

Silvopastoralism

Heard of shade-grown coffee? This is shade-grown livestock!

Producing livestock in tropical areas can be challenging. This is because of the weather constraints that reduce plant (and so animal) growth. Here, plants tend to have a lower nutritional value and are harder to digest, which means cows produce more methane. This not only contributes more to greenhouse gas (GHG) production but also makes the forage less tasty for livestock, which reduces their food intake and affects their productivity.

Enter silvopasture. A silvopastoral farm is one that uses agroforestry (combining trees with agriculture) to build 3D layers of vegetation on a livestock pasture.

There can be two or three layers: either a mixture of grass with either trees or shrubs, or grass with both trees and shrubs.

Most silvopastoral farms are found in tropical and sub-tropical areas such as Latin America and Australia. These locations tend to suffer from droughts, which affect the forage quality and therefore livestock production. Like shade-grown coffee, silvopasture works well in these locations as the system aims to efficiently use environmental inputs to produce more quality and quantity outputs. Another advantage of silvopasture is that it can work well with smallholders as well as large commercial farms.

A tropical silver bullet?

When compared with conventional extensive systems without trees or bushes, the benefits of this system can include:

1. More resilience to climatic changes due to the different species having different responses to weather stress. For instance, grasses may be less tolerant of drought than shrubs, so in dry periods, the livestock can eat the shrub leaves rather than the grass.
2. Higher diversity of forage, which can improve nutrition.
3. Improved animal welfare due to reduced temperature stress, reduced parasite load, reduced stress and increased nutrition.
4. Increased productivity due to reduced heat stress and increased nutrition from better distribution and availability of forage throughout the year.
5. Increased profits due to reduced input costs and increased productivity.
6. Reduced GHG emissions due to reduced fertiliser use, reduced methane emissions from improved



nutrition, higher carbon sequestration from the additional plants and improved soil.

7. Better soil water retention and higher water infiltration to deeper soil layers.
8. Increased nitrogen fixation
9. Better nutrient recycling due to improved ecological functioning.
10. Reduced wind speeds due to shelter provided by trees, which reduces evaporation.
11. Improved livestock thermoregulation due to shade from trees and shrubs, which reduces the animal's metabolic rate as they spend less energy dissipating heat.
12. Higher biodiversity, particularly birds, butterflies and snails.
13. Integrated pest management, due to increased presence of birds, ants and fungi, as well as improved livestock resistance from improved nutrition.

Increasing the power of nature

Intensive silvopastoral systems (ISS) provide high-density fodder shrubs, often planted at over 10,000/ha, along with highly-productive pastures and trees. The “intensiveness” of the system refers to the focused and efficient use of ecological processes to improve the productivity of the ecosystem and farm. The only inputs come from nature: sunlight, soil, water and nutrient cycles, nitrogen fixation and biomass production. Currently, Australia has the most hectares managed in silvopastoral ways, totalling over 200,000.

Managing, not reducing, complexity

The most important part in creating an ISS is choosing the right plant species. White leadtree (*Leucaena leucocephala*) is a common tree planted in silvopastoral farms, as the legumes are drought-resistant, fast growing, palatable, tolerant to grazing and high in protein. Mexican sunflower (*Tithonia diversifolia*) is also popular, but fruit or timber trees can be planted to provide fodder for livestock or wood fuel.

Grasses used are chosen for their high biomass potential, which are then grazed rotationally using fenced paddocks. The higher biomass allows for higher stocking rates (from 1-2.5 animal units(AU)/ha

in conventional extensive systems to 3-6 AU/ha in ISS). Milk and meat production can increase by up to four times due to the more nutritious and productive forage. For example, when Nestlé assisted in the conversion of conventional extensive dairy to silvopastoral farms in Colombia, farms saw an increase in milk production per cow from an average of 3 to 5.5 L/day and stocking density from 0.6 to 1.3 cows/ha. This resulted in overall milk production from 1.8 to 7L/ha. Monthly farm profits also rose by 47%, which allowed them to employ 2 new staff members.

Over the years, the net increase in per ha income from ISS timber farms rises much more than conventional ranches. Silvopastoral farms in Latin America that grew *Leucaena* and lemon trees required no pest or weed control and produced more abundant, larger, juicier and organic lemons. The percentage return of silvopasture when compared with conventional pasture or plantation farms is higher (13% compared

with 6.1% and 8.8% respectively). Silvopastoral ranching is therefore a productive and efficient alternative to conventional extensive ranching.

