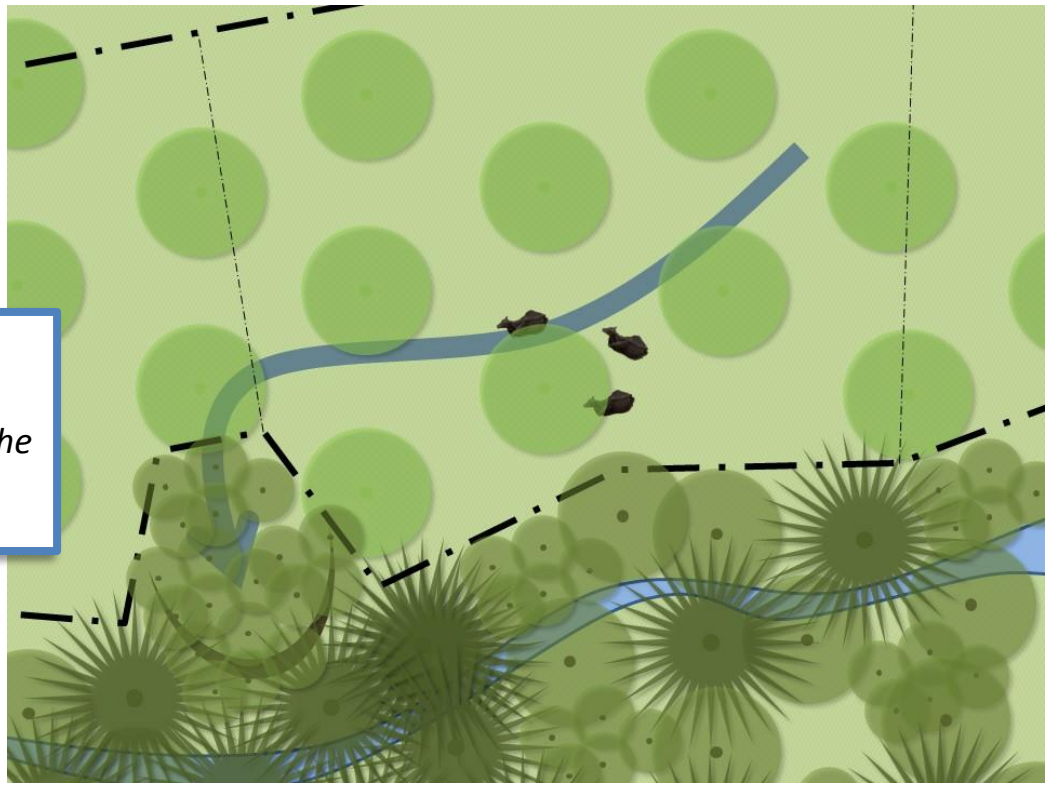
Silvopasture



*"**Silvopasture** is the integration of trees and livestock operations on the same ground."*

Description:

Silvopasture is the deliberate integration of trees and livestock operations on the same ground. Well managed silvopastures employ agronomic principals, typically including introduced or native pasture grasses, nitrogen-fixing legumes, and managed intensive grazing (MIG) systems applying short grazing periods which maximize vegetative plant growth and harvest (Garrett et al., 2004; Hamilton, 2008; Brantly, 2013). The tree canopy is managed for timber, fruit/nut production, or any combination of forest products. By stacking grazing and forage production systems with canopy forest products, producers can maximize and diversify their agricultural operations within close proximity to riparian corridors while providing the ecosystem services to meet environmental conservation goals.

Placement and management of silvopasture systems is specific to the site conditions and landowner needs. This strategy is not intended to replace a properly functioning, closed canopy riparian forested buffer, rather, the goal is to provide a way for the landowner to increase the buffer size and function while at the same time realizing economic benefits. Silvopasture can be a long-term management strategy or it can be a short-term approach to controlling competing vegetation during establishment of a forest canopy.

In silvopasture, livestock are used to manage the vegetative dynamics of this agro-ecosystem through short and low intensity grazing periods, much like the migratory nature of large mammal species found in natural savannas. This ensures the continued and rapid regrowth of dense understory vegetation, sequestering and cycling the additions of nutrients and enhancing the biological process within the upper soil horizon. This

process increases the productive period of the forage plants during the dry season, extending overall site productivity and biological processes that can be supportive to riparian ecosystem habitat and functionality.

