plants are established. A forage crop (hay, silage, etc.) may be harvested during this period.

[Tree density at planting should be approximately 200 to 400 trees per acre for conifers, or 100 trees per acre for hardwoods such as Oaks, Black](#)

walnut, or Black locust. The tree species must be adapted for the site on which Silvopasture is being established.

Throughout the rotation, trees will be thinned in order to maintain understory/overstory balance that accomplishes the producer's goals. It is likely that at the end of the rotation, tree densities will be a little as 35 to 50 per acre for conifers and 15 to 35 for hardwoods, depending on site potential, species, and other factors. Generally, the lower tree densities optimize forage production and the higher densities optimize timber production. See the Operation and Maintenance section of this standard for more information regarding tree density.

Additional Criteria to Increase Carbon Sequestration

For optimal carbon sequestration, select plants that have higher rates of sequestration and are adapted to the site to assure strong health and vigor.

Plant and manage the appropriate stocking rate for the site to maximize biomass production.

Additional Criteria to Improve Water Quality

Favor trees, shrubs and forages that have growth characteristics conducive to high nutrient uptake.

Additional Criteria to Reduce Erosion

Place linear woody plantings on or near the contour when water erosion is a concern.

Additional Criteria to Enhance Wildlife Habitat

Establish forage species and understory shrubs that will provide forage, browse, seed, cover, or nesting habitat for the wildlife species of concern. For additional guidance refer to Upland Wildlife Habitat Management Standard 645.

Favor herbaceous seed mixes that include a diverse mix of native forbs and/or legumes to benefit wildlife including pollinators.

Additional Criteria for Develop Renewable Energy Systems

Select plants that provide adequate kinds and amounts of plant material needed to produce bioenergy feedstocks.

Intensity and frequency of energy biomass removals will be managed to prevent long-term negative impacts on the soil and water resources.

The harvesting of energy biomass shall be accomplished in a manner that will not

compromise the other intended purpose(s) and functions

CONSIDERATIONS

Failure to maintain adequate forage for livestock may result in excessive tree damage and/or loss.

Location and distribution of facilities for water, minerals, or supplemental feed should be such that livestock are not encouraged to over-utilize areas of silvopasture.

Rows should be oriented in an east-west orientation where feasible and practical to allow maximum sunlight onto grass strips.

Where water erosion and/or runoff from melting snow are a hazard, it should be controlled by supporting practices.

Wildlife and pollinators should be considered when selecting tree or shrub species. Species diversity, including use of native species, should be considered.

Consider using native vegetation. Also consider the invasive potential when selecting plant species.

Silvopasture establishment may not be feasible in some existing forest and woodland communities.

Consideration should be given to adverse offsite effects.

Plants established in cropping systems should have root systems that have minimal impact on crop growth.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance):

- Forage and forest management will follow Prescribed Grazing 528 and Forest Stand Improvement 666 Standards. [Tree canopy](#)

should be managed for 40-60 percent canopy for cool season grasses. This requires thinning at varied intervals depending on site productivity to keep the canopy within the desired range.

- Tree limbs will need to be pruned in order to maintain viable, marketable timber stock. Conifers will need to be pruned when trees reach 15 to 20 feet tall and/or the diameter of the tree reaches 5 inches at a height of 6 inches above the ground. Conifers will need follow-up pruning up to the desired harvest height (probably 18-32 feet) where the trunk diameter is greater than 4 inches, but never more than one-half of the total crown. Maintain live crown equal to one-third of the tree height. Hardwood trees will need pruning to achieve the desired canopy type (multi-branched is generally preferred for nut production, single stem for lumber, etc) throughout the rotation.
- Replanting will be required when plant survival is inadequate to meet practice and client objectives.
- Competing vegetation will be controlled until the trees are established.
- Periodic applications of nutrients may be needed for establishment and to maintain plant vigor. Refer to Nutrient Management Standard 590 for further guidance.
- Inspect trees and shrubs periodically and protect from adverse impacts including insects, diseases or competing vegetation. The trees or shrubs will also be protected from wildfire and damage from livestock and wildlife.

REFERENCES

- Bendfeldt, E.S., et al. 2001. Establishing trees in an Appalachian silvopasture: response to shelters, grass control, mulch, and fertilization. *Agroforestry Systems*. 53:291-295.
- Burner, D.M. 2003. Influence of alley crop environment on orchardgrass and tall fescue herbage. *Agron. J.* 95: 1163-1171.
- Byrd, N.A., and C.E. Lewis. 1983. Managing pine trees and bahiagrass for timber and cattle production. USDA Forest Service, General Report R8-GR 2.
- Clason, T.R. 1996. Timber-pasture management enhances productivity of loblolly pine plantations. *Louisiana Agriculture* 39(2): 14-16.
- Clason, T.R. and S.H. Sharrow. 2000. Silvopastoral practices. Ch. 5 in *North American Agroforestry: An Integrated Science and Practice*. American Society of Agronomy, Madison, WI.
- Clason, T.R. 1995. Economic implications of silvipastures on southern pine plantations. *Louisiana Agricultural Experiment Station, in Agroforestry Systems* 29:227-238.
- Clason, T.R. 1999. Silvopastoral practices sustain timber and forage production in commercial loblolly pine plantations of northwest Louisiana USA. *Agroforestry Systems* 44: 293-303.
- Clason, T.R. and J.L. Robinson. 2000. From a pasture to a silvopasture system. USDA - NAC. *Agroforestry Note* 22.
- Clason, T.R. and J.L. Robinson. 2000. From a pine forest to a silvopasture system. USDA – NAC. *Agroforestry Note* 18.
- Cutter, B.E., K. Hunt and J.D. Haywood. 1999. Tree/wood quality in slash pine following long-term cattle grazing. *Agroforestry Systems* 44:305-312.
- Fike, J.H., et al. 2004. Considerations for establishing and managing silvopastures. *Plant Management Network*. 1-12.
- Lehmkuhler, J.W., et al. 2003. Tree protection methods during the silvopastoral-system establishment in Midwestern USA: cattle performance and tree damage. *Agroforestry Systems* 59: 35-42.
- Lewis, C.E., et al. 1983. Integration of pines, pastures and cattle in south Georgia, USA. *Agroforestry Systems*. 1:277-297.
- Sharrow, S.H. and I. Syed. 2004. Carbon and nitrogen storage in agroforests, tree plantations and pastures in western Oregon, USA. *Agroforestry Systems* 60:123-130.