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Research article

Species composition, diversity and management of homegarden agroforestry systems in northwestern Ethiopia

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Abstract

Although homegarden agroforestry systems are essential for conserving biodiversity, research on the contribution of these systems to woody species conservation remains limited, particularly in northwestern Ethiopia. This study evaluated the species preferences of farmers in the homegardens, as well as the diversity of woody species and management techniques. Data were collected from 96 households, with detailed woody species inventories conducted in a representative subsample of 48 homegardens. The study identified 32 woody species from 21 families, of which 69% (22 species) were indigenous and 31% (10 species) were exotic. The highest woody species diversity (1.53) was recorded from poor households, while the lowest (1.14) was recorded from rich households. Wealth status significantly influenced species diversity, with poorer households managing a higher number of woody species compared to wealthier groups. Key management practices included weeding, pruning, fertilizing, watering, fencing, coppicing, and hoeing. The top three preferred indigenous and multipurpose species were *Rhamnus prinoides*, *Cordia africana*, and *Olea europaea*, valued for their economic benefits and ecological roles. Respondents indicated that most woody species in home gardens are retained or planted for income. The study highlights the significant role of homegardens in conserving indigenous woody species, supporting biodiversity, and providing socio-economic benefits in northwestern Ethiopia. Policies should focus on conserving species, sustainable management, development integration, and farmer training.

Keywords: Homegarden agroforestry, Indigenous species conservation, Management practices, Species preferences, Woody species diversity

Introduction

Deforestation and forest degradation pose serious risks to tropical ecosystems, which are among the most biodiverse regions on Earth. These practices severely reduce biodiversity and the availability of ecosystem services (Taro and Kawai, 2024). Deforestation and forest degradation lead to long-term environmental degradation by reducing the forest's ability to provide resources like wood and biodiversity (Bajigo *et al*., 2020; Kouassi *et al*., 2021). Furthermore, because tropical forests act as carbon sinks and absorb large amounts of atmospheric carbon dioxide, they are essential for regulating the climate (Singh *et al*., 2025). Global warming and climate change are exacerbated when these forests disappear because they release stored carbon (Yadav *et al*., 2022). Additionally, the loss of forests alters precipitation patterns and increases susceptibility to floods and droughts by upsetting water cycles (Mugadza, 2022). Millions of people's livelihoods are also threatened by forest degradation, especially in developing nations where local communities rely on forests for shelter, food, and medicine (Djenontin *et al*., 2024; FAO, 2020).

To mitigate these effects and guarantee the survival of tropical ecosystems for future generations, conservation measures are essential. Due to population increase, the need for fuel wood, and illicit logging, especially in the highlands of Ethiopia, a nation in Sub-Saharan Africa, is experiencing severe environmental degradation (Birhane *et al*., 2020). These pressures have resulted in significant deforestation, a decline in biodiversity, and difficulties with forest regeneration (Hishe *et al*., 2021). The issue is made worse by elements including agricultural growth, fires, and livestock grazing (Yassin, 2019; Oljirra, 2019). Ecosystems will shift and biodiversity-rich areas will be threatened if global trends in habitat degradation and climate change continue. Establishing agroforestry systems, which combine crops and trees to promote biodiversity, aid in conservation, and offer social and economic advantages, is one practical way to counteract deforestation (Cheru and Hailu, 2023; Plieninger *et al*., 2020). Agroforestry has been marketed as a sustainable land-use strategy that strikes a balance between environmental preservation and agricultural expansion (Cheru and Hailu, 2023). It combines a variety of species and preserves ecological balance, such as tropical home gardens that provide sustainable harvests and simulate natural ecosystems (Yaregal and Sime, 2024; Zeleke *et al*., 2024).

