Women's Empowerment through Agroforestry-based Home Gardens: Pathways to Food Security, Nutrition, and Income Generation

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Abstract: *Women engaged in homestead agroforestry frequently encounter structural and socio-economic barriers, including inadequate remuneration, poor working environments, and limited recognition of their efforts. These challenges largely stem from the widespread perception of women's work as low-skilled, repetitive, and time-consuming. Proper acknowledgment and systematic assessment of women's contributions are therefore vital for strengthening the long-term viability of agroforestry systems and enhancing the livelihoods dependent on them. Agroforestry-based home gardens contributed significantly to household food security through the provision of fruits, vegetables, fuelwood, fodder, and other essential products, while also supporting nutritional diversity and supplementary income generation. However, several constraints including small landholdings, limited technical knowledge, long gestation periods of tree components, and inadequate institutional support restrict women's ability to fully benefit from these systems. Addressing these barriers through targeted training, gender-sensitive extension services, and inclusive policy interventions is critical for enhancing women's empowerment and ensuring the long-term sustainability of agroforestry-based home gardens.*

Keywords: Women's empowerment; Homestead agroforestry; Food and nutrition security; Livelihood enhancement; Gendered decision-making; Sustainable farming systems

1. Introduction

Agroforestry-based home gardens represent one of the most resilient and multifunctional land-use systems, particularly within smallholder and resource-constrained farming households. These systems integrate perennial trees, annual crops, vegetables, livestock, and sometimes medicinal plants within the homestead, enabling efficient use of limited land while providing diverse ecological and socio-economic benefits. In recent years, home garden agroforestry has gained renewed attention as a climate-resilient strategy capable of enhancing household food security, nutritional diversity, and income stability, especially in vulnerable rural regions (FAO, 2020; Pandey *et al.,* 2021). Across developing countries, agroforestry-based home gardens contribute significantly to year-round food availability, dietary diversification, energy security, and livelihood resilience. They supply fruits, vegetables, fuelwood, fodder, and small timber, while reducing dependence on external markets and buffering households against climatic and economic shocks (Roshetko *et al.,* 2021; Thorlakson and Neufeldt, 2022). In the Indian context, home gardens play a crucial role in supporting subsistence needs and supplementary income, particularly in hilly and marginal landscapes where landholdings are small and agricultural options are limited (Singh *et al.,* 2020; Tiwari *et al.,* 2023). Women are the primary custodians of agroforestry-based home gardens, contributing substantially to their planning, management, and daily operations. Their roles span seed selection, planting, weeding, harvesting, livestock care, post-harvest processing, and maintenance of plant diversity. Recent studies emphasize that women's knowledge of species selection, nutrition-sensitive cropping, and resource recycling is central to the productivity and sustainability of home garden systems (Agarwal, 2021; Doss *et al.,* 2022). Globally, women account for a significant proportion of agricultural labor, and their involvement is

particularly pronounced in homestead-based production systems that combine food, nutrition, and household welfare objectives (FAO, 2023). Despite their central role, women's contributions to agroforestry and home gardening remain inadequately recognized and undervalued. Persistent gender inequalities limit women's access to land ownership, credit, training, extension services, and market opportunities, while decision-making authority particularly over income and resource allocation often remains male-dominated (Meinzen-Dick *et al.,* 2020; Kiptot *et al.,* 2023). Women's labour in home gardens is frequently perceived as informal, unskilled, or an extension of domestic responsibilities, resulting in low wages, poor working conditions, and exclusion from policy and planning processes. These structural constraints not only undermine women's empowerment but also restrict the overall efficiency and transformative potential of agroforestry systems. Emerging evidence highlights that strengthening women's agency within agroforestry-based home gardens can lead to measurable improvements in household food security, nutritional outcomes, and income generation. Women's control over garden produce is closely linked to improved dietary diversity, enhanced child nutrition, and reinvestment in household welfare (Raghunathan *et al.,* 2021; Njenga *et al.,* 2024). Furthermore, empowering women through access to skills, resources, and decision-making platforms enhances adoption of sustainable practices and reinforces the long-term resilience of home garden agroforestry under changing climatic conditions In Jammu and Kashmir, agroforestry-based home gardens constitute a vital component of rural livelihood systems. The region's fragmented landholdings, fragile mountain ecosystems, and limited livelihood alternatives have increased dependence on homestead-based production for food, fuel, fodder, and supplementary income (Bhat *et al.,* 2020; Islam *et al.,* 2021). However, empirical evidence on women's roles in management and decision-making within these systems remains limited. Understanding

the pathways through which women's participation in agroforestry-based home gardens contributes to food security, nutrition, and income generation is essential for designing gender-responsive interventions (Bhat and Rather 2024).

