Role and Problems of Coffee and Enset Dominant Home gardens for Enhanced Livelihood and Food Security in Dilla District, Southern Ethiopia

Melese Mengistu[1]* and Daniel Fitamo[2]

[1]School of Plant Sciences, Haramaya University, Ethiopia
[2]Biology Department, Hawassa University, Ethiopia

Abstract: Home gardens are one of the most complex and diverse agroforestry systems in Gedeo, southern Ethiopia and it has played an important role in the improvement of livelihood and food security of households. The study was conducted with the objective of investigating the role and problems of Coffee (*Coffea arabica* L) and Enset *(Ensete ventricosum (Welw.) Cheesman)* dominated home gardens for improved livelihoods and food security in the study area. A purposive random sampling method was used to obtain a study population of 120 households. Primary data were collected through structured and semi-structured interviews, questionnaires, and direct observations. Data were analyzed using descriptive statistics by generating frequency distribution and percentages. Pearson correlation analysis was used to determine relationships between household age, educational level, household family size, home garden, and food security indicators. The results revealed that out of a total 75 different plant species, 40% were food crops, 17.3% were cash crops, 13.3% were medicinal plants, 17.3% were plants used as live fence, 20% were plants used for construction and fuel, 10.6% were used for home made furniture and utensils, 4% were used as spices crops, 5.3% were stimulants, 10.6% were used as ornamentals and 20% were used as shade trees. It was found that about 36.2% of the household income was contributed by home gardening in the surveyed area. The Pearson correlation coefficient results have showed that home gardening was positively and significantly correlated with household food security with respect to the number of meals eaten per day (0.281 at $P < 0.01$), home garden crops owned (0.716 at $P < 0.01$) and heads of livestock owned (0.223 at $P < 0.05$). However, no significantly positive correlation was observed between home gardening and household educational level. From the result, it was concluded that majority of plant in home gardens were food crops and contributing for food security. Households, therefore, should be aware and encouraged to use technologies to improve their practice of home gardening to realize food security.

Keywords: Agroforesry; Ensete ventrocosum (Welw.) Cheesman; Coffea arabica L.; Food security; Home garden; Livelihood.

1. Introduction

Home gardens are one of the most complex and diverse agro ecosystems worldwide and have played an important role in the development of early agriculture and domestication of crops and fruit trees process (Abdoellah *et al*., 2006). Home gardens are commonly defined as a piece of land with a definite boundary surrounding a homestead, being cultivated with a diverse mixture of perennial and annual plant species, arranged in a multilayered vertical structure, often in combination with raising livestock, and managed mainly by household members for subsistence production (Vorgelegt, 2007). The role of home gardens in improving rural livelihoods is well appreciated and documented throughout the world (Fernandes and Nair, 1986; Soemarwoto, 1987; Nair, 2006; Allen, 1990; Musvoto and Campbell, 1995). They were ancient forms of agriculture, and with the current issues of growing population, scarce resources and food crises, home gardens can provide many people with improved livelihoods (Chris, 2011). Plants grown in home gardens and agricultural fields provide rural families with income, nutritious food for humans feed for animas, etc. This helps communities to achieve food self-sufficiency (Ndaeyo, 2007). Moreover, crop plants, tree, and tree products from home gardens play an important role in the household food security, as it is a sustainable source of food, fruits, and vegetables (Uddin and Mukul, 2004).

Extensive areas of traditional agroforestry home gardens exist in the south and southwestern parts of Ethiopia (Bashir Jama *et al.,* 2006). Most of these gardens are located at altitudes of 1500-1300 meters above sea level where moisture and temperature are favorable for agriculture (Tadesse Kippie, 2002). Zerihun Kebebew *et al.* (2011) found that smallholder farmers appreciated the significance of their home gardens for attaining food security and about 96.9% of the households agreed on the impact of home garden on improving their livelihood. Gedeo 'agroforests' are among ensete - coffee based systems in Ethiopia. The enset-coffee home gardens have been stable agricultural systems for centuries, supporting very dense populations of up to 500 persons per square kilometer (Tadesse Kippie, 2002). However, the contributions of these enset-coffee based home gardens for food security, at household levels have not yet been investigated in the study area. Therefore, this study was conducted to elucidate the roles coffee and enset

*Corresponding Author. E-mail: melese43@yahoo.com

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dominant home gardens play in the livelihoods of smallholder famers and the problem the system faces in the study area.