Homegardens, a form of agroforestry, are tiny, closely monitored plots close to homesteads that are frequently paired with animals and a variety of annual and perennial plants (Vinujan and Thanusan, 2025). High species variety and multilayered structure are characteristics of these systems, which are largely managed for sustenance (Edo *et al*., 2024; Korpelainen, 2023; Yeshiwas *et al*., 2024). Home gardens in Ethiopia are richer in woody species than the local natural forests and are essential for preserving the biodiversity of nature (Mammo and Dereje, 2025). Smallholder farmers must implement them because they offer advantages including revenue creation, ecological balance, and erosion reduction (Abebe and Asfaw, 2023; Yirga *et al*., 2024). In residential gardens, common management techniques include fertilization, coppicing, thinning, pruning, and species protection (Geleta, 2023; Ereso, 2023). Farmers choose species and establish planting schedules based on traditional ecological knowledge, guaranteeing the preservation of biodiversity (Yemataw *et al*., 2016; Alemu *et al*., 2024). In home gardens, maintaining soil fertility is essential for long-term productivity (Yaregal and Sime, 2024). Composting, using animal manure, and adding crop wastes are all typical practices (Mellisse *et al*., 2018; Santos *et al*., 2022; Yaregal and Sime, 2024).

Despite their potential, forest resources in Ethiopia, including in the study area of Lay Aremachiho Woreda, are rapidly declining due to population pressure and agricultural expansion, leading to reduced biodiversity and agricultural productivity. Homegarden agroforestry plays a critical role in mitigating these issues by conserving woody species diversity and supporting sustainable livelihoods (Getachew and Mulatu, 2024). The structure and composition of homegarden systems are not only influenced by ecological conditions but also by socio-economic factors. In particular, household wealth status and related characteristics significantly affect the composition and diversity of woody species maintained in homegardens (Tolera *et al*., 2008). Differences in resource availability, landholding size, management capacity, and livelihood strategies often lead to variations in species richness and preference among households (Giday *et al*., 2019; Marie *et al*., 2026). However, there is limited research on the diversity, management practices, and species preferences of homegardens in Northwestern Ethiopia. This study aims to fill this knowledge gap by examining woody species diversity, management practices, and farmers' preferences in homegarden agroforestry systems in Lay Aremachiho Woreda.

Materials and Methods

***Description of the study area*:** Lay Armachiho Woreda is located in the northwestern part of Ethiopia, in the North Gondar Zone of the Amhara Region. This is located between 12^0 39′ and 12^0 42′ N latitude and 37^0 26′and 37^0 28′ E longitude (Fig 1). It covers an area of 1292.72 km^2 and comprises 33 rural and 1 urban Kebeles. This is delimited by Chilga and Dembia woreda in the west, Wogera woreda in the east, Tach Armachiho woreda in the north and Gondar Town Administration in the south (LAWAO, 2016).

***Sample size determination and household selection*:** The purposive sampling technique was employed to select kebeles (the smallest administrative unit in Ethiopia). The district has 33 kebeles of which 2 kebeles (Kerker Endivina and Chila Dewol) were selected purposively based on the presence of extensive homegarden practice. From two kebeles 4, villages were selected randomly. Stratified random sampling was used to select households using wealth status as criteria. The list of households in different villages was acquired from the respective development agents. Key informants (KI) were consulted to set criteria for wealth category and also classify households into different wealth classes. Then, sample households were randomly selected within each stratum to yield a sufficient number of sub-populations in the sample. KIs were selected by the snowball method (Naderifar *et al.,* 2017). During village reconnaissance, farmers were randomly asked to give the names of KIs. Out of the mentioned candidate KIs by selected farmers, the five top ranking were selected at each village, which makes a total of 20 KIs for the entire study.

Wealth-ranking of individual households was carried out using the wealth-ranking technique of Crowley (1997). The households living in the villages were categorized into three wealth classes of rich, medium, and poor according to the set criteria. The criteria used by the key informants were mainly based on the amount of annual crop production, farm size and number of livestock at the village level. Among the total households living in the study site, 19% were categorized as rich, 33% as a medium and 48% as a poor (Table 1).

