NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

SILVOPASTURE ESTABLISHMENT

(Ac.)

CODE 381

DEFINITION

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

PURPOSE

- To provide forage for livestock grazing and the production of wood products.
- To increase carbon sequestration.
- To improve water quality.
- To reduce erosion.
- To enhance wildlife habitat.
- To reduce fire hazard.
- To provide shade for livestock

CONDITIONS WHERE PRACTICE APPLIES

Situations where silvopasture establishment applies include: 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 and forage species must be adapted to the site and compatible with planned livestock management.

Where trees will be added to existing pasture, site preparation should be based on existing vegetation and soil conditions.

Trees will be planted at the recommended tree density. See TREE AND SHRUB ESTABLISHMENT (612).

For existing forests remove a sufficient number of trees and/or prune existing trees to allow adequate light penetration for forage establishment and silvopasture use.

When using pesticides follow label recommendations and PEST MANAGEMENT (595).

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 will be compatible with the width of equipment to be used in management.

Existing natural hardwood closed canopy sites having an oak site index greater than 60 shall not be used for silvopasture establishment.

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

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 may be mechanically harvested during this period.

Tree densities must be at appropriate levels to allow acceptable forage production and wood products.

Choose tree or shrub species that have potential to produce forest products.

Additional Criteria to Increase Carbon

Sequestration

For optimal carbon sequestration, select plants that have high rates of photosynthesis and are well 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.

Follow NUTRIENT MANAGEMENT (590).

Incorporate conservation buffers if a water source (stream, pond, etc.) is present.

Additional Criteria to Reduce Erosion

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

Water erosion and/or runoff from melting snow hazards will be controlled by supporting practices.

Additional Criteria to Enhance Wildlife Habitat

Establish or maintain forage and woody species that will provide forage, browse, seed, cover or nesting habitat for the desired wildlife species.

Follow UPLAND WILDLIFE HABITAT MANAGEMENT (645) or WETLAND WILDLIFE HABITAT MANAGEMENT (644) for further wildlife guidance.

Additional Criteria to Provide Shade for Livestock

Trees should be uniformly spaced for even shade distribution.

CONSIDERATIONS

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

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

If grazing does not maintain reduced fuel loads, prescribed burning should be considered providing the woody plants are fire adapted and will not be damaged.

Woody plants should have root systems that minimize impact on forage growth.

Modifying a hardwood forest with a closed canopy for silvopasture activities should be done with extreme caution.

Wildlife needs should be considered when selecting tree or shrub species.

Give consideration to wooded sites with existing understory native forbs and grasses.

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):

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

Restrict access by livestock when soils are at or above field capacity (saturated soil conditions).

Forage and forest management will follow PRESCRIBED GRAZING (528A) and FOREST STAND IMPROVEMENT (666) standards.

Competing vegetation will be controlled until the trees are established.

Periodic applications of nutrients may be needed for establishment and to maintain plant vigor.

Inspect trees and shrubs periodically and protect from adverse impacts including insects, diseases, livestock grazing, or competing vegetation.

Protect trees or shrubs from wildfire and damage from livestock and wildlife.

Maintain a 30 – 50 % canopy cover for optimal forage production and livestock use. Canopy covers exceeding 50% will limit forage production and livestock usage.

Once canopy cover exceeds 50%, the system may cease to function as a silvopasture system and begin to approach a forest system.

Replanting will be required when plant survival or canopy cover levels are inadequate to meet practice and client objectives.

Tree pruning may be needed to adjust light levels, improve wood products, or provide adequate space for machinery. Follow TREE/SHRUB PRUNING (660).

PRACTICE SPECIFICATIONS

Site Preparation

For tree/shrubs that will be added into existing forestland sites or where trees will be added to existing grasslands follow guidelines in FOREST SITE PREPARATION (490).

Planting Methods

Use TREE/SHRUB ESTABLISHMENT (612) for planting. Control competing vegetation for a minimum of 3 feet on either side of the woody row(s).

Establishment of forage species will be in accordance with PASTURE AND HAYLAND PLANTING (512).

Species Selection

Base plant selection on soil types, site characteristics, site limitations, landowner objectives, projected or existing canopy characteristics, and forage sunlight and moisture requirements.

Woody. See Tables 1a -1c in ALLEY CROPPING (311) for guidance on species selection. Other species may be used providing they meet the selection criteria list above.

A number of woody species contain natural chemicals that may be harmful to livestock. These species should be avoided or appropriate management activities instituted to minimize exposure and contact. Species listed below have been documented to cause injury to livestock.

