

Silvopasture: A Sustainable Farming System for a Changing World

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INTRODUCTION

Silvopasture is an agroforestry system that combines trees, pasture, and livestock in a mutually beneficial way. In silvopasture, trees are intentionally grown in pastures to provide shade, forage, and wood products for livestock, while also sequestering carbon, reducing erosion, and enhancing biodiversity. This system has gained popularity in recent years as a sustainable farming practice that offers economic, environmental, and social benefits.

Need For Silvopastoral system in Indian Sub-continent

There is a growing need for silvopastoral systems in the Indian subcontinent due to a range of environmental, economic, and social factors.

Firstly, the subcontinent faces significant challenges in terms of land degradation, deforestation, and soil erosion, which impact the productivity and sustainability of agriculture and livestock systems. Silvopastoral systems can help to restore degraded lands and improve soil fertility, as trees and shrubs help to prevent erosion and improve water retention, while also providing fodder and other benefits.

Secondly, the demand for livestock products in the subcontinent is expected to grow rapidly in the coming years, driven by population growth, rising incomes, and changing diets. This presents an opportunity for livestock producers, but also raises concerns about the environmental and social impacts of intensifying livestock production. Silvopastoral systems can provide a more sustainable and resilient approach to livestock production, by reducing the reliance on external inputs, improving the nutritional value of forage, and enhancing the resilience of livestock to climatic shocks. Thirdly, the subcontinent is home to a rich diversity of traditional agroforestry and pastoral systems, which provide important ecosystem services, cultural values, and livelihood opportunities for local communities.

However, these systems are under threat from a range of drivers, including land-use change, land fragmentation, and climate change. Supporting and scaling up silvopastoral systems can help to maintain and enhance the sustainability and resilience of these traditional systems.

Overall, silvopastoral systems have the potential to provide multiple benefits in the Indian subcontinent, including improving soil and water quality, increasing livestock productivity and resilience, and enhancing biodiversity and cultural values. However, the adoption and scaling up of these systems will require supportive policies, investments, and partnerships across multiple sectors and actors.

Benefits of Silvopasture:

- **Climate Mitigation:** Trees in silvopasture sequester carbon, reducing greenhouse gas emissions and helping mitigate climate change. According to studies, silvopasture systems can sequester 30-40 tons of carbon per hectare over 20 years.
- **Increased Productivity:** Trees in silvopasture can provide additional income streams for farmers by producing wood, fruits, nuts, and medicinal plants. Moreover, the shade from trees reduces heat stress in livestock, allowing them to graze for longer periods and increase weight gain.
- **Erosion Control:** Tree roots stabilize soil and reduce erosion, which improves water quality and reduces sedimentation in waterways. This also helps preserve the pasture's topsoil and prevent soil degradation, reducing the need for costly inputs like fertilizers.
- **Biodiversity Conservation:** The combination of trees and pasture provides habitat for wildlife, which can increase biodiversity and support ecological resilience. Moreover, silvopasture systems can act as corridors for wildlife movement

between forest fragments, contributing to habitat connectivity.

Implementation of Silvopasture System:

Implementing silvopasture requires careful planning and management. Farmers must choose the right tree species, spacing, and management practices, depending on the soil, climate, and livestock species. To create the system, the first step is to plant the trees, either by direct seeding or transplanting. Then, livestock can be introduced to the pasture, and the farmer must manage grazing and pruning to optimize productivity and ecosystem health.

Silvopasture systems can be implemented on existing pastures or as new projects. However, transitioning to a silvopasture system requires a long-term vision and planning, and the assistance of technical experts and funding agencies.

Important silvopasture systems of world

Silvopasture systems are found in many parts of the world, and there are several important examples. Here are a few:

Montado in Portugal and Spain: Montado is a silvopastoral system found in the Iberian Peninsula that combines cork oak trees with livestock grazing. The cork oak trees are managed to produce cork, while also providing shade and forage for animals. Montado has cultural and economic significance, as well as environmental benefits, such as carbon sequestration and biodiversity conservation.

Alley cropping in Latin America and Africa: Alley cropping is a silvopastoral system that combines rows of trees with annual or perennial crops. The trees are managed to produce wood and other products, while also providing shade and shelter for livestock. This system has been used in several countries, including Mexico, Costa Rica, and Nigeria.

Silvopastoral systems in the United States:

In the US, there are several examples of silvopastoral systems, including managed grazing systems in the western rangelands, and agroforestry practices in the southeastern US. These systems combine trees with livestock and/or crops, and provide economic and environmental benefits.

Dehesa in Spain: Dehesa is a silvopastoral system that combines holm oak trees with livestock grazing. The trees are managed to produce acorns, which are an important food source for pigs, and the grazing animals help maintain the understory vegetation. Dehesa has cultural and environmental value, as well as economic benefits, such as the production of high-quality ham.

These are just a few examples of silvopasture systems found around the world. Each system is unique and adapted to the local context, and they all share the goal of integrating trees, pasture, and livestock in a mutually beneficial way.

Silvopastoral system in India

Silvopastoral systems are also present in India, and there are several examples of such systems that are being used by farmers and landowners. Some of the important silvopastoral systems in India are:

Nari Shamba: Nari Shamba is a traditional silvopastoral system used in the Northeastern states of India, particularly in Meghalaya. It involves the cultivation of betel nut palms in association with other crops such as paddy, maize, and vegetables, and livestock rearing. The betel nut palms provide shade and betel nut products, while the other crops provide food and income. This system has been used for centuries by the indigenous Khasi community.