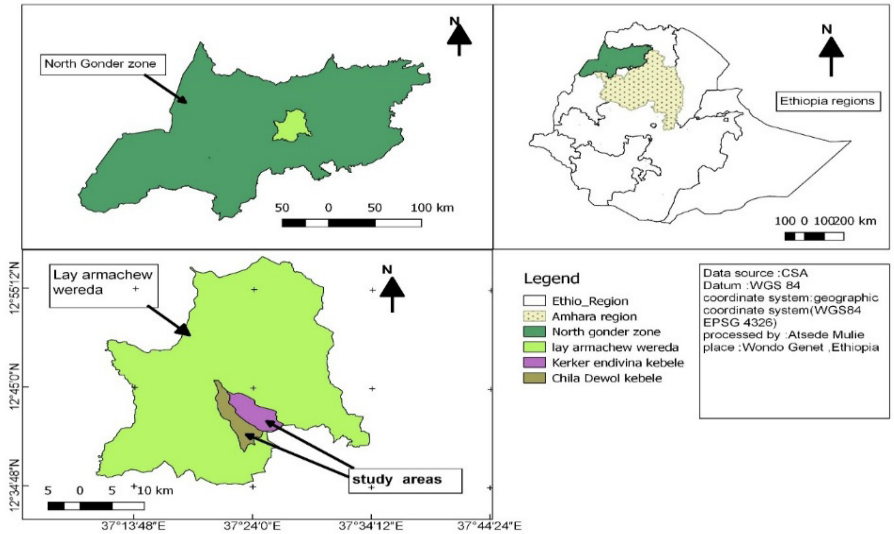

Fig 1. Study area location map

Table 1. Wealth class distribution of household in the study village

Kebele	Village	Poor	Medium	Rich	Total
Kerker Endivina	Debire zuria	45	26	9	80
	Durika	41	27	17	85
Chila Dewol	Lebeta	30	28	20	78
	Koyna	39	24	14	77
Total		155	105	60	320

For the study of management practices and species preference, a total of 96 households (30% of the total households in the study area) were randomly selected from the identified wealth categories. As recommended by Abebe (2005), equal numbers of households were selected from each village to ensure comparability among villages and wealth groups. For the assessment of woody species diversity in homegardens, a representative subsample of 48 households (15% of the total households and 50% of the surveyed households) was randomly selected from the 96 households included in the questionnaire survey. The subsample was proportionally distributed across villages (12 households per village) and wealth categories (four households per wealth class per village) to maintain balanced representation. Woody species inventory involves detailed field measurements, species identification, and structural assessments, which are labor-intensive and time-consuming. Therefore, a subsampling approach was employed to ensure high-quality biodiversity data collection while maintaining representativeness and statistical reliability.

***Data collection method*:** In this study, both primary and secondary data were collected. The primary data sources are household heads (HHs), KIs, and field observation; accordingly, primary data were collected from them through questionnaires (household survey), key informant interviews, focus group discussions, and field observations. Secondary data was collected from periodic office reports from local authorities, institutions, government offices, libraries, websites and from different published and unpublished sources.

***Household survey*:** The primary data from households were collected through both open and closed forms of questions in the four selected villages. The questionnaire was prepared in English and translated into the local language, which is Amharic. Questionnaires were pre-tested. Thus, data about biophysical and socio-economic aspects such as local names of woody species, species preference, and management activities of woody species were collected from a total of 96 sampled households (30% of the households). KIs' interviews were done at each village level to classify wealth categories and collect general information. Focus group discussions were held to gain in-depth information at each village.

***Woody species inventory*:** The quantitative data were collected by measuring and counting the woody species of home gardens. For woody species inventory, 50% of the sampled households were used. Each homegarden was divided into 10m x 10m (100m^2) homogenous plots (ranging from 6 to 22 quadrats), then a total of 48 plots (one plot from each homegarden) were selected randomly for the entire study as per the methodology of Negash (2013).The number of individuals of woody species in each plot was counted, and the diameter at breast height (1.3m height) (DBH ≥ 5cm) of all woody species found in each plot was measured using diameter tape.

