

Agroforestry in India: Challenges and Future Prospects

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Abstract

The practices of agroforestry have shown a great impact on the agricultural system in India. 8.2% of total geographical area or around 25.31 million hectares area used for agroforestry in India. Although agroforestry system has many benefits like it provides alternative source of income, farmers can produce crops along with timber and non-timber forest products. It also supports higher yield of crops. But agroforestry system currently faces many challenges in India like lack of high-quality planting materials, lack of proper research, strict rules and regulations related to transporting and cutting of plants. These challenges are the main reasons which hindered farmers to adopt agroforestry system. Government of India brings National Agroforestry Policy in 2014 to solve these challenges for its wide adoption.

Keywords: Agroforestry structures, Economic potential, Fuel wood, Sustainable agriculture

Introduction

Agroforestry is an exercise of organizing and developing trees in affiliation with crops and cattle on the same piece of land. Agroforestry is a practice for lots small and marginal farmers to optimize their land use by means of integrating timber with annual or perennial plants, improving the preferred production. This way, farmers ensure regular returns throughout the year. Agroforestry consists of a wide variety of practices that are applied in different climates and regions. There are many traditional agroforestry practices in India like shifting cultivation, taungya, home garden, alley cropping, intercropping *etc.* Agroforestry system is a win-win situation for human as it provides agricultural crops, timber, non-timber forest products *etc.* It also helps in conserving natural resources, to combat climate change. Rain fed agriculture is integral to rural livelihoods and communities, providing food, fodder and cash crops that predominantly include stakeholders and landless farmers. Agroforestry provides the tools to address the full range of impacts, which positively impacts not only the larger farming community, but also rural economies and ecosystem health. The actual adoption of multifunctional practices in a diverse farming situation often removes analyses and recommendations from the assumption that financial investment is not a significant constraint. Trees provide continuous income to

farmers, help provide nutritious food to rural people (dry fruits, fodder, fuel, wood, medicinal qualities, *etc.*) and support flood management, soil and water conservation and improvement of natural rainfall. To fill the gap between limited land resources and increasing population to create a harmonized agricultural development approach, the implementation of an agroforestry model seems to be the right approach. It assures productive land by providing both short-term agricultural crops and long-term income derived from tree crops. Furthermore, agroforestry helps in the creation of small, medium and large tree-based industries, ensures agricultural sustainability and maintains the stability of soil, water and climate, *etc.*

The Scope of Agroforestry in India

India's various weather supports a huge variety of agroforestry structures (Table 1). Accurately determining the area under different agroforestry systems is challenging and many researchers and agencies are working to refine these estimates. The current agroforestry area in India is approximately 25.31 million hectares or 8.2% of the country's total geographical area (Dagar *et al.*, 2014; CAFRI, 2015). However, FSI (2017) (Figure 1) provides lower estimates due to the exclusion of certain systems like block plantations. Maharashtra, Gujarat and Rajasthan have the largest agroforestry areas in the country.

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Table 1: Major agroforestry systems followed in India (Dagar et al., 2014; Puri and Nair, 2004)

Sl. No.	Agroforestry Systems	Agroecological Region Adaptations
<u>Agri silvicultural Systems</u>		
1	Shifting cultivation	In tropical forest areas
2	Taungya	In all regions
3	Plantation-based cropping system	Mainly humid tropical regions
4	Scattered trees on farms, parklands	All regions, especially semiarid and arid regions
5	Shelterbelts and windbreaks	In wind-prone areas, especially coastal, arid and alpine regions
6	Boundary Planting and live hedges	In all regions
7	Woodlots for soil conservation	In hilly areas, along sea coast and ravine lands
8	Industrial plantations with crops	Intensively cropped area in northern India.
<u>Silvo-pastoral systems</u>		
1	Silvi pastures	Sub tropics and tropics with bio-edaphic sub-climaxes
2	Horti-pastoral	In hilly orchards for soil conservation
3	Tree on rangelands	In all regions
	Plantation crops with pastures	Mostly humid & sub-humid regions of south regions of south East Asia and South with less grazing pressure on plantation lands
4	Seasonal forestry grazing	Semi-arid and mountainous ecosystem
<u>Agro-silvo-pastoral systems</u>		
1	Home gardens	Mainly tropical region
<u>Others</u>		
1	Aqua forestry	Low Lands
2	Apiculture with trees	In all regions