2. Materials and Methodology

2.1. Description of the Study Area

The study was conducted in Dilla Zuriya district, which is one of the six districts in the Gedeo Zone, Sothern Nations Nationalities and People's Regional State (SNNPRS), Ethiopia. The district has a total area of 12764 hectares and it is geographically located between 5°84"−6°43" North latitude and 38°08"-38°44" East longitude. It is located at the distance of 359 km south of Addis Ababa and 90km from the regional, Hawassa. It is bordered by Sidama zone in the north, Oromiya Regional State in the South and Northeast, and Wonago district of the Gedeo Zone in the south.

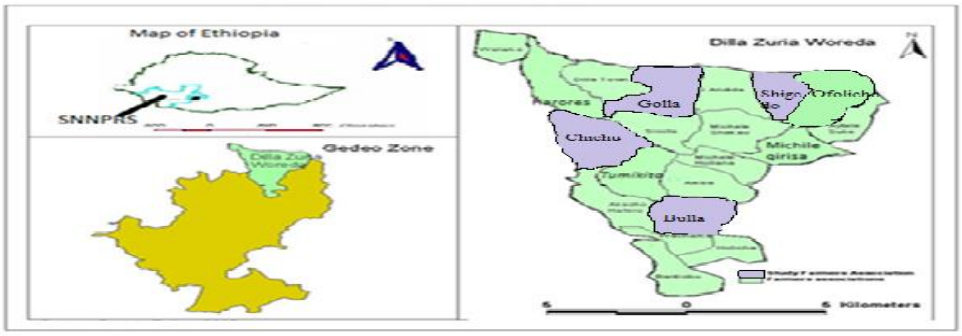

Figure 1. The map of study area.

2.2. Climate

Dilla Zuriya district ranges from 1350 to 2600 meters above sea level. Regarding the agro-climatic zones, the district is predominantly *Woynadega* (70%) while *Dega* and *Kola* constitute 23 and 7.0% of the total area of the district, in that order. The mean annual temperature of the discrict ranges between 18-27°C and the mean annual rainfall ranges between 1400−1800 mm (DZWAoRDP, 2011).

2.3. Population

The Gedeo Zone is the most densely populated area in Ethiopia and the second most densely populated region in Africa. Thus, Dilla district has an approximate population density of 579.5 inhabitants per kilometer square (PHEEC, 2010). The 2007 census conducted by the Central Statistical Agency of Ethiopia revealed that the Woreda has a total population of 98,439, of whom 49,413 are men and 49,026 are women with a population growth rate of 2.9%. A total of about 20,436 households inhabit the district according to the agricultural office of the district. The average landholding size of each household is about 0.5 hectares (DZWAoRDP, 2011).

2.4. Data Collection and Measurement

This study was conducted between January and August 2012. From a total of 17 Kebeles in the study area, only four Kebeles (Golla, Chichu, Bulla and Shigedo) were selected purposely. The choice of the Kebeles was based on their proximity to the capital of Gedeo Zone, Dilla, and the type of home garden practices, in which enset or coffee crop is dominant. Accordingly, the two Kebeles, Chichu and Golla, are relatively near the capital of Gedeo Zone, Dilla, and are only about 0.5 and 1.5km away from it, respectively, whereas Bulla and Shigedo are located at the distances of 13.5 km and 15 km away from the town. Similarly, the home garden types of Chichu and Golla are coffee dominated whereas that of Bulla and Shigedo is enset dominated.

2.5. Interview and Survey

Various tools of data collection methods were employed to gather data. Primary data were collected through structured and semi-structured interviews and direct observation. In the structured interview the selected informants were asked to categorically list plant species in their home gardens by vernacular names that helped to characterize variation in gardening knowledge and production practices among the owners of the home gardens.

In the semi-structured interview, all interviewees were asked the same standard questions in Amharic using open- and close-ended questionnaires. The questionnaire consisted of four parts. The first part contained socioeconomic characteristic like age, gender, and educational background of the selected household member of the home garden owners. The second part contained questions related to home garden function: for what purpose people in the study area use home gardens (household food supply, income generation, medicine, construction or building, shade and ornamentation, fuel wood production etc). The third part consisted of questions related to food security and livelihood systems. The forth part of the questionnaire was concerned with income survey and constrains that affect home garden productivity.