Measurement of diversity: Woody species of home garden were analyzed and summarized by using equations of the parameters such as frequencies, relative frequencies, relative densities, and Shannon diversity index (H') by following Taylor *et al.* (1993). Shannon's Index is the most applicable index of diversity and accounts for both richness and evenness of the species present. The Shannon Diversity Index (H') is calculated using the following formula;

$$H = -\sum_{i=1}^{S} p_i \ln p_i$$

Where; H' = Shannon diversity index,
P_i = proportion of individuals found in the i^{th} species.
S = total number of species,
*l*n = log base n.
Shannon's Evenness (equitability) index (E) of the woody species was computed as follows to estimate the homogeneous distribution of the species (Magurran, 2004). Equitability (evenness) E= $\frac{H'}{\ln S} = \frac{H'}{H'max}$ Where: E = Evenness; = Shannon-Wiener Diversity Index; Hmax = ln(S) is the natural logarithm of the total number of species, S is the total number of different species present. The Simpson index was calculated as = 1- $\Sigma\, pi^2$. Where, P_i = proportion of individuals found in the i^{th} species.

***Direct matrix ranking*:** Direct matrix ranking as suggested by Martin (1995) was used which involves asking people to order their much favored homegarden plants by taking into account various characteristics (medicinal, spices, food, forage, etc.) at a time for each plant, giving reasons why they preferred.

Statistical analysis: Both qualitative and quantitative data was summarized, coded, entered in to a computer and analyzed, interpreted and synthesized using Microsoft-excel 2013 and Statistical Package for Social Sciences (SPSS) software Version 25 (IBM Corn, 2017). One way ANOVA was carried out at $P<0.05$ to test if there is significant difference in woody species diversity between different wealth classes. Tukey test was used to separate the means.

Results and Discussion

***Floristic composition in homegarden agroforestry*:** A total of 32 woody species belonging to 21 families were recorded in the study homegarden (Table 2). Out of these, 21 (67.74%) species were trees and 11 (32.26%) were shrubs woody species and 9 (28.13%) were fruit trees (Table 2). Among the 21 families recorded in area 6 families were represented by more than one species (Table 2). Rutaceae was represented by 4 species; Myrtaceae, Fabaceae and Moraceae, each represented by 3 species; Anacardiaceae and Celastraceae were represented by 2 species. The remaining 15 families' were represented by a single species (Table 2). Rutaceae was the dominant family in terms of species richness. Floristic composition of the homegarden flora consists of both native and exotic species. From 32 woody species, 69% (22 species) were indigenous and 31% (10 species) were exotic. Similar studies in different parts of Ethiopia reported comparable results. For instance, Mekonnen *et al*. (2014) identified 44 woody species from Jabitehenan district; Tefera *et al*. (2016) reported 39 woody species from Dilla zuria, woreda; Birhan and Abebe (2019) reported 65 woody species from Wadera district; Dekeba *et al*. (2019) reported 77 woody species from Habro district and Worji (2023) identified 47 woody species in Metu district, southwest Ethiopia. A higher number of plant species (104) was recorded in mixed-tree silvopastoral systems in the Himalayas compared with the findings of the present study (Bhutia *et al*., 2024). The result on plant composition of home gardens indicated that the area has floristic richness and included plant species from diverse genera and families. This fits well with the assertion that home gardens are valuable sources of plant agro-biodiversity (Sharma *et al*., 2024).

Woody species diversity: The result showed that woody species diversity varies among the wealth classes. The highest woody species diversity (1.53) was recorded from poor households while the lowest (1.14) recorded from rich households (Table 3). Statistically, significant difference was observed between poor households and rich households in woody species diversity in the study homegardens ($p < 0.05$). The reason is likely that wealthier households often own larger plots of land, which lead them to allocate a significant portion of their land to cash crops or monocultures with higher economic returns, rather than maintaining diverse woody species. Studies in Moretina Jiru district, Amhara region and Gimbichu district in Oromia region indicated that households having larger farmlands cultivated cash crops (Baada *et al*., 2023). On the other hand, poor households, with smaller landholdings, may rely on homegardens for multiple subsistence needs (e.g., food, fodder, fuel wood), encouraging a higher diversity of woody species. This finding aligns with (Bayesa and Bushara, 2022), who reported that non-timber forest products (NTFPs) constitute 46% of the income sources for poor households, compared to only 14% for rich households. However, these results contradict with studies in southern Ethiopia (Getachew *et al*., 2022), and the Jabitehenan district (Mekonnen *et al*., 2014) which reported that rich households homegardens are more diversified than poor households homegarden.