Silvopasture Systems in Rangelands:

Silvopasture systems are also being used in the rangelands of India, particularly in the semi-

arid and arid regions. In these systems, trees are planted in pastures to provide shade, fodder, and other products for livestock. The trees also help in soil conservation, water retention, and carbon sequestration. This system is being promoted by several NGOs and government agencies in India.

These are just a few examples of silvopastoral systems in India. These systems are important for sustaining agriculture and livestock production, conserving biodiversity, and mitigating the impacts of climate change.

Criteria for Trees and Grasses in silvopastoral system

The selection of trees and grasses in silvopastoral systems should be based on several criteria, including:

- I. **Adaptability:** Trees and grasses should be adapted to the local climatic and soil conditions. They should be able to tolerate drought, flooding, and other environmental stresses, and should have a good growth rate.
- II. **Nutritive value:** Trees and grasses should have a high nutritional value for livestock. They should be palatable and digestible, and should provide adequate protein, energy, and minerals for the animals.
- III. **Compatibility:** Trees and grasses should be compatible with each other. The trees should not shade out the grasses, and the grasses should not compete with the trees for water and nutrients.
- IV. **Multipurpose use:** Trees and grasses should have multiple uses, such as timber, fuelwood, fodder, and non-timber forest products. This will enhance the economic value of the system and increase its resilience.
- V. **Resistance to pests and diseases:** Trees and grasses should be resistant to pests and diseases, or have a low susceptibility to them. This will reduce

the need for pesticides and other chemicals, and minimize the risk of crop failure.

- VI. Environmental benefits: Trees and grasses should have environmental benefits, such as soil conservation, water retention, carbon sequestration, and biodiversity conservation. These benefits will enhance the ecological sustainability of the system.

Overall, the selection of trees and grasses in a silvopastoral system should be based on a balance between the needs of the livestock, the economic and environmental benefits of the system, and the adaptability of the species to the local conditions.

Opportunity for Silvopastoral Systems in India

Silvopastoral systems have significant potential in India, and there are several opportunities for their adoption and expansion. Some of the key opportunities include:

1. **Livestock Production:** India has a large livestock population, and silvopastoral systems can provide a sustainable and efficient way to produce fodder for them. These systems can also help to improve the health and productivity of livestock, reduce their environmental impact, and increase their economic value.
2. **Climate Change Mitigation:** Silvopastoral systems can help to mitigate the impacts of climate change by sequestering carbon in the soil and in the biomass of trees and grasses. They can also help to reduce greenhouse gas emissions from livestock production by improving the efficiency of nutrient use and reducing the need for synthetic fertilizers.
3. **Soil and Water Conservation:** Silvopastoral systems can help to conserve soil and water resources by reducing erosion and runoff,

increasing infiltration, and improving soil quality. They can also help to recharge groundwater and reduce the risk of droughts and floods.

4. **Biodiversity Conservation:** Silvopastoral systems can provide habitat for a wide range of flora and fauna, including birds, insects, and other wildlife. They can also help to conserve and restore degraded landscapes, and promote agroecological resilience.
5. **Economic Benefits:** Silvopastoral systems can provide a range of economic benefits, such as timber, fuelwood, non-timber forest products, and ecotourism. They can also generate employment opportunities and enhance the livelihoods of farmers and rural communities.

Overall, silvopastoral systems have great potential to contribute to the sustainable development of India, and there are many opportunities for their adoption and expansion. However, their success will depend on effective policies, incentives, and technical support, as well as on the participation and engagement of stakeholders across the public and private sectors.

Suitable trees and grasses for silvopastoral system in Indian Sub-continent

The choice of suitable trees and grasses for silvopastoral systems may vary depending on the specific climate, soil type, and livestock preferences. However, here are some examples of trees and grasses that are commonly used in silvopastoral systems:

Trees:

Acacia Spp.: Acacia is a fast-growing and drought-tolerant tree that provides high-quality forage for livestock. It is also a good source of fuelwood, timber, and non-timber forest products.

Leucaena: Leucaena is a leguminous tree that fixes nitrogen in the soil and provides high-protein forage for livestock. It is also used for fuelwood, timber, and other purposes.

Ficus Spp.: Ficus is a multipurpose tree that provides fodder, timber, and other products. It is also used for shade and soil conservation.

Albizzia Spp: It is also a fast growing multipurpose treespecies known for itsw good nutritive fodder value as well as good timber and pulpwood charqacteristics.

Leucaena species: it is a leguminous multipurpose fast growing species with high crude protein content and highly palatable for catte and other livestock such as poultry and fishery.

Grasses:

Napier grass: Napier grass is a high-yielding and drought-tolerant grass that provides high-quality forage for livestock. It is also used for soil conservation and as a biofuel feedstock.

Guinea grass: Guinea grass is a perennial grass that provides good-quality forage for

livestock. It is also used for soil conservation and as a biomass feedstock.

Stylo: Stylo is a leguminous grass that fixes nitrogen in the soil and provides high-protein forage for livestock. It is also used for soil improvement and erosion control.

Overall, the selection of suitable trees and grasses for a silvopastoral system should take into account the specific environmental conditions, livestock preferences, and economic and ecological objectives of the system.

CONCLUSION

Silvopasture systems offer a promising way to meet the challenges of sustainable agriculture, especially in the context of climate change and biodiversity loss. Farmers and consumers alike can benefit from these systems, which provide economic, environmental, and social benefits. By investing in silvopasture systems, we can support a more sustainable and resilient food system, while also contributing to global efforts to mitigate climate change and conserve biodiversity.