How do women benefit from agroforestry?

Women's engagement in agroforestry extends beyond subsistence farming to provide important ecological, socioeconomic, and empowerment benefits, though their contributions are often under-recognized in mainstream policy frameworks. Across diverse agroecological contexts, women are deeply involved in nursery management, seed selection, fuelwood and fodder collection, and preservation of local agrobiodiversity, which enhances soil fertility, livestock nutrition, and household energy security. In many smallholder systems, agroforestry helps reduce labour burdens for example, on-farm tree products such as fuelwood and fodder decrease the time and effort women spend on resource collection, allowing them to reallocate labor to productive and income-generating activities. Contemporary studies show women participating actively in fruit tree-based value chains, where a large proportion earn income from production, retailing, and processing stages, though barriers remain in areas like wholesaling due to capital constraints (Kassaye *et al.,* 2025). Agroforestry also has the potential to improve economic outcomes and resilience: women's involvement in integrated tree-crop systems contributes to diversified household income, improved food security, and enhanced dietary diversity. Engagement in these systems has been linked with increased annual household income and strengthened natural capital, making households more resilient to climate variability (Gayo, *et al*., 2025).
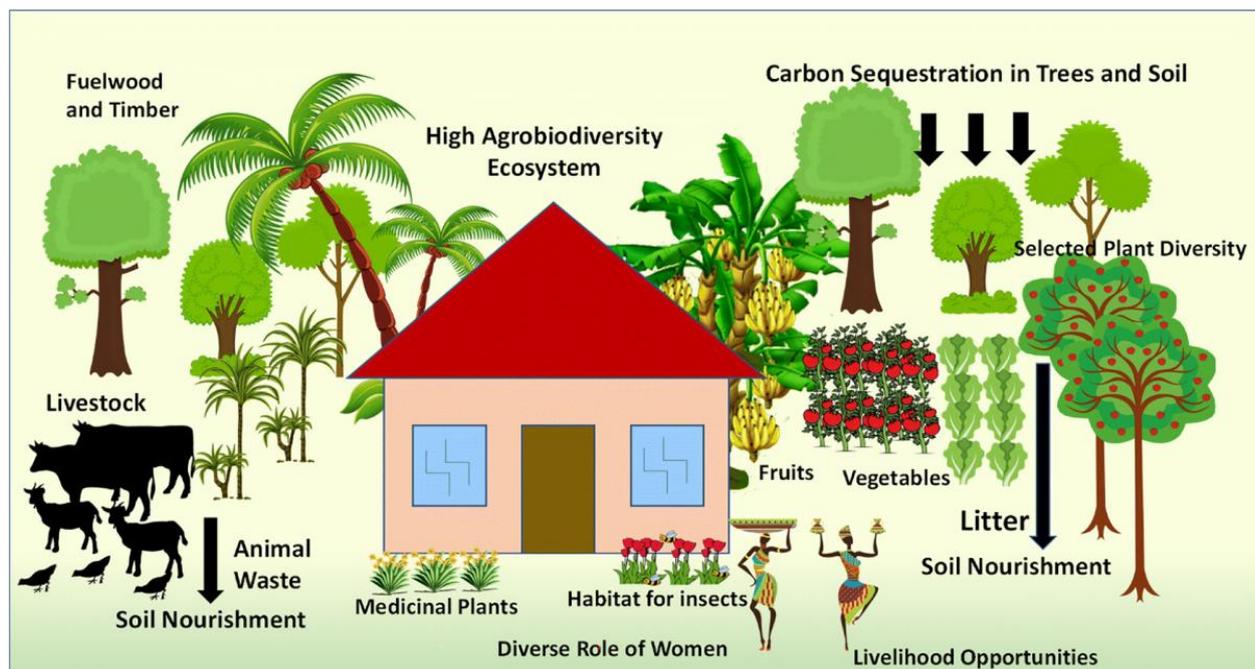
The image visually summarizes the multifunctionality of agroforestry-based home gardens described in the text. It highlights how these systems integrate trees, crops, livestock, and medicinal plants to enhance **livelihood opportunities, soil nourishment, carbon sequestration, and biodiversity**, while also emphasizing the **diverse role of women** in managing and sustaining these multifunctional landscapes.