***Management of woody species*:** Woody species that are either planted or retained in the home garden demand different types of management. People in the study area have developed home gardens (locally called

Table 2. List of woody species composition, origin, frequency and relative frequency (RF) in homegardens in the study area

Species	Origin	Family	No. of species	Proportion (%)	Fruit tree frequency	Fruit tree RF (%)
Coffea arabica L.	Indigenous	Fabaceae	3	9.375	–	–
Cordia africana Lam.	Indigenous	Rutaceae	4	12.5	–	–
Rhamnus prinoides L'Hér.	Indigenous	Moraceae	3	9.375	–	–
Syzygium guineense (Willd.) DC.	Indigenous	Myrtaceae	3	9.375	12	4.49
Olea Africana Mill.	Indigenous	Anacardiaceae	2	6.25	–	–
Croton macrostachyus Hochst. ex Delile	Indigenous	Celastraceae	2	6.25	–	–
Nuxia congesta R.Br. ex Fresen.	Indigenous	Euphorbiaceae	1	3.125	–	–
Apodytes dimidiate E.Mey. ex Arn.	Indigenous	Asteraceae	1	3.125	–	–
Catha edulis (Vahl) Endl.	Indigenous	Boraginaceae	1	3.125	–	–
Vernonia amygdalina Delile	Indigenous	Buddleiaceae	1	3.125	–	–
Mimusops kummel A.DC.	Indigenous	Combretaceae	1	3.125	3	1.12
Albizia gummifera (J.F.Gmel.) C.A.Sm.	Indigenous	Icacinaceae	1	3.125	–	–
Sclerocarya birrea (A.Rich.) Hochst.	Indigenous	Lamiaceae	1	3.125	–	–
Erythrina abyssinica Lam. ex DC.	Indigenous	Lauraceae	1	3.125	–	–
Grewia ferruginea Hochst. ex A.Rich.	Indigenous	Olacaceae	1	3.125	–	–
Ficus vasta Forssk.	Indigenous	Rhamnaceae	1	3.125	–	–
Ficus sur Forssk.	Indigenous	Rubiaceae	1	3.125	–	–
Clausena anisata (Willd.) Hook.f. ex Benth.	Indigenous	Rosaceae	1	3.125	–	–
Lantana trifolia L.	Indigenous	Sapotaceae	1	3.125	–	–
Maytenus arbutifolia (A.Rich.) Wilczek	Indigenous	Tiliaceae	1	3.125	–	–
Otostegia integrifolia Benth.	Indigenous	Verbenaceae	1	3.125	–	–
Combretum molle R.Br. ex G.Don	Indigenous	Combretaceae	32	100	–	–
Mangifera indica L.	Exotic	Anacardiaceae	–	–	10	3.75
Prunus persica (L.) Batsch	Exotic	Rosaceae	–	–	21	7.87
Casimiroa edulis La Llave	Exotic	Rutaceae	–	–	15	5.62
Ficus carica L.	Exotic	Moraceae	–	–	–	–
Citrus aurantiifolia (Christm.) Swingle	Exotic	Rutaceae	–	–	15	5.62
Sesbania sesban (L.) Merr.	Exotic	Fabaceae	–	–	–	–
Psidium guajava L.	Exotic	Myrtaceae	–	–	1	0.37
Persea americana Mill.	Exotic	Lauraceae	–	–	1	0.37
Citrus sinensis (L.) Osbeck	Exotic	Rutaceae	–	–	5	1.87
Myrtus communis L.	Exotic	Myrtaceae	–	–	–	–

wojed) with considerable diversity and flexibility that support production of major livelihood crops. They have managed to select woody species that co-adapt to the local environment and that give multiple benefits. The common management practices were, weeding, pruning, fertilizing, watering, fencing, coppicing and hoeing (Table 4). According to the respondents, fencing was done to protect the plants from damage by animals. The pruning of tree species in the homegarden was done for the reduction of the shade for coffee and crop production,

Table 3. Shannon diversity, Simpson and evenness of woody species in homegarden of households from three wealth class in Lay Aremachiho, Ethiopia

