

# A Study on the Composition, Agro Ecosystem Use and Socio Economic Role of Homegarden in Selected Kebeles of Haramaya District, Oromia Regional State, Eastern Ethiopia

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## ABSTRACT

Homegardens believed to be more diverse and provide multiple services for household than other mono cropping system and this is due to the combination of crops, trees and livestock. The study focused on the composition, structure of homegarden, diversity of plant species and contribution of homegarden to household food security, socio-economic importance. From the total of twenty kebeles, Gode, Damota, Tennike and Finkille kebeles were selected using lottery method. In a reconnaissance survey made in the kebeles from October 10-25 2016 four sites were selected purposively. Totally 80 households which are home garden users were selected for this study. Socio-economic data and potential economic and agro-ecosystem role of home garden agro forestry were collected by using structured questionnaire, focus group discussion and semi structured interview. The family size of respondents ranges from 2-12. There is a strong correlation between the farm land holding and the size of the homegarden. Nine tree species were identified in the study area. The homegardens were covered with fruits and other plants before 20 years ago but know there is complete change on the vegetation cover. The dominant species in the area is chat (*Catha edulis*). The regression analysis made to identify determination of annual income showed that income from home garden and numbers of species in the home garden have strong correlation with annual income at  $P<0.05$ . Home garden agro forestry significantly at  $P<0.05$  improved the farmer's cash income. With insignificant garden size; home garden practice provides good socio-economical and agro-ecological service for the farmers which have higher implication for climate change adaptation and family level food security.

## Original Article

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Agro Forestry, Composition, Household Food Security, Socio-Economic, Agro-Ecological Role

## INTRODUCTION

Home garden agro forestry has been documented as an important source of food and nutritional security throughout the world [1]. Home gardening is an ancient and widespread practice all over the world which is found both rural and urban areas. It is predominantly taken as small scale subsistence agricultural system [2]. It is being practice in Asia, Africa and Latin America predominantly which serves the society for economic and immediate food source [3]. Home garden play important role in ecological and socio ecological system comprising domestic plants and crops [4]. Home gardens are known for their structural complexity and diversity of crops and plant species [3].

Home garden are one of the major practice known by the local community for their ecological sustainability and diversification of livelihood system creation [5]. The socio economic and agro economic roles includes wide range of products such as: firewood, fodder spices, medicinal plants and ornaments including food [6,7]. It is also believed that home garden contribute ecological and conservation functions like formation and maintenance of soil structure, retention of soil moisture and recycling of nutrients that help in mitigating climate change [8]. The land use system involves management of multipurpose trees and annual and perennial agricultural crops within compound of individual house [9].

