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Seri-Based Agroforestry: A Sustainable Approach by Farmer to the Earth

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In a variety of Indian environments, sericulture-based agroforestry systems offer both ecological and economic advantages by combining sustainable agro-based forestry models along with silk production. The effective role of integrating agroforestry models with Mulberry, Tasar, Eri, and Muga silkworms with sericulture is discussed in this paper. By integrating host trees with food crops, fruit trees, and fodder grasses, these systems improve soil fertility, biodiversity, and carbon sequestration while diversifying farm revenue. In order to assess the models' wider replicability, this writeup focuses on successful situations in the Indian setting. Sericulture-based agroforestry may make a substantial contribution to climate-adaptive agriculture, environmental sustainability, and rural resilience with the right kind of governmental support, research-based innovations, and participatory adoption initiatives.

Keywords: Sericulture, agroforestry systems, climate resilience, carbon sequestration and livelihood

Introduction

In developing countries like India, which is home to over 17.78% of the world's population, sustainable resource management has become more and more important in solving issues related to livelihood and nutritional security (*Worldometer*, 2024). Global agricultural systems face serious difficulties from climate change, which has an impact on livelihoods, food security, and ecosystem stability (Mirzabaev *et al*., 2022; Prajapati *et al*., 2024; Yuan *et al*., 2024). An alternate land-use strategy often called as "agroforestry" purposefully combines trees with horticultural and field crops on the same plot of land. By enhancing the physical and biological properties of the soil, this cooperative strategy supports ecological equilibrium and eventually aids in sustainable carbon storage (Jose, 2019; Nair *et al*., 2010; Sheppard *et al*., 2020).

India is home to 04 major types of Silkworms, which not only supports the livelihood of poor farmers but also significantly leads to climate change mitigation through reforestation and afforestation techniques (Jaiswal *et al*., 2020, Kar *et al*., 2013). Sericulture is the agro based industry which involves the practise of rearing of Silkworms for silk production by utilizing the specific host trees for various types of silkworms, which supports the economy of rural areas (Kiruba *et al*., 2024). It involves the cultivation practices of host trees for feeding of silkworms, that are multipurpose in nature, that includes *Morus alba*, *Terminalia arjuna*, *Terminalia tomentosa*, *Shorea robusta*, *Persia bombycina*, *Ricinus communis* etc. these species are called as primary host plants, and many other tree species could also be used for silkworm rearing, often referred to as secondary host plants, that provides a wide range of adoption strategies in a possible agroforestry system.

An agricultural system that incorporates trees, crops, and animals and combines sericulture with agroforestry offers a special chance to improve climate resilience while offering sericulture farmers financial advantages and risk reduction (Lu *et al*., 2004; Wang *et*

al., 2010, Majumdar *et al*., 1967a). When incorporated into agroforestry systems, sericulture provides a special paradigm for combining ecological sustainability with economic output. Circular nutrient pathways are further strengthened and dependence on external inputs is decreased by integration with companion crops and recycling of sericulture by-products. Along with providing quantifiable ecosystem services and improving rural livelihoods, sericulture-based agroforestry also encourages habitat supply, pollinator activity, pest control, and landscape connectedness. However, context-specific management is needed to balance silk production, intercropping, and ecosystem services. This management is influenced by site circumstances, pruning schedules, and farmer expertise. Long-term field experiments that assess ecological, productive, and socioeconomic effects should be the main focus of future research, and regulations and incentives should promote the deployment of multifunctional land-use plans. All things considered, sericulture-centered agroforestry is a practical approach to sustainable, climate-resilient rural development. The deliberate integration of trees, crops, and/or cattle on the same land management unit is known as agroforestry. Farmers may increase soil fertility, boost biodiversity, diversify their sources of income, and contribute to the overall sustainability of the agricultural landscape by integrating sericulture into agroforestry systems.

❖ **"Agroforestry"** refers to the complimentary land use system that integrates cultivation of perennial woody tree species with agricultural crops or pastures, in combination with livestock, in different space and time. For e.g.

- **Agri-silviculture system** – Combination of agricultural crops along with Tree species on same unit of land.
- **Silvi-agriculture system -** Combination of woody tree species, along with agricultural crops on same unit of land.
- **Agri-silvi-horticulture system**- Combination of Woody trees (primary), along with agricultural crops (secondary) and fruit bearing trees (tertiary), on same unit of land.

❖ **"Sericulture"** refers to the art and science of rearing or taking care of silkworms for production of raw silk.

- **Vanya sericulture** (rearing of wild sericigenous silkworms like Tasar, Eri, Muga)
- **Non- Vanya sericulture** (rearing of domesticated sericigenous silkworm like Mulberry)

Functions of Seri-based agroforestry

Carbon Sequestration: The process by which trees absorb and store carbon dioxide is known as carbon sequestration (Kumar et al., 2023). Mulberries and other silk host trees, particularly tasar and muga culture trees, can store enough carbon dioxide in a Seri-based agroforestry system to assist mitigate climate change by lowering greenhouse gas emissions (Nath et al., 2024).