Indices	**Wealth**			
	Poor (N=16) Mean ± S.D	**Medium (N=16) Mean ± S.D**	**Rich (N=16) Mean ± S.D**	**Total Mean ± S.D**
Shannon_H	1.53±.32 [a]	1.53±.24[a]	1.14±.27[b]	1.40±.33
Simpson_D	0.73±.13[a]	0.73±.07[a]	0.6±.1[b]	0.69±.12
Evennes_E	0.83±.13[a]	0.86±.08[a]	0.79±.09[a]	0.83±.11

Single different small letters on mean value indicate significant difference at $p < 0.05$ between wealth classes.

Table 4. Management activities employed by households for different woody species at Lay Aremachiho, Ethiopia

Species	**Management activities (%)**						
	Hoeing	**Pruning**	**Weeding**	**Watering**	**Coppicing**	**Fencing**	**Fertilizing***
Coffea arabica L.	23	-	-	10	-	39	5
Cordia africana Lam.	-	15	-	-	-	5	-
Rhamnus prinoides L'Hér.	53	-	12	33	4	62	23
Syzygium guineense (Willd.) DC.	-	12	-	-	-	-	-
Olea europaea L.	-	17	-	-	-	7	-
Croton macrostachyus Hochst. ex Delile	-	9	-	-	-	-	-
Prunus persica (L.) Batsch	5	-	5	13	-	14	6
Casimiroa edulis La Llave	2	-	1	-	-	5	-
Ficus sur Forssk.	-	3	-	-	4	-	-
Citrus sinensis (L.) Osbeck	7	-	2	5	-	4	3
Citrus aurantiifolia (Christm.) Swingle	5	-	6	2	-	2	6
Total	95	56	26	63	8	138	43
%	22.14%	13%	6%	14.7%	1.9%	32.17%	10.1%

* Fertilizing refers to the practice of adding green manures, compost and other wastes.

to get good timber and to collect wood to be used for fencing, forage for livestock, firewood and also for sales. Some home garden owners stated that they continuously manage plants for economic as well as ecological benefits. Crop residues, weeds, ashes and manures were reported to be used as fertilizers in homegardens. Some home garden owners reported that they grew seedlings during the dry season as well and watering was done for early survival of planted seedlings, especially for *Coffea arabica* and *Rhamnus prinoides* during transplanting time.

The result is supported by Yaregal and Sime (2024) who reported that homegarden largely managed by indigenous knowledge, including hand weeding, manure and compost application, nursery preparation, fencing, and flood run-off control. Another study in in central highlands of Ethiopia also stated that rural households implemented weeding, pruning, thinning, looping, pollarding, fertilizer application, watering, coppicing, fencing, and mulching to maintain and optimize the productivity of their homegarden and woodlots (Yirga *et al*., 2024). Farmers in the study sites did try to manage woody species in their gardens to obtain different benefits. The most frequently mentioned purposes for planting and retaining woody species in the homegardens were consistent with the findings of Edo *et al*. (2024) where they stated that tree species were deliberately planted in homegarden and managed for maintenance of soil fertility, habitat provision to many organisms, enhancement of water quality, prevention of soil erosion, carbon sequestration, and improvement of soil moisture by providing shade.

***Species preference in homegarden*:** Interviews on importance and management of woody species indicated that most of woody species preferred were indigenous and multipurpose woody species. This shows that the abundance of woody species is influenced by preference of farmers. People of the study area use their indigenous knowledge for selecting, managing and utilizing of different multipurpose plant species of homegardens. The first, second, and third preferred species were *Rhamnus*

Table 5. Farmer's species preference ranking (first, second and third) of woody species for homegarden at Lay Aremachiho, Ethiopia