Household Survey

Income survey*:* Information on household income from the home gardens was obtained by asking the respondents, how much income he/she earned from sale of home garden produces in the previous year. This enabled to calculate the proportion of total income earned from the home gardens. Net annual income of sampled households from the home gardens, farmland, and off-farm activities was also determined in order to compute the percentage contribution of the home gardens to household annual income.

Food security status*:* The household food security status presented in this study are based on a measure of food security determined from responses given by respondents to a series of questions about conditions known to characterize households having difficulty meeting basic food needs. Each households were asked about whether insecurity condition has occurred at any time during the previous 12 months and required specifying any lack of food availability or money to obtain food. Using standard scoring methods, households were placed into 2 categories: food secure or food insecure as indicated by Nord *et al.* (2009). In addition, households were asked to recall their number of meal per day in previous three days prior to the interview. The amounts of food obtained from their home garden in the daily consumption were also estimated. The households that have three and more meals per day and obtain greater than 20% for daily meal from their home gardens were considered as food secure whereas those who have meals less than three meals in a day and obtain less than 20% from their home gardens as food insecure.

Market survey: In addition to vegetation data collection in home gardens, a market survey was also conducted to record varieties and amounts of food and other plant products that have market values in the local market in the study area by interacting with producers, sellers and consumers.

2.6. Data Analysis

The data were analyzed using SPSS (Statistical Package for Social Sciences) version 16 (SPSS Inc., 2007). Descriptive statistics were used to generate frequency distribution and percentages. Pearson Correlation coefficients were used to determine the relationship between household age, educational level, household family size, home garden and food security indicators. Households were also asked to recall socioeconomic factors that hinder their garden productivity.

3. Results and Discussion

3.1. Household Characteristics

The study revealed that the average age of the respondents was 47.7 with minimum of 31.0 and a maximum of 75. The age of the majority of the respondents (53.3%) fall between 40 to 60 years while the age of 34.2% and 12.5% of the respondents were between 25 and 40 and above 60 years, in that order. Out of the 120 surveyed households, 15% were female-headed whereas the reaming ones were male-headed. The average family size in the study Kebeles was 6.76 persons per household with a range of 2.0-13 persons. The total land size of each household consists of the farmland and home garden. Of the 120 households, 75% have farm size ranging between 0.5 - 1.0 hectare.

3.2. Plants in the Home Gardens and their Utility

In the present study, twenty-four plants with high value to meet household food consumption and income were identified from a total of 75 species based on farmers' opinions (Table 1).

Table 1. Highly valuable plant species, their frequency distribution and purpose of production.

Plants Species	Frequency (N=120)	Percentage	Purpose of Production (%)		
			Consumption	Sale	Both
Allium cepa L	33	27.5	83.4	4.4	12.2
Annona reticulata	61	50.8	43.5	51.2	5.3
Brassica carinata Braun	120	100	92.6	0.0	7.4
Brassica oleracaea L	41	34.2	41.9	3.3	54.8
Capsium frutescens L	54	45	89.3	2.5	8.2
Carica papaya L	69	57.5	34.7	26.2	39.1
Coffea arabica L	120	100	-	98.9	1.1
Collocasia esculenta (L) Schott	120	100	99.3	-	0.7
Cucuribiata pepo L	85	70.8	100	-	-
Dioscorea alata L	120	100	97.8	-	2.2
Ensete ventricosum (Welw.) Cheesman	120	100	98.1	-	1.9
Ipomoea batatas (L) Lam	58	48.3	91.5	0.7	7.8
Mangifera indica L	78	65	23.8	47.7	28.5
Manihot esculenta Crantz	54	45	63.2	13.5	23.3
Musa paradisiacal L	115	95.8	19.1	13.5	67.4
Persea americana Mill	88	73.3	32.6	11.3	55.1
Phaseolus lunatus L	93	77.5	88.2	9.4	2.4
Phaseolus vulgaris L	107	89.2	89.6	4.2	6.2
Pitcairnia feliciana (Chev.)	47	39.2	21.8	67.5	10.7
Psidium guajava L	43	35.8	39.3	48.3	12.4
Saccharum officinarum L	52	43.3	12.1	73.4	14.5
Solanium americanum Mill	36	30	52.0	17.3	30.7
Sorghum bicolor (L.) Moench	44	36.7	93.6	1.4	5.0
Zea mays L	105	87.5	94.4	4.3	1.3

Note: Frequency of occurrence does not imply abundance. It is used here as a potential indicator of importance to the farmer.