The animal welfare potential of these systems tends to be much higher than both conventional pasture-based and indoor systems. The quality and the quantity of the forage increases compared with conventional grazing systems, meaning that the body condition of livestock improves, and the animals are better adapted to their environment. Compared with intensive indoor systems, livestock have the potential to exhibit more natural behaviours, such as

grazing, and show far more positive social behaviours with herd members. They are also less stressed due to not being overcrowded.

“Silvopasture is part of a trend globally to sustainably coax more food from each acre – without chemicals and fertilizers – while reducing greenhouse gas emissions, increasing biodiversity, and enhancing the land's ability to withstand the effects of climate change”

Lisa Palmer, environmental journalist



Photo: D. Goulson

Ranching becomes part of the solution to environmental problems

Intensive silvopastoral systems can have similar productivity to conventional intensive systems that rely on manmade inputs like artificial fertilisers, concentrates, medicines and agrochemicals. Also, the meat quality (fat thickness, colour, marbling score) can be equal to that of meat produced in feedlots. And on top of that, the meat has more protein and unsaturated fat, and less saturated fat than in feedlot systems.

Although hot, wet countries are the normal location of silvopastoral farms, the technique can be used in countries susceptible to night-time frosts too, such as Argentina. Here, ISS has been shown to successfully reduce frost damage of fodder by 80% and eliminated the need for pesticides. Also the trees and bushes can be used to make living fences, rather than having to rely on wooden posts made from chopped-down trees.

Whilst cattle tend to be the preferred species of choice for silvopastoral farms, sheep have also been used in Mexico. Possibly one of the reasons for focusing on ruminants is that the seeds of the white leadtree can be toxic to non-ruminants. However, other tree species can be used instead with poultry and pigs.

So what's the catch?



Photo: PhillipC (iStock)

Silvopastoral farms require a permanent source of good quality water. This is potentially why the practice has been more common in areas where rainfall is higher. It is more appropriate to use silvopastoral practices in areas with higher temperatures, such as Brazil, Mexico and Colombia, where the where the heat would otherwise reduce the productivity of the system.

Silvopasture is found less often in areas where the terrain is steep and in sensitive locations, such as wetlands.

A potential difficulty with setting up a silvopastoral farm is the high cost of establishing the system, which can be 30% more than conventional monoculture pastures, costing \$1,000-2,000/ha. This can be mitigated by the higher economic returns of ISS (at least 30% more a year compared with conventional farms). The first year of converting to silvopasture often shows a similar or slightly lower profitability of the farm compared with the baseline, but by the end of the 2nd year most farmers see their return on their investment. Some farms have reported 70% more weight gain of livestock fed on *Leucaena* pasture compared with only foraging on conventional pasture. Farmers also use less mineral lick in ISS systems because the more balanced composition of the fodder. Therefore whilst the initial costs may be higher, the return on investment far surpasses conventional grazing.



Photo: Neil Palmer (CIAT)

The Cattle Site, at <https://tinyurl.com/cattleSP>, make the following recommendations if you are thinking about converting to silvopasture:

1. Research heavily into this topic, particularly via online sources such as the handbook at <https://tinyurl.com/HandbookSP> or this forum at <https://tinyurl.com/ForumSVP>.
2. Build capacity in woodland management and husbandry.
3. Find local silvopastoral advisors to provide help and support.
4. Contact a forester to assist you achieve your land and livestock management goals.

Silvopasture may well be a gold standard in terms of economic, social and environmental sustainability that has the potential to create high animal welfare.

Case study: converting extensive pasture to silvopasture in Colombia

Colombia undertook an 8-year study to determine the effect of converting 12,000 ha of extensive ranches to ISP. This resulted in 2,000 ha of the recovery of degraded pasture, which had the knock-on benefit of an additional 5,000 ha of preserved forests, as less forest was converted to pasture. In total, 5,69 MtCO₂e was captured or avoided. Net income per ha-livestock produced increased from \$237.70 to \$533.20 and milk production increased from 5 L/cow/day to 6.1L/cow/day. Soil erosion reduced from 80.9 tonnes/ha to 44.1 tonnes/ha and the percentage of farms using fire fell from 38% to 2.3%.

Source: UK Government (2010) Silvopastoral systems for climate change mitigation and poverty. <https://tinyurl.com/ColombiaSP>

Compassion in World Farming, 2017. Case study: Silvopastoralism

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