The Role of Homegarden Agroforestry in Household Livelihoods
(Studied at Yayo Coffee Forest Biosphere Reserve, Chova District, South Western Ethiopia)

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Abstract: Traditional homegardens in southwest Ethiopia is well-known land use practices playing an important role in livelihood aspects. Thus, the objective of this study was to examine the contribution of homegardens towards of local people livelihoods. A household interview data collection method was used. A systematic random sampling method was used to select 139 households. Descriptive statistics, one way ANOVA were used for analysis. Homegarden Agroforestry was more important for a food source, and contribute about 4079.70Birr annual income on average. This study suggests that homegardens contribute to the sustenance of the livelihoods of smallholder farmers in the study area.

Keywords: Yayo, Coffee Forest, Buffer Zone, Cash Crop, Food Security,

1. INTRODUCTION

Agroforestry is a dynamic land use practices that maintain overall farm productivity by combining herbaceous food crops with woody perennial and livestock on the same piece of land. Homegardens are among Agroforestry practices with the most complex and diverse agroecosystem that have been developed by numerous human cultures worldwide. They played an important role towards the development of early agriculture and domestication of crops. Homegardens often show a promising
option for biodiversity conservation and mitigation of ecosystem degradation. In some cases, they were found to be equally effective as natural forests in the conservation of tree species diversity (Abdoellah et al., 2006; Mohri et al., 2013; Jhariya et al., 2015).

The high diversity of species in homegardens, which combines crops, trees and animals have different uses and production cycles is considered as an essential component of sustainable agriculture because of the wide socioeconomic and ecological roles it plays in these systems. Studies carried out in homegardens of various regions have recorded notable richness of species and varieties that provide an additional food supply and cash income for the people. They have been playing essential socioeconomic and ecological role due to the fact that it is related to the production of food and other products such as the source of firewood, fodder, medicinal plants, cash crops, and ornamentals (Das and Das 2005; Bharucha and Pretty, 2010; Olango et al., 2014).

On the other hand, the ongoing land fragmentation and the declining farm size in rural Ethiopia have limited the livelihood choices and opportunities of most smallholder farmers. The expansion of cultivated area is likely to require further infrastructure development that would result in further negative environmental implications with huge loss of biological diversity. In order to adapt to such socioeconomic changes, subsistence-oriented Agroforestry homegardens are increasingly becoming more commercially oriented. This ongoing land use change has been carried out at the expense of diversity and stability of the long-existing farming practices important for sustainable livelihoods and food security (Gole et al., 2009; Seyoum et al., 2012; Mohri et al., 2013; Gebrehiwot et al., 2016).

In addition, reduction of forest resources and increasing demand for its products especially in areas where people rely on natural resources for their livelihood needs are common. Finding alternative options to this widened gap between the demand and supply of forest products for local livelihood sustenance coupled with the natural resources conservation goal attainment is a fundamental concern. Homegarden seems to have the potential to provide options for sustained rural livelihoods and biodiversity conservation. It integrates protected areas with the surrounding landscapes and mediates the livelihood need of people within the conservation goal of the protected area. Thus it provides a potential to reduce land-use pressure and improve rural livelihoods in human-dominated landscapes and at the same time conserving a large proportion of biodiversity (Jose, 2012).

Although extensive areas of traditional Agroforestry homegarden exist in southwestern Ethiopia, the locals' priorities to satisfy the immediate needs for food and cash under socioeconomic changes are being carried out at the expense of the diversity and stability of existing land use systems in the area (Abebe, 2005; Abebe et al., 2010).