Enset *(Ensete ventricosum* (Welw.) Cheesman) was the main staple crop in the study district and 100% of the inventoried homegardens maintained this crucial food crop. Taro (*Collocasia esculenta)* is shade-tolerant and was found planted in the home gardens. It is mainly planted under enset, coffee and trees species. It does not compete for space and alleviates the problem of land shortage. From the total respondents, 100% were cultivating Taro in their home gardens during the study. The study revealed that 99.3% of the sampled households produced Taro for household consumption whereas 0.7% produced it for both home consumption and sale. This shows that Taro is one of the important crop plants in the study area. Yem (*Dioscorea alata* L) is another root crop that has been produced across all home garden systems in the district. From the surveyed sample households, 100% of them grew *yem* in their home garden and 97.8% of them used it as food. The remaining 2.2% produced the crop for both home consumption and sale.

Banana is one of the major plant components in the home gardens in the agroforestry system in the study area. Of the 120 households, 19.1% grew banana for home consumption, 13.5% for earning income and 67.4% for both home consumption and income generation.

Mango is one of the dominant fruit trees in the surveyed home gardens, particularly in two sites (Golla and Chichu). From the total respondents, 23.8% produced mango for home consumption, 47.7% for sale in nearby markets and 28.5% produced the crop for both home consumption and income generation.

Coffee is the major source of income for the households in the study area. All the 120 (100%) of the surveyed home garden households possessed coffee shrubs in large numbers indicating that it is an essential cash crop for them. The main purpose of its production is for income generation (98.9%) and 1.1% households produced the crop for both income and home consumption. None of the respondent cultivated coffee only for home consumption purpose.

The home garden plants observed in the home gardens were kept for both food and non-food purposes. However, the proportions of the food plants in the home gardens were much higher than the proportion of non-food plants. The food plants of the home gardens included fruits, roots/tuber/bulb, vegetables, cereals, spices, and pulses.

Table 2. Uses and species composition of home garden plants in the study area.

Plant use types			
Food plants	No. of Species (%)	Non-food plants	No. of Species (%)
Fruits	16 (21.3)	Income	13 (17.3)
Root/tuber/bulbs	7 (9.1)	Medicinal	10 (13.3)
Vegetables	11 (14.7)	Ornamental	8 (10.6)
Cereals	2 (2.7)	Building/fuel	15 (20)
Spices	3 (4)	Stimulants	4 (3.3)
Pulses	1 (1.3)	Shade	15 (20)

The study revealed that fruits accounted for 21.3% of the total plant species in the home gardens followed by vegetables (14.7%), root/tuber/bulb crops (9.1%), spices (4%), cereals (2.7%) and pulses (1.3%) species in the food plant groups. In non-food groups, plants that are indirectly used to fill food shortage gaps that are used for construction/fuel and shade share the largest part (20%). These were followed by cash crops (17.5%), medicinal plants (13.3%), ornamental plants (10.6%), and stimulants (3.3%).

Different parts of the food plants are processed for use as food. Fruit, root/tuber/bulb crops, leaves, stems, seeds and flowers are the parts of the plant that are used for food from the home garden crops.

The study revealed that 16 or 53.4 % of the plant species were fruits, which were utilized as food in the home gardens followed by root/tuber/bulb food plant species (23.3%). The root/tuber/bulb food crops comprised 7 food plant species that accounted for 23.3% of the total food plant species (Figure 1). The major crops in this category were Enset (*Ensete ventricosum*), Yem (*Dioscorea alata*), taro (*Colocasia esculenta*) and Sweet potato (*Ipomoea batata*). Those root crops were mainly grown for household consumption. Crops that their seeds are utilized as food source accounts 10% and most of them are cereals and pulses (*Zea mays*, *Sorghum bicolor* and *Phaseolus lunatus*). Leaves of two crop plants are used as food (10%). These are *Brassica carinata* and *Brassica oleracaea*. Stem of one plant species (*Saccharum officinarum*) was used for food (3.3%).

3.3. Income Generated from Home Gardens and Livelihood Improvement

3.3.1. Home garden crops with market value

Home gardens serve as a reserve bank for food and cash for farmers. The households subjected to the study give priorities to 13 cash crops for their financial needs (Table 2).