Conservation Benefits

The implementation of silvopasture management within a riparian zone provides a unique opportunity for landowners to maintain livestock operations while providing shade, leaf litter, carbon storage, and the water quality enhancement capabilities of trees along riparian corridors. Though livestock can create sediment and fecal coliform pollution if managed improperly, research has shown that proper integration of silvopasture techniques with riparian buffers along the stream, exclusion fencing, and grazing management can provide numerous environmental benefits:

Benefits of trees:

- Incorporating deep rooting trees into a pasture landscape diversifies rooting depths and increases nutrient and water uptake (Hooper and Vitousek, 1997).
- Tall trees provide shade to both the stream, keeping water temperatures cool for fish, and the pasture. Shading the pasture during droughty conditions increases soil moisture and the length of the growing season, allowing for increased nutrient uptake.
- From a structural perspective, during flood or winter storm events, trees within pastures slow moving surface water and encourage infiltration thereby reducing fecal matter and nutrient runoff (Michel et al., 2007; Jose, 2009). Rows of trees planted either on contour or parallel to the riparian channel can provide a physical barrier to pollutants moving toward a waterway.
- Incorporating trees into the agricultural landscape increases carbon sequestration both above and below ground (Schoeneberger et al., 2012).
- A forest with an open understory creates a unique natural habitat that can enhance nesting site potential (ground and aerial nesting sites), movement of migratory mammals, and increases flowering of trees and shrubs for pollinator habitat when compared to open pasture systems (Garrett et al., 2004; Hinsely and Bellamy, 2000; Varah et al., 2013). Trees provide birds with refuge, shelter and forage sites. Bald eagles feeding on salmon carcasses can bring salmon and their nutrients further into the pasture settings aiding in upland fertility.

Benefits of grasses and other forage crops:

- Grasses and other understory forage species have a much longer productive period than woody shrubs and trees as well as much more rapid vegetative growth. As such, forage grasses that are buffered from summer droughty conditions yet allowed full winter sun potential under a deciduous tree canopy have the potential for increased nutrient uptake as compared to native forest understory (Sovell et al., 2000).
- Well managed pasture grasses have deep soils that are rich in organic matter where healthy microbial systems filter pollutants before they reach surface waters.
- The high stem density of grasses spreads surface flows, reducing concentrated flow paths and allowing for greater water infiltration, pollutant removal, and nutrient uptake. Proper rotational grazing,

whether on open pastures or under a sparse tree canopy, has been shown to reduce fine sediment and fecal loading into surface waters more than traditional exclusion fencing (Sovell et al., 2000; Lyons et al., 2000).

- In a well-managed and long-term rotational grazing system, nutrient removal can be achieved through livestock consumption or harvest of forage grasses.

Landowner Benefits

Silvopasture provides farmers reduced economic risk by managing for three enterprises on the same land: tree crop, livestock, and forage. In addition:

- Trees provide livestock shelter from summer heat while diversifying their diet. Current research nationwide is showing increased weight gain, calve/kidding success rates, and milk production when livestock are produced in silvopasture scenarios (Angima, 2009; Garrett et al., 2004).
- Properly managed rotational grazing systems provide an opportunity to increase animal stocking rates, even on seasonally grazed sites, by maximizing forage growth throughout the season (Hancock and Anrae, 2009; Nygard, 2014).
- A canopy tree crop can increase the nutritive quality of the forage, which compensates for the slight decrease in forage productivity, translating to higher livestock growth rates (Garrett et al., 2004; Kallenback et al., 2006; Moreno, 2008).
- A canopy also provides the potential for extending the growing season of forage or hay due to increased soil moisture and shade during droughty summer months (Kallenback et al., 2006; Feldhake 2001 and 2002).
- If the goal is to develop a timber stand in the long-term, livestock can be used to reduce labor and cost for weed and grass suppression, while increasing tree growth productivity (Burner, 2003).

Design and Implementation

Design, implementation and management of silvopasture systems are always defined by site environmental conditions matched to the landowner's economic goals and management interests. The intent with silvopasture systems is to integrate livestock and forage production with long-term forest establishment. Though the intent is not to remove livestock from agricultural operations, this technique can be used as a successional management tool leading towards a focus on tree crops while providing economic gains in the short-term through livestock sales. In this instance, highly monitored and flash grazing practices can be allowed in the first year or two of riparian buffer plantings to reduce competition

Livestock Selection:

- *Marketable*
- *Best suited to tree crops and forage*
- *Able to be intensively managed*

between grasses and early pioneer woody perennials, while also selectively managing for invasive weeds.