Gender-Specific Barriers to Food and Livelihood Security

Gender-based inequalities play a decisive role in shaping the adoption and effectiveness of agroforestry-based home gardens. Differences in participation between men and women, as well as between male- and female-headed households, are largely driven by unequal access to and control over key productive resources such as land, financial capital, quality planting material, extension services, and market information (Meinzen-Dick *et al.,* 2020; Doss *et al.,* 2022). Although women are the primary managers of home gardens and contribute substantially to household food supply and nutritional diversity, their ability to fully benefit from agroforestry systems remains constrained by persistent socio-cultural norms and structural economic disadvantages (Agarwal, 2021; Kiptot *et al.,* 2023).

Women's engagement in agroforestry-based home gardens is often closely linked with domestic responsibilities, including food preparation, childcare, fuelwood collection, and livestock care. When these gendered roles, time burdens, and knowledge systems are not adequately considered during the design and implementation of agroforestry interventions, adoption rates and long-term system sustainability may be compromised (Raghunathan *et al.,* 2021; FAO, 2023). Limited recognition of women's indigenous knowledge and restricted participation in household and community-level decision-making further reduce their influence over resource allocation and management outcomes (Njenga *et al.,* 2024).

Agroforestry-based home gardens also hold considerable potential for income generation through the marketing of surplus fruits, vegetables, fuelwood, fodder, medicinal plants, and processed products. However, women's effective participation in agroforestry value chains is often hindered by poor access to credit, improved technologies, entrepreneurship training, and market linkages (Thorlakson and Neufeldt, 2022; Kiptot *et al.,* 2023). Lower literacy levels and limited exposure to institutional support services further

widen gender disparities in enterprise ownership and income control, preventing women from scaling up home garden activities into viable livelihood enterprises (FAO, 2020; Doss *et al.,* 2022). Addressing these gender-specific barriers is essential for strengthening agroforestry-based home gardens as effective pathways to food security, improved nutrition, and sustainable income generation. Gender-responsive policies, inclusive extension approaches, and targeted capacity-building initiatives that enhance women's access to resources and decision-making platforms are critical for unlocking the full empowerment potential of home garden agroforestry systems (Meinzen-Dick *et al.,* 2020; FAO, 2023).

Role of Agroforestry-Based Home Gardens in Addressing Food and Nutritional Security

Agroforestry-based home gardens, which integrate crops, trees, and livestock within household production systems, provide critical social, economic, and environmental benefits to millions of smallholder families worldwide. These systems contribute directly to food availability, dietary diversity, and household resilience by enabling the continuous production of diverse food items within limited land areas (FAO, 2020; Roshetko *et al.,* 2021). Food and nutritional security are achieved when individuals have consistent physical and economic access to adequate, safe, and nutritious food that meets their dietary requirements for a healthy and active life, a condition that agroforestry-based home gardens are uniquely positioned to support (HLPE, 2020). Addressing food and nutritional insecurity requires integrated agricultural strategies that move beyond calorie-focused production systems. Contemporary research emphasizes the importance of diversifying food sources through the cultivation of fruits, vegetables, nuts, legumes, and nutrient-dense crops alongside staple foods (Ruel *et al.,* 2021; Fanzo *et al.,* 2022). Agroforestry-based home gardens contribute to this diversification by supporting the production of a wide range of edible species, thereby improving micronutrient intake and dietary quality at the household level. n addition to the direct provision of food, trees within agroforestry-based home gardens enhance crop and livestock productivity through multiple ecological functions. These include microclimate regulation, shade provision, soil fertility improvement through litter fall and nutrient cycling, and increased water-use efficiency (Sida *et al.,* 2023; Thorlakson and Neufeldt, 2022). Such interactions create favorable growing conditions for vegetables and fruit crops, leading to higher and more stable yields. By promoting the availability of diverse, nutrient-rich foods rather than solely increasing caloric intake, agroforestry-based home gardens play a crucial role in improving overall nutritional outcomes and supporting sustainable, nutrition-sensitive food systems.