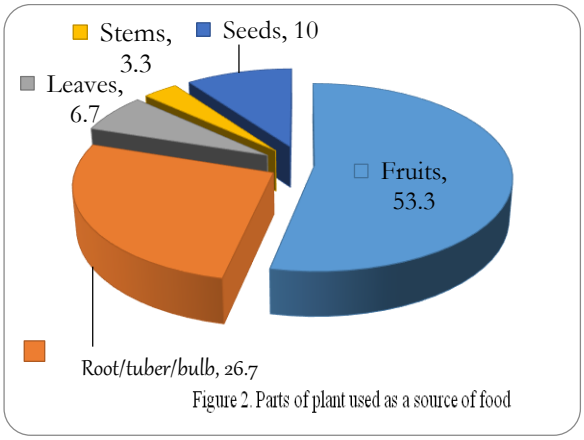

Figure 2. Parts of plant used as a source of food

Table 3. Income generated from crops produced in the home gardens of the study area.

Homegarden Crops	Chichu	Golla	Bulla	Shigedo	Total	%
Coffee	37,792	41,265	31,379	34,746	145,182	57.5
Fruits	14,147	15,824	2,679	3,964	36,614	14.5
Root and tuber crops	4,721	3,518	2,838	3,483	14,560	5.8
Leafy vegetables	2,136	2,871	2,246	1,321	8,574	3.4
Trees	11,743	17,277	6,165	8,392	43,577	17.3
Animals	1,061	945	893	994	3893	1.5
Total	71,600	81,700	46,200	52,900	252,400	100

Coffee (Coffea arabica) is the main cash crop in all study Kebeles. 57.5% of the annual income derived from home gardens came from this crop. The highest income from coffee was obtained in Golla. The reason for this was that a number of households at Golla had larger sized home gardens planted to coffee than the other sites. Trees accounted for 17.3% of the total income followed by fruits (14.4%). The tree plant species that were used for income generation included *Eucalyptus comaldulesis*, *Eucalyptus globulas, Cordia africana*, *Croton macrostachys, Juniperus procera* and *Millettia ferruginea*. Fruit crops, namely, mango (*Mangifora indica)*, avocado (*Persea americana)*, banana (*Musa paradisiacal)*, guava (*Psidium guajava)*, cherimoya (*Ananas comosus)*, Casmir (*Casamiria edulis)* and papaya (*Carica papaya)* are the major income sources in the study area. Root or tuber crops and vegetables sold in local markets as sources of income comprises 5.8% and 3.4%, respectively. Livestock or livestock products add only 1.5% to the total income from home gardens. In two of the study sites, Chichu and Golla, the market access enabled farmers to produce more cash crops like *Mangifora indica*, *Persea amercania*, *Musa paradisiaca* and pineapple (*Annanas comosa)* for sale. These home garden products are sold fresh. It was observed that farmers who have medium sized home gardens intensively cultivated different crops. Giving priority to a few profitable cash crops might be the reason for getting more income from their home gardens.

3.3.2. Contribution of home gardens to household income

Household benefits from home gardens are not confined to obtaining food. In many cases, sale of crops produced in home gardens significantly add an extra income to improve the households' financial status. Home gardens are cost effective since they are managed by all household members. The average annual costs of running home gardens from four assessed Kebeles are illustrated in the Table 4 below.

Table 4. Annual expenditures in running home gardens of four study Kebeles in Dilla district in 2013.

Cost	Chichu	Golla	Bulla	Shigedo	Total	Average
Management cost	875	747	566	639	2827	23.56
Transport cost	629	693	993	877	3192	27.43
Seed/seedling	1932	1688	1273	1491	6384	53.2
Household labor cost	3904	4072	2162	2833	12977	108.14
Total	7340	7200	5000	5840	25380	211.5
Average	244.6	240	166.6	194.6		

Note: Household labor cost: time spent in home garden converted into price (8hr/day=40ET Birr). This is equivalent to 1hr = 5 ET Birr during the study.

The total average costs spent by the households in each study Kebeles for management, transport of home garden product to the market, buying of seeds or seedlings and labor cost in the home gardens was found to be 211.5ET Birr (Table 4). This shows that home gardens were cost effective. The entire family members were involved in its management and there were no money spent for applying inorganic fertilizers.

Table 5. Average income generated from home garden, farmland and off farm of the study Kebeles.