Moreover, following the nomination of Yayo Coffee Forest Biosphere Reserve (YCFBR), as a site for biodiversity conservation in southwestern Ethiopia (Gole et al., 2009), the local people dependency on homegarden as an alternative option is increasing. However, less emphasis is given towards of assessing homegarden contribution towards of economic returns are not fully studied. According to Agbogidi and Adolor (2014), to determine how homegardens can best contribute to conservation, it is necessary to understand what diversity is being maintained by farmers. Hence, in order to strengthen homegarden products for locals need, scientific information is required. Local people livelihood sustenance; it documents the role of homegarden towards communities' livelihood, food security and income generation at the household level. Objective of the Study: To investigate

homegardens role to households livelihood. Research Questions: The study was aimed to address the following research question, and What is the role of homegarden to the households’ livelihood in the study area?

2. MATERIALS AND METHOD

2.1 Description of the Study Area

2.1.1 Yayo coffee biosphere reserve (YCFBR)

The study area YCFBR is located in the Oromia state, south-western Ethiopia, between 8°10’-8°39’ N and 35°30’-36°4’ E. The area was registered in 2011 by the UNESCO as the ‘Yayo Coffee Forest Biosphere Reserve’ for the in-situ conservation of wild Coffea arabica. It covers about 167,021ha split into six woreda, namely Algae Sachi, Bilo-Nopa, Chora, Doreni, Hurumu, and Yay (Gole et al., 2009). The area has a rolling topography where altitudes range from 1140 to 2562 m a.s.l., and is crossed by three major rivers, i.e., Geba, Dogi and Sese. The climate is hot and humid, and the mean annual temperature is around 20°C oscillating between the average extremes of 12°C and 29°C. The area exhibits a uni-modal rainfall pattern with mean annual precipitation of 2100 mm, with high disparity from year to year, and ranging from 1400to 3000 mm (Gole et al., 2008). Dominant soil groups include nitosols, acriosols, vertisols, and cambisols (Senbeta et al., 2005).The reserve is managed in zones, so that smallholder farmers can still use forest resources sustainably. The core zone encompasses 27,733 ha of undisturbed natural forest; the buffer zone 21,552 ha of mostly semi–coffee forest, where restricted use of forest resources is allowed (Schmitt et al., 2010). The research was conducted in the YCFBR areas (specifically in Hawayember, Sololo and Uta None kebeles of Chora district (Figure 1).
2.1.2 Population

In 2007, around 310,000 people lived in the six woreda (CSA, 2007). The Oromo ethnic group predominates and is considered indigenous. There are a significant number of Amhara, Tigreway and Kembata as they migrated from other parts of the country due to the government’s forced resettlement program of 1984 (Kassa et al., 2009). Orthodox christian, muslim, protestant and indigenous beliefs are evenly practiced (Tulu, 2010). Currently, the population of Yayo is booming due to the high birth rate, and the intense internal migration due mainly to the thriving infrastructural development (Tadesse, 2015), such as the construction of fertilizer and coal factories, a network of roads planned to ease the trade of coffee, and the forthcoming hydroelectric dam on the Geba River (Bacha, 2014).

2.1.3 Land use systems

The major land-use types are forest, agricultural land, wetland, and grazing land (Figure 2). Forests cover most of the area, and consist of four major variations, namely undisturbed natural forest, semi-forest coffee systems, fully managed forest for coffee production, and old secondary forests (Gole et al., 2009).

Figure 1: Map of the study area
2.1.4 Transitional zone of YCFBR and households livelihood

The transition area is found adjacent to the buffer zone and it is composed of agricultural land, wetland, grassland, settlement area and fragments of forest land and covers area of 117,736 ha. It is the place of residence for all the human population in the biosphere reserve, the development organizations and local institutions. Around 154,300 permanent residents live in the transition areas of the Biosphere, including urban and rural settlements of whom the majority depend on agriculture for their livelihoods. Most income for the livelihood of the population of the area comes from the transition area (UNESCO, 2010; Teketay et al., 2010).

The main livelihood source of the Yayo households is coffee-based agriculture, which employs over 90% of the active labour of the area (Assefa, 2010). Most coffee plots are small, however it is estimated that more than 60% of the population depends on coffee production and coffee-related activities, such as collection, processing and marketing (Gole, 2003; Ilfata, 2008). Besides coffee and the other cash crop khat, smallholders produce annual crops, such as Zea mays, sorghum (Sorghum bicolor), teff (Eragrostis teff), and other cereals and pulses.