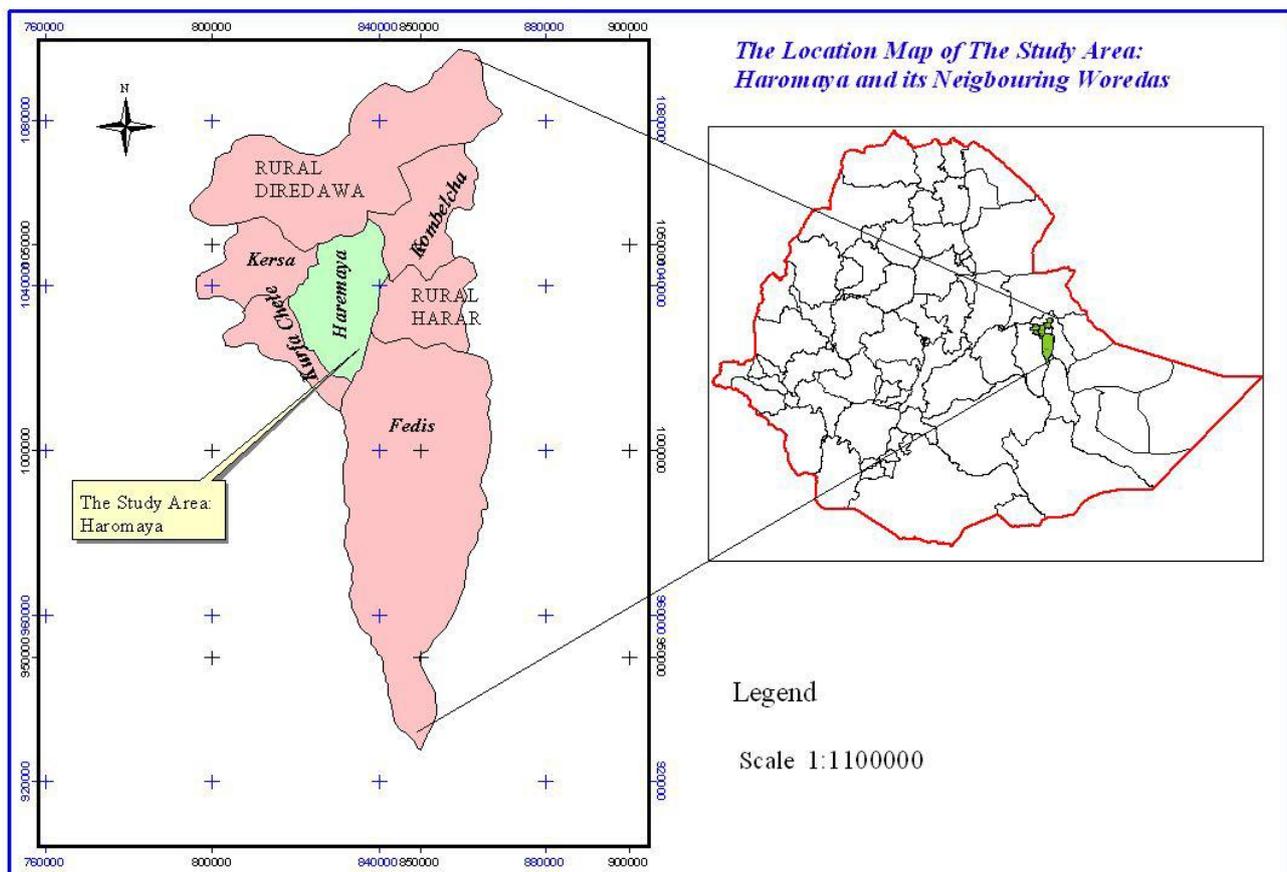
In Ethiopia, where most of the population is farmer (80%) which depends on agriculture for their livelihoods and contributes 42-45% of the total GDP of the country [10]. Haramaya district is one of the districts found in Eastern HarargheOromia regional state and the area is known for its productivity. The local communities in the study area are farmers and employed workers of different NGOs and government offices even if they are

employed they practice home gardening in their home. In Haramaya district, home gardening mostly practiced through combination of Chat (*chat aduls*) with different crop species such as: Sorghum (*Sorghumbycolour*), maize (*zea maize*) and variety of fruit types. Chat is widely cultivated cash crop which is used as immediate source of income and. The average monthly income of the family practice chat cultivation ranges from 50birr to 533birr [11]. The study aimed at identifying the composition, agro ecosystem use and socio economic role of home garden in the district.

## MATERIAL AND METHODS

### Description of the study area

**Location.** Haramaya district is part of Ethiopian highland and lies in the semi-arid tropical belt of eastern Hararghe zone. The Woreda is bordered on south by Kurfachelle, on west by Kersa, on the north by Dire Dawa, on the east by Kombolcha and on the south east by Harar regional state. The district has the total area of 550 km<sup>2</sup> and comprises three smaller towns; namely Haramaya (the main town), Adele and Bate. In addition, there are 25 rural kebeles in the district. Haramaya district is noted for its intensive agricultural practices and cropping system Figure 1. Its astronomical location lies roughly between 9° 20'1" - 9° 35'1" North latitude and 41° 51'1" - 42° 04'1" East longitude.