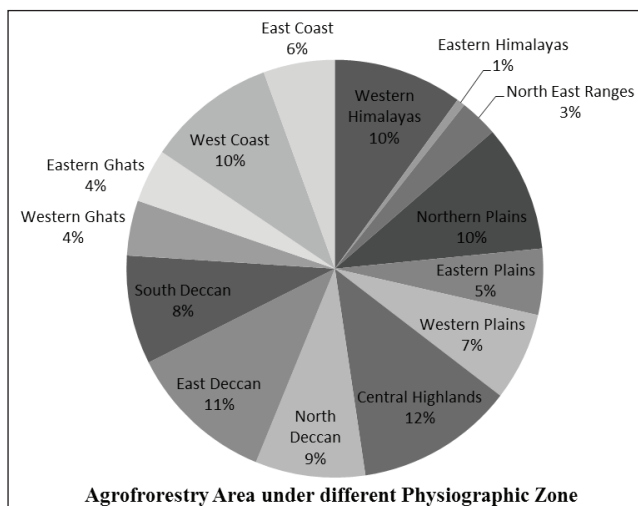


Figure 1: Physiographic zone-wise agroforestry area (FSI, 2017)

Challenges Faced by Agroforestry in India

Although agroforestry is a viable and low-cost strategy of not only farm sector development but also integrated natural resource management and economic upliftment, it is faced with numerous challenges. Inadequate institutional support related to user’s right over land and the product generated, lack of financial support, lack of research and development support, inadequate extension support to the farmers and restricted access to the market are some of them. The

policy support to agroforestry development has not been appropriately addressed in India. With severe degradation of natural resources in India, there is an increasing demand for wood and other non-food forest goods. However, the current policy discourages commercial farm forestry enterprises.

1. Land Tenure Issues

In India, less than 28% of land holdings are owned by farmers, while the majorities are tenants. Consequently, the rights of tenants, most of whom are small and marginal farmers, have become a major concern. Existing laws, while recognizing the rights of tenants, have allowed landlords to go to court and halt their rights recognition. As a result, leasehold land cultivation has become more precarious, with rights transferred mostly through verbal agreements and tenants forbidden from making improvements like well-drilling or tree planting. In this situation, agroforestry on common property resources and waste land is crucial for small and marginal farmers.

2. Lack of Awareness and Technical Knowledge

A low level of consciousness amongst stakeholders concerning agroforestry systems and their benefits significantly restricts the practice’s adoption. Moreover, there are only a few agroforestry farms that aspire to disseminate data about this practice. The stakeholders have little technical knowledge about agroforestry systems and their management. Factors such as a non-availability of seeds of multipurpose tree species or a lack of a working system (agroforestry + land

use options) encourage the stakeholders to practice only the existing land use option. Limited accessibility to research institution-patented agroforestry technologies restricts farmers from taking up any agroforestry systems. Existing agroforestry policy does not cater to individual small and marginal farmers, nor does it promote the strengthening of extension systems for agroforestry dissemination. The per-minute charges for acquiring agroforestry information from Kisan Call Centers are very high and thus unfeasible for small and marginal farmers (Barlagne *et al.*, 2023).

3. Economic Constraints

Financial constraints notably avoid the tremendous adoption of agroforestry in India, posing demanding situations which are mainly mentioned for small and marginal farmers. Those farmers, who form the spine of India’s agricultural population, frequently locate it tough to undergo the excessive initial fees related to setting up agroforestry systems. The charges concerned in shopping planting materials, hiring labor and putting in important infrastructure are significant and without good enough financial support, many farmers are unable to make these investments. Another, good-sized economic barrier is the restricted access to credit. For agroforestry to be a feasible preference, farmers need access to inexpensive credit to finance the prolonged-term nature of those projects. However, many farmers battle to relaxed loans from monetary institutions due to the lack of collateral or the perceived riskiness of agroforestry investments.