Farmers in the transitional zone own and cultivate land and are free to use it as they like. Many of them also own patches of private coffee forest in the transitional zone and have been assigned patches in the buffer zone. The agricultural landscape of the transition zone includes some of the semi-forest coffee production areas, garden coffee, small coffee plantations, cropland, and grazing land. Even though the area has abundant resources, which can support the local livelihood and the quality of important products like coffee, honey and spices, it has a large potential for improvement, mainly due to lack of improved production and processing technologies. The transition part of YCFBR has a lot of spices and herbs flora; among Korarima (Aframomum korarima) spice ranks first and other spices such as chilies, ginger, turmeric, coriander, etc. are grown widely (Etissa et al., 2016).

The agricultural landscape of smallholder surrounding the forest area is also important for the conservation of cultivated many horticultural crop landraces. The smallholder farmers in the this area grow cereals, legumes, coffee, vegetables, fruits, root and tubers, spices and herbs and other crops.
together either as sole crop or in a combinations others in the homegardens with the shade trees (Tadesse et al., 2009) as cited in (Etissa et al., 2016).

YCFCBRarea is forest environment, its arabiaca species, and makes a meaningful contribution to the livelihoods of hundreds of smallholder farmers (Bharucha and Pretty, 2010). Also, according to Kuria et al. (2016), the farmers cultivate diverse crops in YCFCBR areas. They do not solely rely on one cereal but many households cultivate a mix of two to four different staple items such as maize, sorghum, millet, wheat, barley and teff (Eragrostis teff).

In addition they grow different pulses (beans, peas, and chickpeas), root and tuber crops (potato, sweet potato, beetroot, carrot, anchote and enset (Ensete venricosum), vegetables (hot/green pepper, tomato, pumpkin, Ethiopian kale, cabbage, Tarro, Abrango, onion and garlic), fruits (avocado, banana, mango, papaya, orange, lemon, and jackfruit) and a variety of spices (ginger, Ethiopian cardamom (Aframomum corrorima), and turmeric. The most important cash crops in the area are coffee and khat (Catha edulis); sugarcane and eucalyptus tree are also cultivated in the study area. Livestock and their products are also common commodities produced in the area. The main livestock includes: cows (milk production), bulls, sheep and goats, poultry and apiculture. Maize and coffee are the dominant commodities produced with the aim of consumption and market, respectively.

2.2 Homegardens in YCFCBR

The traditional Agroforestry systems in YCFCBR in south-western Ethiopia are among the most widespread and best performing Agroforestry practices, and support the livelihoods of the local population while maintaining environmental integrity (Assesfa, 2010; Sentra et al., 2013). Homegardens of transitional zone of YCFCBR encompass a mix of useful plants including staple crops like Enseteventricosum and Zea mays, tuber and root crops, e.g., anchote (Coccinia abyssinica), taro (Colocasia antiquorum), potato (Solanum tuberosum) and sweet potato (Ipomoea batatas), leafy and other vegetables, e.g., kale (Brassica oleracea) and hot pepper (Capsicum frutescens); exotic fruits, e.g., papaya (Carica papaya), mango (Mangifera indica) and avocado (Persea americana), and some pulses crops, e.g., haricot bean (Phaseolus vulgaris) and lima bean (Phaseolus lunatus) (Etissa et al., 2016; Jemal et al., 2018).

Species found in homegardens do not show a pre-determined spatial arrangement, with the exception of small plantations of Catha edulis. Rather, the location of individual plants and cohorts is random and conveniently determined by the farmer’s needs. For instance, spices are planted close to the homestead, or shade-loving crops under fruit trees. In addition, species density is also variable depending on the household and market demand, and generally tends to increase based on the farmers aim to introduce and test potential useful species gathered elsewhere (Jemal et al., 2018).