Species	Number of respondent			Relative rank			Relative score	Uses
	1st	2nd	3rd	1st	2nd	3rd		
Rhamnus prinoides L'Hér.	41	13	13	17.9	1.9	1.82	21.6	income, consumption
Cordia africana Lam.	17	31	16	3.1	10.8	2.75	16.62	timber, agri. implementation, shade, construction, income
Olea europaea L.	22	7	10	5.2	0.55	1.1	6.77	fuel wood, agri. Implementation, construction, fence
Syzygium guineense (Willd.) DC.	4	7	17	0.2	0.55	3.11	3.82	fuel wood, food, construction, fence
Croton macrostachyus Hochst. ex Delile	0	5	9		0.28	0.87	1.15	fuel wood, fence, construction
Coffea arabica L.	3	7	8	0.1	0.55	0.69	1.33	income, consumption
Prunus persica (L.) Batsch	4	5	7	0.2	0.28	0.53	0.98	income, food
Citrus aurantiifolia (Christm.) Swingle	0	5	4		0.28	0.17	0.45	income, food
Eucalyptus camaldulensis Dehnh.	2	3	5	0.04	0.1	0.27	0.41	timber, agri. implementation, construction
Casimiroa edulis La Llave	0	5	3		0.28	0.1	0.38	income, food, construction
Ficus vasta Forssk.	1	0	0	0.01			0.01	shade, timber, fodder
Albizia gummifera (J.F.Gmel.) C.A.Sm.	0	0	1			0.01	0.01	shade, construction
Mangifera indica L.	0	1	0		0.01		0.01	income, food
Total	94	89	93					

* Relative score was calculated by multiplying the number of respondent in each rank by its proportion (e.g. (41*41/94) =17.9)

prinoides, *Cordia africana*, and *Olea europaea* respectively (Table 5). In the study area, *Rhamnus prinoides* is the major shrub woody species used as a source of cash income. Due to high market value (30 ETB/kg) and harvesting frequency (3 times/year) of *Rhamnus prinoides,* farmers give special attention to this species compared to other indigenous species. *Cordia africana* is mainly used for furniture and timber production, agricultural purposes, providing shade, construction, and as a source of income through timber sales. *Olea europaea* is used for fuelwood, construction, agricultural purposes, timber, and as a source of income through the sale of charcoal and fuelwood. Study in southwest Ethiopia by Kebebew and Ozanne (2024) also reported that the most preferred tree species were *Cordia africana*, *Croton macrostachyus*, and *Milletia ferruginea* due to their purpose such as for timber, and hanging beehive in addition to coffee shade.

Homegarden can be considered a land use system involving purposeful management of useful trees and shrubs in close connection with annual and perennial agricultural crops (Geleta, 2023). Assemblages and repositories of a vast number of plants in small parcels of land around the home (homegarden) fulfil specific economic, social, and cultural needs of the individual owners and provide other intangible benefits to the society. Study in south central Ethiopia by Yaregal and Sime (2024) confirmed that homegardens contributes to the preservation of agricultural genetic diversity, promotes food availability, accessibility, and utilization as well as considered as a basic contributor to food self-sufficiency. Multipurpose trees are widely selected and managed by farmers across the world due to their positive effects on soil improvement. For instance, a study by Kumar *et al.* (2017) reported that multipurpose tree species, namely *Prosopis cineraria*, *Acacia senegal* and *Tecomella undulate*, had positive impacts on the physical and chemical properties of soils in Thar Desert of Rajasthan.

Conclusion

The study revealed that homegarden agroforestry in Lay Aremachiho hosts considerable woody species diversity, with 32 species from 21 families, comprising both indigenous (69%) and exotic (31%) species. Trees dominated the system, followed by shrubs, with a significant portion of fruit trees contributing to household nutrition and income. Wealth status influenced woody species diversity, with poorer households maintaining higher diversity, likely due to reliance on homegardens for multiple subsistence needs, whereas richer households favored monocultures or cash crops. Indigenous multipurpose species, particularly *Rhamnus prinoides*, *Cordia africana*, and *Olea europaea*, were the most preferred by farmers, reflecting their roles in income generation, timber, construction, fuelwood, and agricultural support. Management practices such as pruning, weeding, fertilizing, watering, coppicing, and fencing were widely employed, highlighting the importance of local knowledge in maintaining species productivity and diversity. Homegardens support agro-biodiversity and livelihoods. Policies should focus on indigenous species conservation, sustainable management, integration into local development, and farmer training to enhance income, biodiversity, and climate resilience.

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