Consideration for weed pressures, proximity to streambank, flood potential, and types of trees should be considered when selecting livestock type and rotation scheduling. Long-term silvopasture grazing systems should be implemented no closer than 35ft from the top of bank within a riparian zone and should be implemented in conjunction with a forested riparian buffer along the water course to ensure water quality benefits are achieved. As such, fencing should be installed along boundaries of the silvopasture to exclude livestock from the riparian buffer along the stream and also to allow proper rotational grazing.

Silvopasture systems are most successful on well-drained upland areas that are not prone to seasonal flooding to prevent manure from moving directly into riparian corridors. To reduce surface runoff, trees should be planted using techniques to prevent movement of manure solids and nutrients into surface flow (i.e on contours of slope, on parallel to riparian vegetation zone, or perpendicular to concentrated flow paths).

Timing of grazing is important to maintain vigorous growth of the forage during the growing season but also to reduce mud and soil compaction from overgrazing or grazing during the rainy season. The practice of silvopasture in the Pacific Northwest is new and provides for a wealth of innovation and niche market development opportunities for the landowner. This, of course, presents the challenge of designing each specific component of the silvopasture scenario to work in conjunction with the natural resources influencing the site and the intended products to be managed for.

Trees will need to be protected in their early development. Electric/temporary or permanent fencing may be required to keep livestock from browsing on terminal buds. In some cases, it may be best to remove livestock grazing during the first few years of tree growth. During this time, cutting the forage for livestock feed can still be used to manage understory growth and provide needed on-farm feed or income.

Tree Selection:

- *Marketability*
- *High Quality*
- *Fast Growing*
- *Deep Rooted*
- *Site and Climate Tolerant*
- *Produces Light Shade*

Placement of trees will depend on the landscape and the intended cropping system. On sloped land, trees placed in rows are best suited to capture runoff and reduce soil erosion. Rows may also aid in tree crop harvest, management of tree growth and management of grazing patterns. Trees should be spaced to provide even shade coverage for livestock and forage, maximize tree growth, and allow ripening of fruit or nut crops.

Suitable Tree Species for PNW Silvopasture				
Common Name	**Family**	**Genus**	**Harvestable Material**	**Notes**
Well Drained Soils				
Douglas-fir	*Pinaceae*	*Pseudotsuga*	Trees	Christmas trees
Chestnuts	*Fagaceae*	*Castanea*	Nuts	High value nut and timber
Butternuts	*Junglandaceae*	*Juglans*	Nuts	High value nut and timber
Black Walnut	*Junglandaceae*	*Juglans*	Nuts	High value nut and timber
Filberts	*Betulaceae*	*Corylus*	Nuts	High value nut crop
Stone Pines	*Pinaceae*	*Pinus*	Nuts	High value nut
Domestic Apple	Roseaceae	*Malus*	Fruit	Cider production

Wetter Conditions				
Spruce (all species)	*Pinaceae*		Ornamental/Timber	Large market and distribution available
Western Red Cedar	*Cupressaceae*	*Thuja*	Boughs/Timber	Large market and distribution available
Alder	*Betulaceae*	*Alnus*	Timber and Syrup	Furniture, firewood and syrup
Birch	*Betulaceae*	*Betula*	Timber and Syrup	Furniture, firewood and syrup
Hybrid Poplar/Cottonwood	*Salicaceae*	*Populus*	Timber and Syrup	Biomass, firewood and syrup
Cascara	*Rhamnaceae*	*Rhamnus*	Medicinal bark	Large market and distribution available
Heartnuts	*Junglandaceae*	*Juglans*	Nuts	High value nut and timber
Elderberry	*Caprifoliaceae*	*Sambucus*	Fruit	High value fruit
Crabapple	*Roseaceae*	*Malus*	Rootstock	Grafter to high value fruit
Pear	*Roseaceae*	*Pyrus*	Fruit	Cider production source
Plum	*Roseaceae*	*Prunus*	Fruit	Local high value fruit
Cherry	*Roseaceae*	*Prunus*	Fruit/Timber	High value fruit and hardwood
Quince	*Roseaceae*	*Cydonia*	Fruit	High value fruit
Fig	*Moraceae*	*Ficus*	Fruit	High value fruit
Mulberries	*Moraceae*	*Morus*	Fruit	Great mast crop and high value fruit

Pacific Northwest Production Models:

Various livestock species can be matched with a diverse array of tree crops depending on the operator's goals. All species of livestock production, including chickens, pigs, cattle, sheep, goats, and horses, can benefit greatly from the integration of tree crops.