3. Methods

3.1 Study site selection

The study sites (Kebeles, the smallest administrative unit in Ethiopia) and the district was selected purposefully. Three Kebeles (Hawayember, Sololo and Uta None) were selected for this study. The selection was based on their inclusion in YCFCBR, and widespread practice of homegarden for the objective stated.
3.2 Sample size and sampling techniques

The sample size was determined using the method proposed by Yamane (1967).

\[
\frac{N}{1 + Ne^2} \approx \frac{48}{1 + 48(0.14)^2} = \frac{45}{1 + 45(0.14)^2} = \frac{46}{1 + 46(0.14)^2} \approx
\]

Where \( n \) is the sample size, \( N \) is the population size, and \( e \) is the desired level of precision.

\[
n = \frac{865}{1 + 865(0.14)^2} = \approx 48 \text{ Hawayember Kebele}
\]
\[
n = \frac{381}{1 + 381(0.14)^2} = \approx 45 \text{ Sololo Kebele}
\]
\[
N = \frac{447}{1 + 447(0.14)^2} = \approx 46 \text{ Sololo Kebele}
\]

Accordingly, a total of 139 households were determined and selected by systematic random sampling method from 1693 households list (of the three Kebeles) for an interview (Table 1 and Figure 2). The resulting sampling distribution of the study site by Kebeles is shown as in Table 1 below.

Table 1: Total population and sample used for the study

<table>
<thead>
<tr>
<th>Kebele</th>
<th>Total number of Households</th>
<th>Sample size per Kebele</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Hawayember</td>
<td>807</td>
<td>58</td>
</tr>
<tr>
<td>Sololo</td>
<td>333</td>
<td>48</td>
</tr>
<tr>
<td>Uta None</td>
<td>445</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>1585</td>
<td>128</td>
</tr>
</tbody>
</table>

3.3 Data collection methods

3.3.1 Household survey

Primary data were collected from the sample rural households using a semi-structured and structured questionnaire administered during October to December 2017. Prior to the actual administration of the general survey, the questionnaire was pre-tested, modified and refined. Data on homegarden contribution, with households demographic and socioeconomic (i.e. Age, family size, annual income, level of education, etc) were collected (Appendix 1-4). Household heads were interviewed to list their livelihood sources, products and their prices at the farm gate and/or local market at the time of selling to determine both total incomes and that obtained from homegarden components (Appendix 1 and 4).

Note: The income determination in this study was based on the one year (2016/2017) yield and its prices estimation including both products consumed at home and sold in the market for income generation (i.e. those products around homestead were termed as homegardens and outside homestead as other sources) (Appendix 1 and 4).

In addition to the household survey, focus group discussions (FGDs) and key informant interviews (Table 4) and field observation were undertaken. These methods were used to confirm the information given by an individual farmer and to catch important issues that were not raised by respondent farmers. Questions were asked in a structured conversational format (Appendix 5 and Appendix 6); allowing us to gather consistent data across gardens, while also learning about qualitative aspects of homegardens through farmers’ perspectives and insights (Coomes and Ban, 2004).
data were also collected from published and unpublished sources including information on the study area.

Table 2: Summary and descriptions of instruments

<table>
<thead>
<tr>
<th>No</th>
<th>Types of instruments</th>
<th>Target group</th>
<th>Number of target group representations</th>
<th>Types of sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Household survey</td>
<td>Selected household heads</td>
<td>139</td>
<td>Systematic random sampling</td>
</tr>
<tr>
<td>2</td>
<td>Key informants</td>
<td>Community leaders and experts, model farmers and members of the biosphere reserve management unit</td>
<td>15</td>
<td>Purposive sampling</td>
</tr>
<tr>
<td>3</td>
<td>FGD</td>
<td>Local community members</td>
<td>41</td>
<td>Purposive sampling</td>
</tr>
</tbody>
</table>

3.4 Data Analysis

Descriptive analysis through (percentage, frequency, mean, range, and standard deviation) and one way ANOVA were applied using IBM statistical package for social science SPSS version 20.0.

