



Dryland Systems Solutions

Producing More with Less

Pastoral and Agro-Pastoral Systems

Managing rangelands: promoting sustainable practices

Silvopasture: offering multiple benefits for agro-pastoralists

Silvopasture is ideally suited to the dry areas where its application in agro-forestry production systems can help to improve fodder production, enhance soil health, and reduce erosion. In India, where the practice is traditionally used in drought-tolerant regions, it offers multiple benefits for poor rural communities.

Traditionally, silvopasture – the integration of livestock and forage in an agro-forestry production system – has been common in most arid and semi-arid parts of India. This system, which involves planting trees or shrubs in rows with wide spacing, creates ‘alleyways’ where animals can graze on forage crops or native pasture.

Silvopasture is ideal for arid and semi-arid environments: it can improve forage production in areas highly dependent on livestock production; is suited to drought-tolerant regions; and can be used to rehabilitate natural pastures – both in terms of productivity as well as species composition or biodiversity.

In addition, combined with the diversification of forage crops in multi-crop systems, it can improve diet quality, extend the grazing system, and improve the organic layer of soil by preventing soil erosion, contributing organic matter, and improving water-holding capacity. This is achieved through increased water infiltration in the micro-catchments provided by shrubs and trees.

Finally, the canopy of shrubs/trees provided by silvopasture creates micro-habitats and a refuge for native species, and presents a way to sequester carbon and still allow for the grazing of livestock. As a result it is a system that addresses multiple problems while generating multiple benefits.



AGRO-FORESTRY
an intensive land-use
management combining
trees and/or shrubs
with crops and/or
livestock.

Benefits:

- Enhances soil health – improves organic content and water-holding capacity
- Ensures production in drought conditions
- Provides a refuge for native species
- A useful tool to reverse degradation and rehabilitate pastures



Hardwickia binata based silvopasture



Ailanthus excelsa based silvopasture



Prosopis cineraria based silvopasture

Appropriate management

Silvopasture requires relevant management skills to sustain the system. It constrains traditional mobility and requires protection and periodic maintenance for the system to be sustainable. In general, it takes two years to experience the benefits and there are substantial costs involved.

Many site characteristics must be taken into consideration when establishing a silvopasture system, including: slope, soil characteristics, climate conditions, and appropriate plant species. While fodder shrubs or trees assist in reducing the feeding gap, they can only constitute up to one quarter to one third of the dry matter intake of small ruminants. As a result, grass must be provided or maintained between the rows. Species can vary by locality depending on site characteristics and local knowledge.

Almost all shrub or tree species need to be transplanted - except for a few species that can be established through broadcasting or direct seeding. Planting before the rainy season has benefits that help establish roots. Selected grass species need to have the ability to adapt to low light, particularly when tree species are used, by moderating the efficiency of their photosynthetic apparatus.

Selected plant species should be drought tolerant, moderate to highly palatable, and have the ability to withstand grazing. It is sometimes preferable to use multi-purpose trees that can also be used to grow fruits for human consumption. Rooting structure of both species needs to be taken into account so there is no competition between species. Plants that have allelopathic effects on other plants should not be selected. Some silvopasture systems grow cash crops such as barley or wheat between the rows that are cut and carried, allowing animals to graze on the stubble and shrubs after harvest.

Choosing species

For the drylands of India, there are many well adapted planted shrubs/trees that can be considered when establishing a silvopasture system. Commonly planted trees that are used include *Ailanthus excelsa*, *Acacia nilotica*, *Prosopis cineraria*, *Ziziphus nummularia*, *Z. mauritiana*, *Tecomella undulata*, and *Dalbergia sissoo*, amongst others.

The trees *Prosopis cineraria*, *Ziziphus nummularia*, and *Tecomella undulata* are commonly planted in arid zones with low rainfall, while *Dalbergia sissoo* is grown in the irrigated areas of arid regions. The growth of *P. cineraria* is very slow to develop in rainfed areas with precipitation of less than 200 mm, taking approximately 20 years to reach a desirable height. Under alluvial soils and higher rainfall zones (300-450 mm) it grows well and is able to produce 40-50 kg dry leaves at 12-15 years of age.

The tree can withstand heavy lopping and browsing. *Z. nummularia* can regenerate through root suckers and can regenerate even after being felled. Aside from creating leaf fodder *Z. nummularia* can yield 3-5 kg of fruit per bush even while growing under rainfall conditions of 150-250 mm per year. Fruit trees are also often cultivated such as *Cordia myxa*, *Ziziphus mauritiana*, *Phyllanthus emblica* and *Phoenix dactylifera*, but irrigation may be necessary depending on the species.

Rangeland factsheets:

This series of flyers is designed to build awareness of sustainable rangeland management through best practices and well-adapted species among extension workers and those working in the agricultural research and policy sector.

ICARDA's Rangeland Ecology and Management Unit

ICARDA's Rangeland Ecology and Management Unit aims to address the unsustainable use of resources induced by mismanagement, the adverse effects of climate change, and an increasing demand for food and feed in the dry areas. ICARDA programs promote the enhanced quality and productivity of crop, forage, and livestock, and the improved management of water resources through close cooperation with farmers and national researchers.



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