Types of homegarden	Study Kebeles	No.	Source of income	Total	Average	%
Coffee based			HG	71600	2386.7	36.05
	Chichu	30	Farmland	122300	4076.7	61.57
			Off farm	4731	157.7	2.38
			HG	75500	2723.3	36.75
	Golla	30	Farmland	136700	4556.7	61.5
			Off farm	3893	129.8	1.75
Enset based			HG	52900	1763.3	34.07
	Shigedo	30	Farmland	99350	3311.7	63.98
			Off farm	3024	100.8	1.95
			HG	75000	1540.0	31.20
	Bulla	30	Farmland	99100	3303.3	66.92
			Off farm	2786	92.9	1.88

The household may sell products produced in the home garden, including coffee, fruits, vegetables, animal products and other valuable materials such as fuel wood in the local markets. The most important plant species found in the home gardens that contributed to the household income were *Coffea arabica, Mangifera indica*, *Persea americana* and *Musa paradisiaca.* Of these, the main income source in the study area is Coffee (*Coffea arabica)*

because 98.9% of the interviewed households cultivate it as a cash income (Table 1).

The average incomes from enset dominant home gardens in Shigedo and Bulla were 1763.3 and 1540 ET Birr, respectively. The cost to the home garden averages 194.67 ET Birr. The average farmland income in Shigado Kebele was 3311.7 ET Birr (63.98%). Similarly, the average incomes obtained from coffee dominant home garden in Chichu and Golla were 2386.7 (36.05%), and 2723.3 (36.75%), respectively. The result revealed that the average income in enset based home garden (Shigedo and Bulla) is lower than that of coffee based home gardens (Chichu and Golla). The possible reason for this was the decrease in fruit crop diversity in Shigedo and Bulla sites since they have higher elevation, 2048m and 2132m, respectively. These home gardens are dominantly occupied by enset crop which is staple food source for the family rather than income. There is also variation in cost in home garden and income from farmland. In Shigedo, the average cost is 194.67 ET Birr, in Bulla it is 166.7 ET Birr. However, in Chichu, it is 244.67 ET Birr and in Golla it is 240 ET Birr. The farmland average income in Shigedo, Bulla, Chichu and Golla are 3311.7, 3303.3, 4076.7 and 4556.7 ET Birr, respectively (Table 5). The off-farm average was higher in Chichu than the other three Kebeles since it is more close to the capital city of the Zone, Dilla that many households earn income from many activities like wage labor, small businesses etc. The increasing access to the market has gradually created more opportunities for off farm activities and intensification of cropping pattern to produce more marketable livestock products.

The total average income of the surveyed household from the home garden was 2103.3 ET Birr. The costs to the garden averages 211.5 ET Birr and income from farmland accounts an average of 3812.1 ET Birr.

Table 6. Annual total average income, expenditure, net average and total percent of the study area.

Income Source	Average income	Average expenditure (cost)	Net average income	% total income
Homegarden	2103.3	211.5	1891.8	36.2
Farmland	3812.1	478.8	3333.3	63.7
Off-farm Business	117.3	111.3	6.0	0.1
Total	6032.7	801.6	5231.1	100

The net total income from the home garden the study area was 1891.8 ET Birr. It was calculated by subtracting the total cost in to the home garden from the total average income obtained. The study showed that the total percentage of the income derived from home garden in the study site was 36.2%. The finding agrees with Maria *et al.* (2008) who reported that home gardens generate a monetary contribution that can be significant for domestic economies. This contribution oscillates from 10 to 100% and in Nicaragua, it represents from 10 to 100% with the average being 35%. In addition, Mendez (2000) in Honduras reported that the contribution of home garden varies between 10 and 26%. Beside the home garden and farmland income, small and marginal households access seasonal off farm employment opportunities in the form of labor. About 0.1% of the total household income is derived from off-farm employment opportunities (Table 6) mainly from business trade and labor. The income generated is used to maintain or improve living conditions especially to purchase household materials, crop seed, cover health, education and clothing costs.