4. RESULTS AND DISCUSSION

4.1 Households characteristics

The average age of the respondents was 42.9 with a standard deviation of 7.23. The family size of the sampled households on average was six. The largest frequency in family size is seven family members per household, which was 27.8% of the sample households. The sampled household education level in the study area ranges from illiterate to complete secondary school. The total land size of each household mostly consists of the cropland, coffee plantation, and homegardens. The average farmland size was 1.6 hectare with the range of 0.5 to 3.5 hectare whereas about 56.5% of the households have farmland ranging from 1.5 to 2 hectare. Regarding the households annual income, the average household annual income is 31848.48 Birr. The size of homegarden in the study area ranges between 0.02 to 0.27 hectare, with the average of 0.14 hectare (Table 12), which is less than the mean homegarden size (0.185) reported by Linger (2014), for homegarden around Jabithenan District, Northwestern Ethiopia. About 29.3% homegarden area was 0.18 hectare, while about 85.8% was less than 0.2 hectare.

Table 3: Characteristics of sampled households, (n = 139)

<table>
<thead>
<tr>
<th>Household characteristics</th>
<th>Measuring system</th>
<th>Observed range</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Year</td>
<td>28-67</td>
<td>42.91</td>
<td>7.23</td>
</tr>
<tr>
<td>Total land size</td>
<td>Hectare</td>
<td>0.5-3.5</td>
<td>1.60</td>
<td>0.67</td>
</tr>
<tr>
<td>Homegarden land size</td>
<td>Hectare</td>
<td>0.02-0.27</td>
<td>0.14</td>
<td>0.07</td>
</tr>
<tr>
<td>Education</td>
<td>Year</td>
<td>0-10</td>
<td>3.5</td>
<td>2.78</td>
</tr>
<tr>
<td>Family size</td>
<td>Numbers</td>
<td>3-17</td>
<td>6.2</td>
<td>1.86</td>
</tr>
<tr>
<td>Annual income</td>
<td>Thousand</td>
<td>10-65</td>
<td>31535.96</td>
<td>10017.49</td>
</tr>
</tbody>
</table>

Source: Own data, Chora district, 2017
4.2 Major benefits of homegarden for households

About 86.5% of the respondents agreed that homegarden provides high food products for their family. Whereas about 21.8% of the respondents agreed that homegarden used for high income generating and 47.4% of the respondents said that homegarden had a medium potential for income generating (Figure 4). These perceptions of the gardeners could probably imply that food crops in homegardens of the study area had a significant role to enhance nutritional and income status of the local people. Thus, along with the ecological benefits, homegardens provide potential food security to the household. This result is agreed with Jemal et al. (2018), stating that homegarden, multistorey-coffee-system is mainly used to generate money and, for the majority of households, is the main, if not the only, source of cash. Most farmers use multipurpose-trees-on-farmlands to produce food, and homegarden is used for both a source of food and cash to supplement the other two practices. This result is agreed with Regassa (2016), reported that about 75% of the home gardeners explained that they conserve useful plant species for foods, around Hawassa, Ethiopia. Again, the result is also supported with the Mengistu and Fitamo (2016), in which they reported that diverse mixture of crops that are harvested at different times, and constant supply of food in a different form is available from homegardens.