**Figure 1.** Map of the study area

### Population

Total population of district is about 271,018; of whom 138282 are male and 132736 are females. 50,032 populations are urban dwellers and the remaining are rural dwellers. Area of the district is about 550 sq.kilometers. The largest ethnic groups are Oromo (96.04%) and Amhara (3.12%). All other ethnic groups made up of 0.84% of the population. The first language spoken in district is Afan Oromo about 95% and 4.44% spoke Amharic and remaining 0.56% spoke other languages. The majority of inhabitants are Muslims about 95.82% and remaining 3.71% are orthodox and other religious followers [11].

### Topography

Topography of the district is generally characterized by gentle slope. Altitude of the district is range from 1400-2340 meters above sea level. The highest point places in the district are Dof and Jaldo. 60.1% of land are cultivatable, 2.3% are pasture land, 1.5% are forest and 36.1% are degraded or unusable (Haramaya Agriculture and Rural Development office, 2015).

### Types of vegetation and fruit in study area

Studied garden were growing and cultivating plants as parts of horticulture and others. These include: carrot (*Daucuscarota*), coffee (*Coffearaabica*), maize (*Zea mays*), mango (*Mangiferaindica*), orange (*Citrus sinensis*), onion (*Allium cepa*), pea (*Pisumsativum*), sorghum (*Sorghum bicolor*) and others. For fencing purpose Bargemoadii (*Eucalyptus camaldulensis*), Wedessaa (*Cordiaafricana*) and Bargemodemaa (*Eucalyptus globulus*) were exhibited in the area. Shrubs found in the area include *Lanatanacamara*, (Yewefkolo) which is an invasive exotic species found in the area and farmers used it for fencing their garden. These are some of the major species found in the locality (Haramaya Agriculture and Rural Development office, 2015).

### Climate

Climatically, the district falls within midland and lowland agro ecological zone. The mean annual temperature is about 22°C with maximum temperature about 31°C and minimum temperature about 12°C. The mean annual rain fall ranges between 700-1350mm<sup>3</sup> (National Metrology Agency NMA2015) (Figure 2).

Based on the agro-climatologically classification, Haramayaworeda has WoinaDega (wet and cool, 70%) and Kolla (dry and hot 30%) areas. Haramaya district lies between 1900 to 2450 m.a.s.l. These altitudinal ranges gave the district Dega5 and Woinadega6 agro-ecological zones. The mean annual rainfall is 74.1mm, with mean annual temperature of 16.90c. The dry season, with relatively less than 30 mm of rain fall per month, extends from October to February. The main autumn rain occurs from September to November while the smaller spring rain occurs from March to May.