3.3.3. The significance of home gardens to livelihood

Agriculture was the major livelihood strategy in the study site. This is followed by non-agricultural sources of income including wage labor and small amount of commerce (0.1%). Home gardens were one of the agricultural systems. Within home gardens, crop-based livelihood activities were diversified but depended mainly on root/tuber, cash crops, fruits and small amount on livestock. Food crops supply food for family and fruits and vegetables provides nutrient essential for the health condition. Cash crop, *Coffea arabica* , production was the major source of income for livelihood improvement in most visited households, perhaps because coffee were the major source of cash for people at these sites. In addition, home gardens provide tree plant species that are used to construct houses and produce materials utilized in home. Furniture like tables, beds, chairs and doors are mainly made from *Cordia africana.* Others, 15 plant species (20%) are used as firewood. Trees and shrubs are very important components of home gardens, as they play multiple roles in the systems.

3.3.4. The Importance of home gardens to food security

Home gardens maintain the diverse mixtures of crops that are harvested at different times, and thus constant supply of food in some form or the other is available from these home gardens at all times of the year.

Table 7. Food security status of the study area.

Variables of food security study	Food Secure	No.	Food insecure	No.
Shortage of food in the last12-month	1-2months	23	3-5 months	17
Number of meal/day in 3days	3 meals/day	19	2 meal/days	21
Yearly income from HG	>3000ET Birr	14	< 3000ET Birr	9
Home garden supply to daily meal	>20%	11	< 20%	6
Total number (120); No. (%)		67 (55.8)		53 (44.2)

The result revealed that 55.8% households were food secured while 44.2% were food insecure. From the food secured households, 34.44% were faced only 1-2 month of food shortage in 12 months prior to this study (Feb. 2011 to Feb. 2012) and 28.38% households had three meals per day. The percentage of the home garden supply to the daily consumption of household varied from 0-20% to 41-60%. Of the total surveyed households in the food secure group, 16.4% indicated that their home garden supplied more than 20% of their daily meal and 20.9% obtained more than 3000 ET Birr from their home gardens annually. The 44.2% of the households of the study area faced food shortage in different times of the year (Table 7) and regarded as food insecure. In this category, 25.4% households faced insufficient availability of food for three to five months within the last 12 months prior to the interview and 31.34% households ate two times per day in last three days prior to the interview. Similarly, in food secure category, majority of the households (84.2%) obtain greater amount of food for family consumption from home garden and 15.8% purchase from nearby market. For the food secured households, their home gardens were largely occupied by *Ensete ventricosm*, which is found at different stage (mature, medium and seedling stages) that can be harvested for household consumption.

To determine the significance of home garden in the households' food security, the Pearson correlation coefficient was computed between household age, educational level, household family size, home garden and food security indicators (Table 8).

Table 8. Pearson correlation coefficient between household characteristics by study factors (*N = 120*).

Correlation	Educational level	Family size	Home garden size	No. of meals per day	No. of livestock	Home garden crops
Household age	-.417**	.068	.378**	.219*	.174	.215*
Household education level		.249**	-.073	.087	-.058	.013
Family size			.118	.104	.097	.138
Home garden size				.281**	.223*	.716**
No. of meals per day					.208*	.265**
No. of livestock						.244**

*Note: ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).*

Results of the Pearson Correlation Coefficient in Table 14 showed that the household age and educational level exhibited highly significant negative correlation at ($p < 0.01$). This reveals that as the age of household increase the educational level decreases. Such relationship could be due to the general condition in the rural area where individuals often dropout of school shortly after few years of attending school. On the other hand, size had highly significant ($p < 0.01$) positive correspondence ($r = 0.378$) with the age of household. This indicates that households with increased age have large sized home gardens because of a corresponding change in size of land. The home garden sizes of young aged households were small because they have taken the farm land from their parents and the corresponding home garden size would be small. There was a significant correlation (0.219) between age of household and number of meals eaten daily ($p < 0.05$) and household age and home garden crops (0.215) at $p < 0.05$. This also shows that households with higher age possessed increased land size for home gardening and produce high yield which increases their daily meal. They can grow large number of food crops in their home gardens. The result revealed that there was no significant relation ($p > 0.05$) between household age, family size and number of livestock at 0.068 and 0.174, respectively. The household educational level and family size at 0.249 was highly significant ($p < 0.01$). However, results of the correlation between home garden size and household education was negative ($p > 0.05$) with a correlation of (-0.073), indicating that minimal changes in home garden size was because of increases in educational level. There was no significant association ($p > 0.05$) between educational level and the number of available home garden crops with a correlation of 0.013. Similarly, there was no significant relationship ($p > 0.05$) between family size and home garden size, number of meal per day, number of livestock and home garden crops with a correlation of 0.118, 0.104, 0.097 and 0.138, respectively. Home garden size was strongly and significantly correlated (0.281) with