The images depict women actively managing and tending home gardens, highlighting their involvement in planting, weeding, and nurturing diverse crops.

Women's Perception of Homestead Agroforestry

Women's perceptions of homestead agroforestry are largely shaped by their day-to-day interactions with these systems and their direct contributions to household food provision, nutrition, and livelihood security. In general, women tend to perceive agroforestry-based home gardens primarily as productive and livelihood-supporting systems, as they provide a reliable source of food, fuel, fodder, fruits, vegetables, and medicinal resources for household use. These tangible benefits are often valued most strongly, as they directly reduce household dependency on external markets and enhance self-sufficiency, particularly among resource-poor rural families (FAO, 2020; Njenga *et al.,* 2024). Beyond subsistence needs, women also recognize the economic importance of homestead agroforestry through opportunities for supplementary income generation, cost savings, and improved household financial stability (Thorlakson and Neufeldt, 2022). In addition to productive and economic benefits, women commonly associate homestead agroforestry with improvements in household well-being, knowledge, and skills, particularly through enhanced food diversity, better nutrition, and opportunities for learning and intergenerational

knowledge transfer. Social and protective functions such as strengthened social networks, improved microclimate, soil and water conservation, and reduced vulnerability to environmental stresses are also acknowledged, though these benefits are often perceived less explicitly due to their indirect and long-term nature (Roshetko *et al.,* 2021; Kiptot *et al.,* 2023). Intangible values related to ecological services, cultural practices, and spiritual significance tend to receive comparatively lower recognition, largely because their benefits are less immediate and more difficult to quantify. Overall, women's perceptions highlight homestead agroforestry as a multifunctional system that supports household resilience, environmental sustainability, and livelihood security, underscoring the importance of incorporating women's perspectives into agroforestry planning and policy frameworks.

Women's role in selecting components, organizing inputs, income ownership and uses of produce

Women play a central role in agroforestry-based home garden management, particularly in the selection of components and the organization of inputs, reflecting their close engagement with day-to-day farm activities and household needs. Their involvement in choosing tree and crop species is often guided by considerations of food, nutrition, fuelwood, fodder, and medicinal requirements, which directly support household food security and resilience. Women are also actively involved in organizing inputs such as seeds, planting materials, manure, and labor, drawing on indigenous knowledge and experience to efficiently manage limited resources. However, despite their substantial contribution to production and management, women's control over income ownership and the use of produce remains relatively limited, as decision-making authority and financial control are frequently dominated by men due to prevailing socio-cultural norms. This imbalance constrains women's economic empowerment and reduces incentives for their greater participation in value addition and market-oriented activities as depicted in Table-1. Strengthening women's access to resources, decision-making power, and income rights within agroforestry systems is therefore essential for enhancing livelihood security, equity, and the overall sustainability of agroforestry-based production systems (Kiptot and Franzel, 2012; Degrande & Arinloye, 2014; Meinzen-Dick *et al.,* 2019; FAO, 2021).

Table 1: Women's role in selecting components, organizing inputs, income ownership & uses of produce

S. No.	Role	Selecting Components	Organizing inputs	Income ownership & use of produce
1	Women	120 (70.18)	89 (52.05)	21 (12.28)
2	Men	30 (17.54)	50 (29.24)	130 (76.02)
3	Children	0	0	0
4	Women + Children	3 (1.75)	3 (1.75)	0
5	Women + Men	14 (8.18)	25 (14.62)	20 (11.7)
6	Women + Men + Children	4 (2.34)	4 (2.34)	0

Link between the homestead agroforestry and women's role

Approximately 70% of women engaged in activities such as spot weeding, cleaning, plant protection measures, and mulching, according to the results in Fig. 01, showed that all men were performing homestead agroforestry tasks such as lopping, root trimming, and climber cutting. When it comes to home garden maintenance, men and women share duties. The habit of women caring for their home gardens is widespread in settled societies worldwide. There is ample evidence that women play a significant role in the maintenance and cultivation of household gardens. These include choices about which species to use, how to use therapeutic plants, how to choose seeds, how to store and manage pests, and how people gather fuel wood.