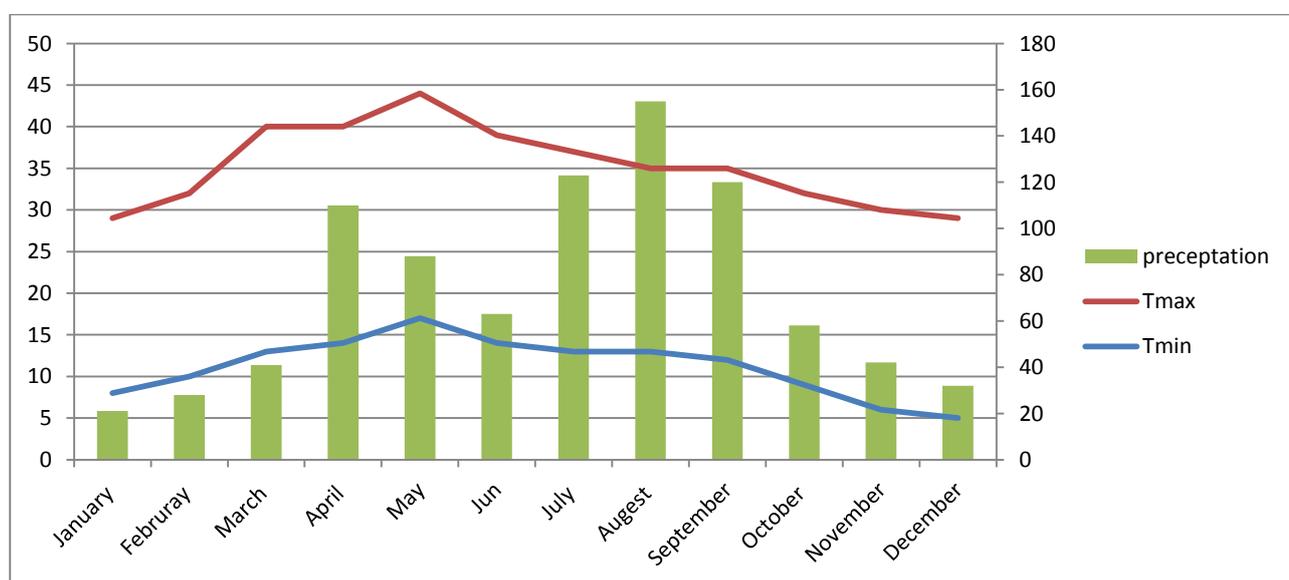


Figure 2. Climate condition of study area

### Sampling Method

For the study probability sampling method was employed. Among 25 kebeles in the district four Kebeles were selected using lottery method to give each kebele a chance to be included. The selected kebeles were Gode, Damota, Tennike and Finkille. In a reconnaissance survey made in the kebeles from October 10-25 2016 a potential village from each kebele was identified purposively. In this study, key informants and households were involved to assess importance of homegarden for socio economic and to determine the composition of homegarden. Key informants for the study were identified on the basis of number of years stayed in the area (individuals who concurred a land for more than 20 years). This was done due to the fact that the research also examines the role of homegarden for ecological maintenance also to determine the pats ecosystem. The key informant selection was adopted from Ewuketu Linger [12], accordingly during village reconnaissance, six farmers were randomly asked. Out of 24 candidates of key informants the six top ranking were selected at each village. Finally, from village 20 households were picked randomly making 20 kebele and 80 key informants for the entire study.

### Data collection method

Based on information from interview of key informants, questionnaires were designed to collect data on the role of home gardens for socio-economic and agro-ecosystem maintenance and associated implication were also collected. In addition key informants were also made to respond about the condition which was 20 years ago, 10 years ago and current states of the home garden. The local community was also engaged in FGD to isolate the major socio economic benefits of home garden and to create an image of the area of 20 years back and 10 years back.

## Data Analysis Method

The data which was collected from key informant's interview and from focused group discussions was analysis by simple descriptive statistics (e.g. percentage, frequency, tables and graphs). Home garden are different in their structure direction of occurrence and vegetation type and use in each local community. The analysis follows as procedure that each home garden data was collected by considering these facts. The quantitative data which was obtained from the closed ended items were coded and subjected to SPSS version 24 for further analysis of data. Regression analysis was made to identify the annual income from home garden and numbers of species in the home garden.

## RESULTS AND DISCUSSION

### Socio-economic characteristics of the respondents

**Age structure of respondents.** The age category of the respondents were classified into three categories; young age (<18 years old), adult age (19-50 years old) and old age (>50 years old). It is revealed that the majority of the respondents were in the middle age category 60 (75%). This finding is adequate to the national statistics indicating that the selected homesteads were typical homestead of the country (Table 1). In this study 80 participating households, 64 (80%) were male headed whereas the remaining 16 (20%) were female headed. The number of male households is greater than that of female households so the households in the study are more patriarchal.

### Family Size

Family size of the respondents ranged from 2 to 12 and classified in to three categories as small (2-4 members), medium (5-10 members), and large (more than 10 members). Data indicates that 75 (60%) of the respondents were in medium size family which was also a representative of typical family size in eastern Ethiopia. It is very common to live together with parents and with brothers and sisters and sometime with relatives. The education level of the households shows that 48 (60%) were illiterates where they don't read or write, whereas 16 (20%) of them were literates, that can read and write. The rest of the respondents 12 (15%) of them finished primary school education and 2 (2.5 %) respondents each were with secondary education and TVET educational background respectively (Table 2).