Chestnuts (Castanea Spp.): Chestnut production is a potential high-value cropping system for the Pacific Northwest. Traditionally, chestnuts have been used worldwide for flour for pasta and bread as well as beer making. It is currently recognized as a gluten-free substitute for many wheat products. Demand for chestnuts is growing in the US and high-productivity, low maintenance and relatively short planting to harvest time makes this a viable alternative crop particularly when matched with livestock production. The Washington Chestnut Company in Everson, WA started commercially harvesting chestnuts on 4 year old trees in the Skagit Valley floodplain with an expected average yield of 2,000 lbs per acre (Hilgart, 2014). Given ideal conditions, 3,000-4,000 tons can be realized. Currently, chestnuts are selling for $3.60/lb wholesale and upwards to $8.00/lb retail (Hilgart, 2014). Allen Creek Farm in Ridgefield, WA currently sells their harvest for between $5.75/lb and $8.00/lb depending on nut size (ChestnutsOnline.com). As chestnut harvest occurs between late September and early December, livestock can still be maintained as the primary use of the landscape during spring and summer months.

Agricultural Production

Tree crops:
- *Timber*
- *Firewood*
- *Fruit/Nut crops*

Livestock production:
- *Improved pasture and hay production*

Additional economic opportunities:
- *Recreation, hunting and fishing leases*
- *Conservation incentive programs*

Alder (Alnus Spp.): Alder is an ideal candidate for many different working buffer techniques including silvopasture. Preferring disturbed and wet soils, alder can be used along riparian corridors, drained wetlands,

or floodplains with shallow water tables. The nitrogen fixing capability of alder makes this species well suited for restoring highly degraded pastures or grasslands that are poor in fertility and soil structure. It can be harvested and sold for a multitude of uses and at various stages of growth. As timber, alder has been desired as a cabinetry or furniture wood currently valued at over $800/thousand board feet (MBF) for logs greater than 12 inches in diameter, achievable in a 25 year time frame (Wick, 2015; Scott, 2003). On a shorter rotation, alder can be used for mulch (on-farm), packaged as green shavings for horse and livestock bedding (retail $38 for 1/3 cubic yard on smallcrop.com), "value-added" for smoking meats, or used to cultivate mushrooms from plug spawn (branches) or sawdust inoculations ($7.50/10 lb bag on Fungi.com). Due to the low tannin and lignin structure found in alder sawdust, livestock operators, large-scale composters and mushroom producers are seeking alder sawdust resources nationwide.

Financial Assistance and Cost-Share Opportunities

Financial assistance in the form of cost-share funds or public subsidies can aid landowners interested in implementing silvopasture management practices. Agencies currently equipped to provide this funding, including implementation funds and technical assistance, can be secured through the following agencies and programs:

- Conservation Districts – Local conservation districts can help to provide technical assistance and planning, and seek funds though the Washington State Conservation Commission and other local funding sources.
- National Resource Conservation Service (NRCS) – EQIP and CSP programs. Contact your regional NRCS Field technician for application details: http://www.nrcs.usda.gov/wps/portal/nrcs/main/wa/contact/local/

Sources of Funding and Assistance

- USDA Farm Service Agency – Conservation Reserve Enhancement Program (CREP)
- NRCS – Environmental Quality Improvement Program (EQIP)
- NRCS – Conservation Stewardship Program (CSP)
- Washington Conservation Commission – Livestock and Shellfish Funding Programs
- Department of Ecology – Pollution Identification and Correction (PIC) program
- Local Conservation District, NGO, and other Environmental Protection Partnerships

Approved WA NRCS Best Management Practice Standards:

The NRCS provides Best Management Practice (BMP) standards for Washington State to ensure cost-share subsidies are used appropriately for the natural resource concerns to be addressed. The following NRCS BMP standards have been developed in accordance to state environmental policy specifically addressing natural resources management within agricultural landscapes:

Silvopasture (381): Establishing tree species in a silvopasture setting that have a potential to yield wood products, are conducive to high nutrient uptake, provide wildlife habitat and are planted to ensure water and soil conservation. Resources are also provided to install highly productive forage species. Prescribed Grazing (582) must be implemented to ensure successful implementation and environmental benefits.

Prescribed Grazing (582): Developing and implementing a prescribed grazing plan to meet the silvopasture production scenario. This plan will provide the operator with technical assistance and monitoring to ensure livestock forage and production is maximized while conserving on-site natural resources.

Plant Enhancement Activity – PLT18 – Increasing on-farm food production with edible woody buffer landscapes: As part of the their Conservation Stewardship Program, NRCS has recently added this enhancement funding source to provide resources for enhancing windbreaks, alley cropping, silvopasture and riparian forested buffers with trees and shrubs that provide food for human and wildlife consumption.

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