the number of meal per day ($p < 0.01$) implying that higher number of meal was due to the large size of home garden that provide high food stock for the households. The correlation between the size of home garden and number of livestock at 0.223 was significant ($p < 0.05$). This shows that when the size of home garden increases it maintain high amount of fodder for livestock. Again, the correlation between the size of home garden and home garden crops was highly significant at 0.716 ($p < 0.01$). This tells that the change in home garden crops is due to the corresponding change in the size of home garden. There was a significant correlation (0.208) between the numbers of meals per day and the numbers of livestock ($p < 0.05$). The number of meals per day was also significantly correlated with the home garden crops at 0.265 ($p < 0.01$). Finally, there was highly significant correlation (0.224) between numbers of livestock and home garden crops ($p < 0.01$). This implies that increase in the number of livestock provides organic manure for the soil fertility that support high crop in the home garden.

3.3.5. Factors affecting diversity and productivity of home gardens

Main factors affecting the productivity and diversity of crops in home gardens of the study area as reported by respondents are size of the land (home garden), lack of access to water, weeds, pests and diseases, monkeys and availability of better seeds.

Table 9. Informant's response on factors affecting productivity of homegarden (*N = 120*).

Factors	Number of respondents No. (%)
Size of land	109 (90.8)
Water (weather)	63 (52.5)
Weeds	52 (43.3)
Disease and pests	88 (73.3)
Monkey/baboon	48 (40.0)
Availability of better seeds	73 (60.8)
Market access	43 (35.8)

Land or more specifically plot size is the major factor influencing productivity of home gardens. The result shows that 90.8% of the respondents said the size of land takes the biggest part in controlling the productivity of home gardens. This means that households with larger land size have large sized home gardens, cultivate more diversified crop species and produce more food. On the other hand, households with small land size have small sized home garden with few crop plants and producte less.

The availability of water or the lack of water is another constraint in growing home garden crops in the study area. According to the informants, a little over half (52.5%) of home gardens in the study area are primarily rain fed and home garden crop diversity highly decreases in the dry season due to lack of water. Particularly, plants at the lower layer like *Collocasia esculenta, Dioscorea alata and Brassica carinata* are less resistance to shortage of water and their production decreases in dry season. Shortage of water or rain also affects the productivity of coffee. During its flowering time, coffee needs much water. The second major factor, as indicated by 73.3% respondents, was diseases. Diseases mainly affect enset and banana crops and less frequently coffee. The diseases of these crops are locally known as 'Kollera'. The households have their own knowledge to manage these diseases; they remove as soon as the disease infects the plant. As told by 40% of the informants, wild animals especially apes destroy garden crops in two study sites, Bulla and Shigedo. They may feed on maize when it mature and destroy the others. Lack of better seed also reduces productivity of home gardens.

4. Conclusion

This study reveals that the home gardens of the study area ranges from 250 m^2 (small) to 2000 m^2 (large) with mean of 665.42 m^2. The home gardens display three vegetation layers making them typical agroforestry systems. Home gardening could result in tangible benefits for the household, including increased food for family consumption, extra income, and food reserves for emergencies and special occasions, enhanced traditional varieties and ultimately improve family food security and nutrition. Access to fresh homegrown vegetables, fruits and livestock not only ensures a more balanced diet for families with limited purchasing power, but also increases their self-reliance. Results of present study have shown that home gardening plays a role in household food security with respect to household age, size of home garden, number of meals per day, home garden crops and number of livestock but not with family size and household educational level.

Home gardens also have the potential to generate income. The economic gain from selling home garden products varied greatly depending on the size of the home garden, the needs of the household, and plant diversity. More than 36.2% of the household income was contributed by home gardening in surveyed area. However, the major problems associated with home gardening in the study area were insufficient land (home garden), lack of access to water, weeds, diseases, monkey and shortage of better seeds and seedlings. Home gardens are distinctive agricultural spaces, near to home, with significant potential in raising the food security, nutrition, and livelihood of the rural people. It was observed that home gardening could be an effective tool in enhancing the nutritional intake of the farmers, increasing household food supply through enhancing the food security. The promotion and improvement of home gardens requires special emphasis.

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