**Table 1.** Age structure of respondents

Age	Frequency	Percentage
<18 years old	0	0
19-50	60	75
>50 years old	20	25

**Table 2.** Educational level of respondents

Educational level	Frequency	Percentage
Illiterate	48	60
Read and write	16	20
Primary education	12	15
Secondary education	2	2.5
TVET	2	2.5
Total	80	100

### Home garden size

In the study area different size of homegardens were reported for simplicity the homegarden were categorized in to three groups. The scale was adopted from [Asfaw and Woldu \[13\]](#). Which is 0.1-1.5 hectare small land holders, 1.6-3 hectare medium size land holders and above 3.5 ha large size land holders. The study reviled that the size of the home garden ranges from 0.2-0.5 hectare in Gode, 0.3-0.5 hectare in Damota, 0.1-0.4 hectare in Tinike and 0.2-0.5 ha in Finkelle. As it is shown the size of the home gardens in each sample kebele is deferent except Gode and Fenekele. Largest home garden size exhibited in Damotakebele were the home garden ranges from 0.3 up to 0.5 (Table 3). The average size of homegarden was found to be different within each land categories and village. The category of farm yard was categorized in to three parts as larger, medium and small land holding. The average size of land holding for larger farm yard was 3.548 ha while the land holding for

medium and small farm category were 1.16 and 0.81 ha respectively. On the other hand, the average homestead size for large category was 0.43 ha whereas the medium and small categories were 0.25 and 0.1 ha respectively. Strong correlation ( $r = 0.8124$ ) was observed between the farm yard of farmers and the size of home garden.

As the data indicates in table 4 among the total of 80 household respondents 70 (87.5%) households produce cereals whereas 10 (12.5%) of them are producing crop through integrated perennial trees in their gardens. In case of the location and arrangement of the home gardens the data show that the spatial arrangement is variable at the study site. About 53 (67%) of the home garden are located on the backyard 17 (21%) located on the side homestead and 12% are located on the front side. Among studied home garden 57 (71%) were partially fenced, 20 (25%) were fenced and 3 (4%) were not fenced.

The nine tree species which were recorded and identified in the study area are: buna (*coffee arabica*), Gaattiraa (*cupressus lusitanica*) Bargemoadii (*Eucalyptus camaldulensis*), waddeesa (*Cordia africana*), Burtukaana (*citrus sinensis*), Mangoo (*Mangifera indica*), Papaya (*Carica Papaya*), Jankaraandaa (*Jacaranda mimosifolia*), Bargemodima (*Eucalyptus globulus*) and chat (*Catha edulis*). The most dominant tree species were mango (*Mangifera indica*), papaya (*Carica Papaya*), chat (*Catha edulis*), Bargemoadii (*Eucalyptus camaldulensis*) and Bargemodimaa (*Eucalyptus globulus*) in the contrary less common species were Gattiraa (*cupressus lusitanica*), Jacaranda (*Jacaranda mimosifolia*) and orange (*citrus sinensis*).

### Livestock and home garden relation

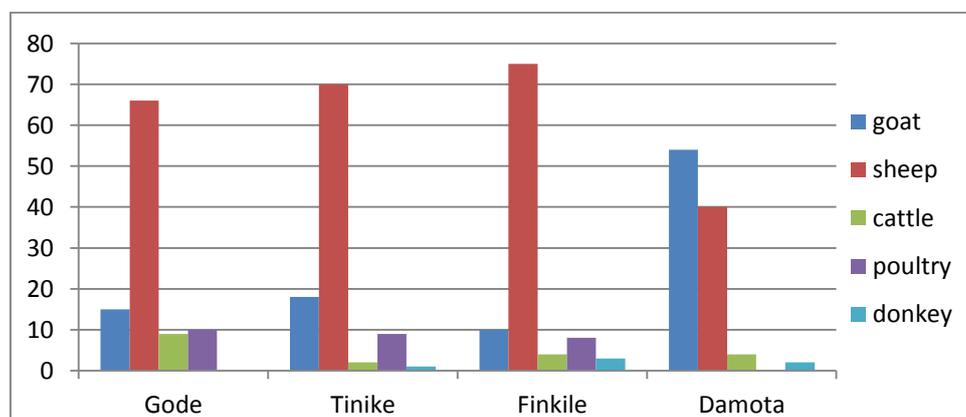
Number of livestock reared in each kebeles varies both in type and quantity. Finkilekebele rears high quantity of livestock than others kebeles which is 75% sheep, 10% Goats, 7% poultry and 5% cattle and donkey 3%. In Gode the community rears 66% sheep, 15% Goats, 10% poultry and 9% cattle were as in Tinkekebele the farmer's rears 70% sheep, 18% goats, 9% poultry, 2% cattle and 1% are donkey respectively. In Damota, 40% sheep, 54% goats, 4% cattle and 2% donkey are respectively (Figure 3).