Black walnut: Springtime pollen may induce laminitis in horses.

Red maple: Ingested wilted leaves will cause hemolytic anemia in horses.

Black cherry: Ingested wilted leaves and twigs will cause cyanide poisoning in livestock.

Black locust: Ingested seeds, leaves, and twigs will causing poisoning in livestock.

Oaks: Ingested leaves and seeds are toxic in large doses to livestock.

Pines: Ingested needles can cause toxic reactions in livestock.

Wildlife. See WILDLIFE UPLAND HABITAT MANAGEMENT (645) for additional woody species recommendations and guidance.

Forage. See PASTURE AND HAYLAND PLANTING (512) for guidance on species selection. Choose species that have shade tolerance and/or high net forage production. For establishment into existing hardwood sites, native forage species will be used.

Woody Spacing/Layout

Spacing distance between woody plants and row sets should be based on landowner objectives, tree and shrub environmental requirements, light requirements and growth periods of the forage, and machinery width needs.

Planted Acres. Plant trees in single, double or triple row sets. Cluster plantings may also be used. When multiple row woody planting sets are used, stagger within row plantings.

Within the row spacing for sets should be:

small shrubs (< 8 ft)	3-6 feet
large shrubs	5-8 feet
evergreens	8-12 feet
deciduous trees	8-12 feet

Between the row spacing for sets should be:

between shrub rows	6-10 feet
between tree rows	10-12 feet
between tree/shrub	10-12 feet

Use Table 1 as a guide for woody planting rates (plants/acre) when row sets and 15 to 40 feet alley widths are used.

Existing forests. Reduce stocking levels to at least 50%. See FOREST STAND IMPROVEMENT (666) for guidance.

Trees should be uniformly spaced as possible for even shade distribution.

Consultation with a NRCS, MDC, or consulting forester shall be arranged during planning to assess site feasibility.

REFERENCES

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. 1996. "Timber-Pasture Management Enhances Productivity of Loblolly Pine Plantations." Louisiana Agriculture 39(2): 14-16.

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. and J.L. Robinson. 2000. "From a Pine Forest to a Silvopasture System." USDA NAC Agroforestry Note 18. Pp. 1-4.

Clason, T.R. and J.L. Robinson. 2000. "From a Pasture to a Silvopasture System." USDA NAC Agroforestry Note 22. Pp. 1-4.

Clason, T. R. and S. H. Sharrow. 2000. "Silvopastoral Practices" Chapter 5 in North American Agroforestry: An Integrated Science and Practice. American Society of Agronomy, Madison, WI. Pp. 119-148.

Table 1. Silvopasture Woody Planting Rates (Trees/acre) Based on Row Set Type and Alley Widths *

	Single Row Set				Double Row Set				Triple Row Set			
Alley Width	Row Spacing	In Row Spacing 6 ft	8 ft	10 ft	Row Spacing	In Row Spacing 6 ft	8 ft	10 ft	Row Spacing	In Row Spacing 6 ft	8 ft	10 ft
15 feet	*Row spacing and alley width are the same for single row sets.*	484	363	290	6 feet	691	518	414	6 feet	807	607	484
					8 feet	631	473	378	8 feet	703	528	422
					10 feet	580	435	348	10 feet	622	468	374
					12 feet	537	403	322	12 feet	558	418	335
20 feet		363	272	218	6 feet	558	418	335	6 feet	680	512	409
					8 feet	518	388	311	8 feet	605	455	363
					10 feet	484	363	290	10 feet	545	409	327
					12 feet	454	340	272	12 feet	495	372	297
30 feet		242	182	145	6 feet	403	303	242	6 feet	512	390	311
					8 feet	382	287	229	8 feet	473	356	284
					10 feet	363	272	218	10 feet	435	328	262
					12 feet	345	259	207	12 feet	403	303	242
40 feet		182	136	109	6 feet	315	237	189	6 feet	419	315	252
					8 feet	303	227	182	8 feet	389	292	234
					10 feet	290	218	174	10 feet	363	273	218
					12 feet	279	209	167	12 feet	340	256	204
60 feet		121	91	72	6 feet	220	165	132	6 feet	302	247	181
					8 feet	213	160	128	8 feet	287	215	172
					10 feet	207	155	124	10 feet	272	204	163
					12 feet	202	151	121	12 feet	259	194	155

* Field shape and planting design may cause some variation in plants/acre.