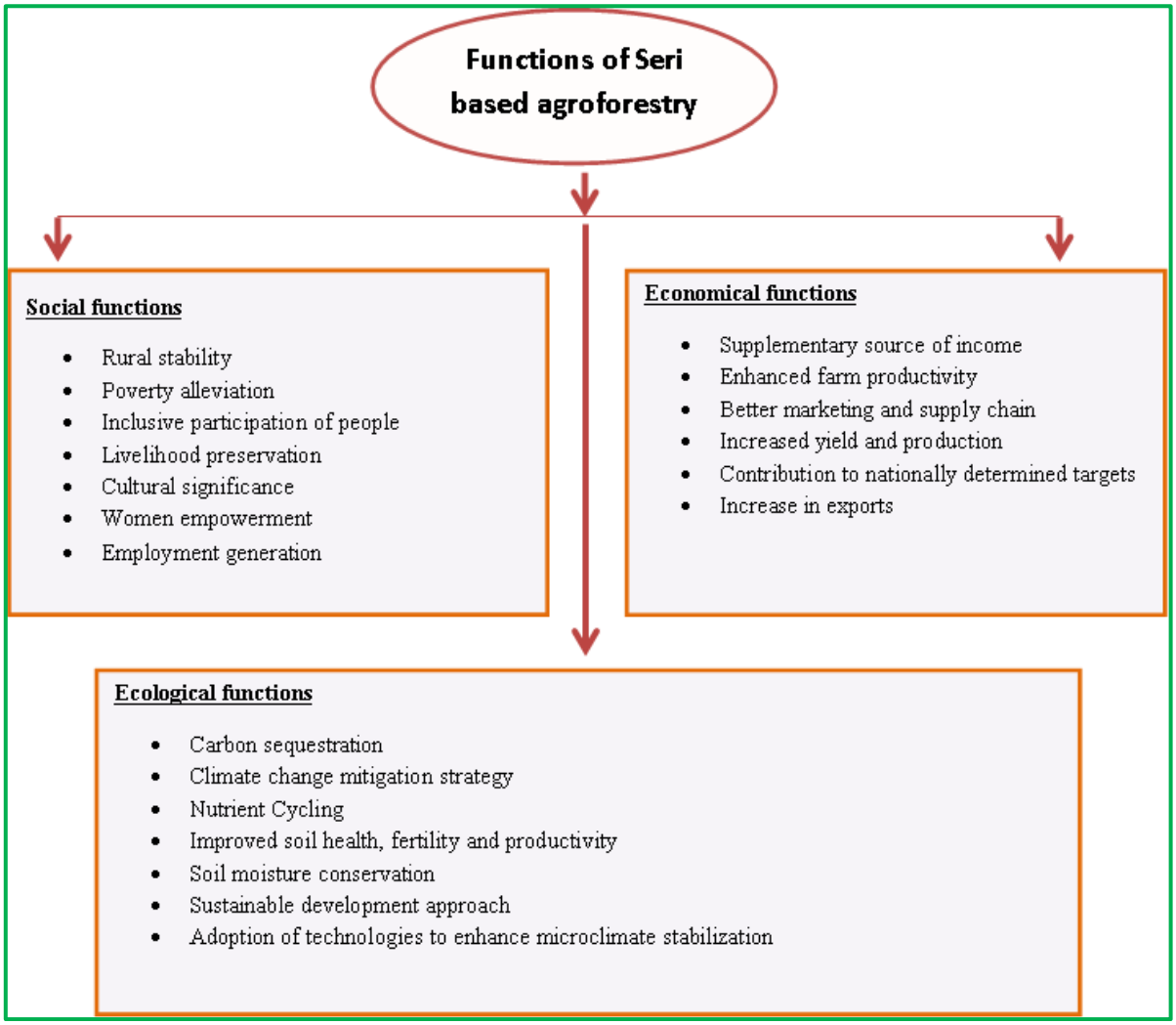
Biodiversity Conservation: The production of Tasar and Muga silk promotes the preservation and revitalisation of natural forests, where wild trees act as silkworm hosts (Chowdary, 2024) [7]. By offering homes for a variety of species and encouraging natural pest management, these wooded regions support biodiversity (Mwaniki et al., 2021).

Soil health improvement: By providing organic matter through fallen leaves, host plants of mulberry, tasar, eri, and muga sericulture significantly improve soil fertility. They also serve to minimise erosion and raise soil nitrogen levels (Kaushal et al., 2024) [21]. Additionally, the agroforestry system's deep root systems enhance soil structure, allowing for improved drainage and water retention (Fahad et al., 2022).

Income Diversification: In order to prevent farmers from becoming too reliant on a single source of income, agroforestry enables the integration of cash crops, fruits, medicinal plants, or shade-tolerant crops (Baruah, 2024). Farmers can profit from intercropped agricultural items like vegetables, legumes, or medicinal plants in addition to silk manufacturing (selling cocoons or raw silk).

Restricted use of chemicals: Because silkworms are extremely sensitive to toxins, sericulture methods restrict the use of chemical pesticides to protect them. This limitation can

lower the system's overall output and raise the danger of pest infestations on both crop and host plants in sericulture (Bora et al., 2012) [4]. Alternative pest control techniques, which may be more expensive or less successful, may be necessary if chemical treatments are used sparingly. This approach may effectively manage pests and diseases by using biopesticides and Integrated Pest Management (IPM) (Singh & Saratchandra, 2002).



Conclusion

Agroforestry system has benefits, but it also has drawbacks, such as limited area, a shortage of high-quality planting materials, and complicated, stringent laws pertaining to the shipping and harvesting of trees. To fully realise its promise as a sustainable farming practice, future advancements will need stronger extension services, governmental backing, and the marketing of compatible species. Agroforestry systems based on sericulture present a viable strategy for producing silk sustainably while offering several ecological and financial advantages. By combining sericulture and agroforestry, farmers may increase soil fertility, preserve biodiversity, diversify their revenue streams, and help mitigate climate change. The effectiveness of these systems is largely dependent on the choice of appropriate host plant species, appropriate establishment and maintenance techniques, and the use of silkworm waste as organic fertiliser. However, for the industry to flourish sustainably, issues including insect outbreaks, climate change, and the need for research and extension assistance must be addressed.

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