**Table 3.** Size of home garden in hectare

Kebele	Garden size in hectare
Gode	0.2-0.5
Damota	0.3-0.5
Finkele	0.2-0.5
Tinnike	0.1-0.4

**Table 4.** Structure of home garden in the study areas

Home garden structure	Frequency	Percentage
Use and style of home garden	Cereals without trees	70
	Integrated perennial trees and crop	10
Spatial arrangement of the home garden	Back yard	53
	Onside	17
	Front side	10
States of the home garden	Fenced	20
	Partially fenced	57
	Not fenced	3



**Figure 3.** Frequencies of livestock in four kebeles

### States of home gardens

The participants in FGD described that the establishment of home gardens goes to the time of revolution in Ethiopian history. The participants agreed that the land formation in the country which is during the Dergu regime (1974). In related to the past experience of home gardens the overall size ranges from 0.2-0.485 ha in the average of the four kebeles. According to the information from FGD the homegardens were covered by cereal/cash crops. Before 20 years, most garden were covered by sorghum (*Sorghum bicolor*) and maize (*zea mays*) and for local use chat were planted. Ten years back, most cereal crop species were introduced soybean (*Glycine max*), pea (*Pisumsativum*), the coverage of Chat increased by more than half of the home garden size as compared to the previous year's coverage as explained by the respondents. Currently, species like potato (*solanumtubersum*), sugarcane (*saccharumofficinarum*), onion (*allium cepa*), maize (*zea Mays*) sorghum (*Sorghum bicolor*), cabbage (*Brassica integrifolia*) and soya bean (*Glycine max*) were found but the farmers prioritize chat of other cereals and vegetables as cash crop.

### Agro ecosystem role

Home garden plays an important role for agro ecosystem service mainly through providing raw material. The respondents confirm that the amount of compost produced varies due to raw material (weed, grass and tree leave) availability within the homegardens. From the semi structured interview 95% of respondents (n=76) confirm that fertility status of soil stays up to minimum of three years and maximum of four years. The respondents also responded that the homegardens, in addition to soil moisture conservation it's also provide fuel wood source which interns lead to less farm crop residual biomass removal also less dependence on animal dung for fuel. The mentioned importance's in FGD leads to the decrease in the investments of money for inorganic fertilizer.

As observed, the impacts of demography on the agro-ecosystem were high because in most villages numbers of the family size is large. Repeated cultivation of land exhausts mineral and other important materials from the soil and requests the farmers for extra money to buy inorganic fertilizer. This decreases the family income from garden product and also trampling effects of the family on growing garden crops. In study area, about 81% of the farers use animal manure and 19% use compost prepared from plant residues and other use chemical fertilizers.

The study reveals that fertility of garden is higher in home garden than main farm yard. The fertility of the lands were described with their productivity rate that the productivity of the home garden is much better than that of the farm land. According to the information from the questionnaire home garden are much fertile due to their nearness to the home where animal manures are damped and this garden were easily conserved than main farm yard.

### Socio-economic role

As described by respondents in FGD, homegardens have wide socio economic roles, which includes production of food (both for consumption and for income generation), medicinal plants, and source for fire wood, fodder production and service as compost production. The farmers use both hired labors and family labors in their home garden and they use selected seed of different crop species that tolerate climate variability. Only few farmers use chemical fertilizers and most of the farmers use animal dung as result, the income generate is high as roughly calculated with their expenses

The income of homegarden owners is determined by different factors. The regression analysis made to identify determination of annual income showed that income from home garden and numbers of species in the home garden have strong correlation with annual income at  $P < 0.05$  (Table 5). This implies that the income is more dependent on home garden vegetation composition.