Market access issues additionally present a significant challenge. Although farmers efficiently set up agroforestry systems, they often come across problems in accessing markets for their products. Insufficient infrastructure, which includes terrible road connectivity and the dearth of storage facilities, hampers the green transportation and sale of agroforestry products.

4. Environmental and Climatic Challenges

Agroforestry faces several challenges because of changing weather situations. Unpredictable rainfall patterns, temperature fluctuations and severe weather events, driven through weather trade, threaten the boom and productivity of trees and plants, potentially undermining the effectiveness of agroforestry practices. Additionally, the

degradation of natural sources, especially soil and water, poses a significant barrier to the successful established order of agroforestry structures. Problems along with soil erosion, nutrient depletion and water shortage are regular in lots of regions, proscribing the capability for agroforestry to thrive. Moreover, agroforestry structures are liable to invasive species and pests, which could reason considerable harm and reduce yields.

5. Research and Development (R&D) Gaps

There are still some challenges in agroforestry system which must be address through proper Research and Development (R&D) and Innovations for wide adoption in India. But, numerous gaps in R&D presently restrict the development of agroforestry. One major difficulty is the lack of location-specific studies on agroforestry systems. There is an urgent need for research that concentrates on appropriate tree-crop combinations, effective control practices and the long-term sustainability of those structures across India’s numerous agro-climatic zones. Unluckily, a great deal of the present studies is concentrated in a few areas and fails to provide comprehensive solutions relevant to the whole United States of America. Another considerable gap is the dearth of interdisciplinary collaboration. Collaborative approach of scientists and researchers working in field of agriculture, forest, social economy *etc.* will help in advancing agroforestry system in India. However, the absence of such collaboration frequently outcomes in a narrow technique to investigate, limiting the development of holistic solutions that deal with the complex demanding situations of agroforestry. Moreover, there is confined awareness on weather-resilient agroforestry practices.

Opportunities and Innovations for the Future

Agroforestry structures contribute drastically to the economic system with the aid of presenting raw substances to various industries and promoting sustainability *via* carbon sequestration, biodiversity conservation and soil health improvement. Furthermore, they play a crucial role in improving farmer’s incomes and ensuring food safety *via* incorporated crop-farm animal’s systems (Table 2), whilst additionally helping mitigate the unfavorable consequences of weather exchange.

Table 2: Total Domestic demand for various commodities and agroforestry contribution in 2050 (CAFRI, 2015)

Sl. No.	Items	2010-2011	Projected for 2025	Projected for 2050	Contribution from Agroforestry in 2050
1	Food grains (million t)	218.2	320	457.1	41.14
2	Fruits (million t)	71.2	106	305.3	47.74
3	Fodder (million t)	1061	1170	1545	154.5
4	Fuel wood (million t)	308	479	629	308
5	Timber (million t)	120	171	347	295
6	Biodiesel (million t)	12.94	22.21	37.92	30.34
7	Required for 20% blending of diesel area (million ha)	12.32	15.86	21.67	17.34

As a limited resources of land, India may face many challenges in future related to food grains, climate change etc. Agroforestry system may play a crucial role to ensuring food security and to address environmental related challenges. Research in this field should focus on productivity of biomass and crop per unit area, providing quality planting material, improve post- harvest processes, value addition etc. It should also focus on capacity building of farmers and development of different agroforestry models.

Conclusion

Agroforestry system has potential to improve livelihoods, enhance food security and combat climate change. Its success depends upon the implementation of rules and regulations, awareness, quality research in this field. The National Agroforestry Policy of 2014 supposed to address all the key challenges face by agroforestry system in India. But it has to be upon on government that how they implement these on ground to bust agroforestry system in India. Proper implementation of these regulations will help agroforestry system to delivers its full range benefits.

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