The findings were consistent with those of Halbrendt *et al.* (2014), seeding and transplanting were mostly considered women's tasks in the past due to outdated farming methods; however, with the implementation of better procedures, the effort was distributed more fairly between men and women. According to Gebrehiwot *et al.* (2018), women grow and process fruits, vegetables, dairy products, and distribute food in traditional household gardens, whereas males till, cultivate, and trade cash crops at wholesale prices. According to Maharjan *et al.* (2012), more than 80% of women work in agriculture in some regions of Nepal, yet they are only marginally involved in the application of fertilizer and pesticides.
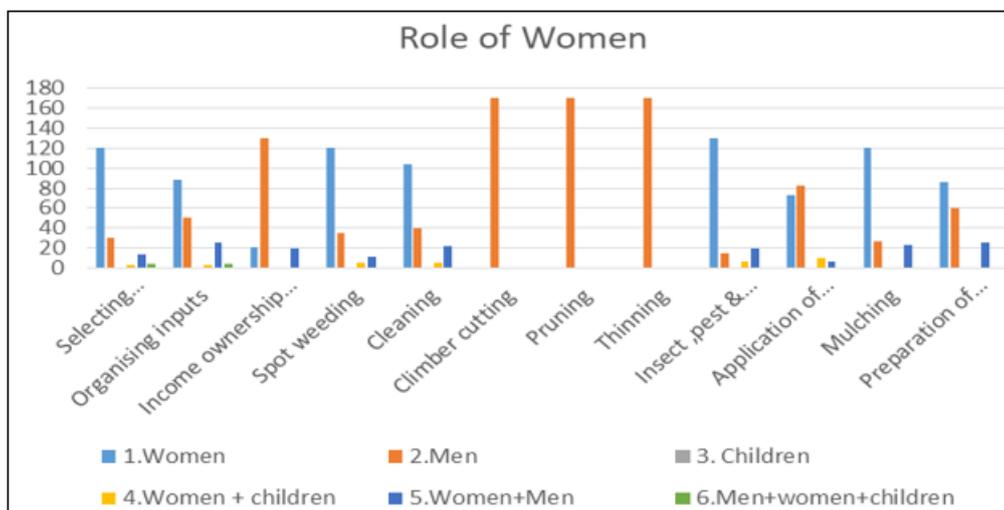
Agroforestry product markets: are women involved?

Women play a critical role in agroforestry systems, particularly in the collection, management, and marketing of certain products such as indigenous fruits, vegetables, and spices. Their involvement often centers on retail activities, while men typically dominate wholesale trade due to the higher capital requirements and mobility demands associated with larger-scale operations. Socio-cultural norms, household responsibilities, and limited access to transport often constrain women's market participation and reduce their economic gains from agroforestry products. In addition to market participation, women frequently face disparities in access to agroforestry information and extension services. Studies indicate that women receive fewer extension visits and training opportunities than men, often due to perceptions of men as primary decision-makers, limited female literacy, and the predominance of male extension agents. Despite these barriers, women actively contribute to agroforestry adoption and management, highlighting the need for gender-sensitive approaches to improve their access to markets, information, and decision-making roles (Awono *et al.,* 2002; Schreckenberg, 2004; Meinzen-Dick *et al.,* 2010; Franzel *et al.,* 2007; Wanyoike, 2001; UNEP/GRID-Arendal, 2008).

The images illustrate women actively engaged in various stages of agroforestry product markets, including sorting, packaging, and processing fruits and nuts. They highlight women's pivotal role in managing, handling, and preparing agroforestry produce for sale, emphasizing their contribution to household income and local market supply chains.

2. Conclusion

Women in home gardening and agroforestry, highlighting their contributions to food production, livestock management, and household sustenance. Women are actively involved in decision-making, resource management, and organization of agroforestry activities, which positions them as key agents for enhancing household food security and nutrition. However, their empowerment is constrained by small landholdings, limited technical knowledge, complex agroforestry practices, and challenges in marketing their products. The significant gap in income control, with most earnings managed by men, further limits their economic agency. Strengthening support mechanisms, providing technical training, and improving access to resources and markets are essential for enhancing women's participation and benefits. Promoting gender-inclusive approaches in home gardening and agroforestry can serve as an effective pathway for improving food security, nutrition, and income generation, while fostering the socio-economic empowerment of women in rural communities.

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