**Table 5.** t value of respondents

Determinants	Coefficient	Std dev.	t-ratio	Probability
Constant	1427.37	2908.63	-0.993	0.323
Education level	185.33	1.06	0.954	0.342
HG income	0.19	12529.57	11.92	0.000**
No. of spp in HH	87.52	6.04	2.548	0.012**
Number of cattle	31.03	2.26	0.343	0.732
Farm size	253.87	0.84	1.075	0.285
Family size	16.3	2.43	0.218	0.827
Age	20.69	8.63	0.905	0.367

$R^2=32\%$ , \*\*significant at 5% (0.05)

## **Social role of homegardens**

Number of respondents in FGD and semi structured interview confirms that having homegarden strength neighbors and family relationship. Household gave some home garden products like fruit, vegetable and chat to their relatives and neighbors at different ceremony. This increases social relationship and sharing of different working experience create positive relationship within the society that will help in sharing indigenous and other scientific knowledge.

## **DISCUSSION**

The practice of homegardening is serves as a source of social and economic benefit. In Haramaya district homegardens used as a source of income and as a means of generating good relationship with the neighborhood. The same result has been reported in Arifin et al. [4] in Zimbabwe homegardens user farmers. The practice of homegardening has been developed primarily in response to the needs for generating income and for fulfilling household food security. In Ethiopia most of the fruits, vegetables, and fuel wood come from the homesteads or marginal lands attached to or near homestead [12]. The same idea was reported in the study area that most of the source of the fuel wood, fruit and vegetable came from the homegardens. The dominant trees in the area also show similar trend as Asfaw and Woldu [12] study that the cash crops are mostly found in the homegardens than farm yards. In addition according to Asfaw and Woldu [12] the study estimated that 3 million ha of the homestead provided 80% of fruits and 85% of fuel wood to the urban and other society. Similarly the nearby community and homegarden owners' source of vegetables, cash crops and fruits are homegardens of this kebeles.

The land used for homegardens was small as compared to other areas in the country. According to Asfaw and Nigatu [13] survey of the homegardens, the homegardens in the other parts of the country is much bigger than the study area. Since the space limitation in the homestead is reflected in the land size of the homegardens, The T value of the study also indicates that the income is directly related to the homegardens size which is similarly indicated in the study by Asfaw and Nigatu [13]. Haramaya district homegardens are the source of fuel woods and other sources. The homegardens were also an important source of fuel wood, particularly for poor households, supplying from 40% to 80% of the rural need [14]. In a similar manner these homegardens are the sources fuel wood for the local community and the nearby urban dweller. Traditional homegarden has many desirable characteristics which is indicated in Tynsong and Tiwari [15]'s work which is in line with the study result. According to Tynsong and Tiwari [15] and Regeena [17] homegardens strengthen the social bond in a society through sharing knowledge and ideas. In the study area the same idea was reflected during FGD and key informant interview about the use of homegarden for the local community.

## **CONCLUSION**

Homegarden enhances livelihood of the local people by providing socio-economic, agro ecosystem and agro ecological roles. Advantage of homegarden to socio economic development of society was clearly seen from the results. In addition the immediate income is generated from the homegardens. The improvement of the homegarden intern helps the urban dweller and the local community to have quality of livelihood. The contribution of homegarden for the production of different resources food, fuel wood, medicinal plant and stimulant plants is high. The states of homegarden is at alarming rate, are at the verge of extinction in most of the areas the homegarden are turning to be mono-cropping, chat dominated homegardens due to high pricing of chat.

The government and non-government organization should work jointly with local farmers in changing the production of items by using management technology of horticulture and agro forestry under multi-storied cropping system. If the family size keep looking like this homegarden will be vanished so family planning has to be practiced. Different trainings and demonstrations are mandatory to keep the homegardening practice in the villages. So the University and other stakeholders has to work together to achieve this goal.

## **DECLARATIONS**

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### **Authors' Contributions**

The author made most of the research work by itself and for collection students were participated.

### **Competing interests**

The authors declare that they have no competing interests.

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