The discussion held during the focus group discussion also supported that homegarden agroforestry used for a long period of food sustenance during the time of food shortage. They revealed that the canopy of the tree used as shade during high sunlight and warm weather. Although there is a shortage of land for homegarden, households get diverse products from such land as they cultivate it intensively. In general members of the group discussion household head respondents were agreed that homegarden practice contributes a lot and provide multiple benefits from a small unit of land (Figure 5). This result is in agreement with findings of Kassa et al. (2015), stated that the agroforestry practices contribute to the conservation of biodiversity, while providing multiple products and services, in Yem district southern Ethiopia.
4.3 Homegardens as a source of income

Homegarden annual income contribution for the households of the three Kebeles was not shown significant differences statistically, \( F_{136, 2} = 0.281; p=0.755 \). However, households in the study area generate income from different homegarden products. The homegardens contributions to household's annual income on average was about 13\% of the total annual income (table 12 and Table 13), among which Catha edulis and coffee arabica homegardens produce share the main role, while the rest household income/economic contributors are from food source plants, such as fruit, spices, root and tubers, and vegetables in the practice (Figure 3).

![Figure 3. Income generating food source components of homegarden (of the total recorded species)](image)

Concurrently, over 90\% of the respondents reported that coffee (which is mainly from coffee plantation site) is their greatest household financial source (i.e. total household annual income). Similarly, the discussion held during the focus group discussion also implies that villagers cultivate and maintain plants in their homegardens mainly for household consumption and surplus vegetables and fruits were sold in the nearby market for monetary benefits. The most marketed fruits and vegetables Persea americana, Mangifera indica, Musa sapientum, Lycopersicon esculentum, Brassica napus, and Brassica integrifolia. Similar findings were obtained by Jemal et al. (2018), Coffee forest production is mainly practices used to generate money for the majority of households, where homegarden is used as both a source of food and cash income generation for local community around Yayo, southwest Ethiopia.

The above finding is in agreement with the findings of Nischalke et al. (2017), reported Coffee is an important part of the cultural identity and the most important livelihood source for households around YCFBR. Similarly, the above finding is in agreement with the findings of Etissa et al. (2016), reported that many crops such as coffee, avocado, mango, banana, Enset, root and tubers, and many other crops grow in the sample homegardens of the households around YCFBR. The main structural arrangements in most homegardens are primarily coffee mixed with trees and shrubs, fruit trees or planted in strips, or planted as a boundary and fence, edges of plots and fields mainly for coffee shades,
and live fence. From these trees including fruit trees farmers get food, fodder for their livestock, fuel wood and other wood products and other uses such as a windbreak and shades.

However, the above findings are slightly different from the findings of Regassa (2016), who reported that 35% household's annual income contribution from homegardens around Hawassa, Southern Ethiopia. The difference might be due to the livelihood sources and lifestyles of society living in the two areas (Hawassa city and those of Chora rural villages), and finding of Gebrehiwot (2017), in the same area, reported that over 50% of the Sidama community generate their household financial income mainly from coffee. Similarly, Mbow et al. (2014), stated that homegardens enhance smallholder’s resilience by providing food for household consumption and to sell surplus food products to supply other needed items. Hence, this farming practice enhances and maintains human capital (health and education) for the rural community. It accomplishes this through continuous production and supply of food, nutrition, and financial income. According to Morse et al. (2009), livelihood outcomes include more stable income, increased human wellbeing, improved food security, and sustainability.

Table 4: Annual incomes from homegarden

<table>
<thead>
<tr>
<th>Level of income</th>
<th>Income in Ethiopian Birr per site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max income</td>
<td>17000.00 Birr</td>
</tr>
<tr>
<td>Min income</td>
<td>1200.00 Birr</td>
</tr>
<tr>
<td>Average income</td>
<td>4095.65 Birr</td>
</tr>
<tr>
<td>Average annual income</td>
<td>4079.70 Birr</td>
</tr>
</tbody>
</table>

Source: Household survey, Chora, 2017

5. Limitation of the Research
Even though this research was carefully prepared, I am still aware of its limitations and shortcomings. First of all, the research was conducted based the data collected for three months, which is not enough for the researcher to assess enough information on the homegarden role. It would be better if it was done in a longer time. Second, the population of the experimental group is small, only one hundred thirty nine households might not represent the majority of the households in the biosphere reserve. Third, since the questionnaire designed to measure the households’ annual income of one year. It might give useful information about the role of homegarden to local household livelihood; it seems not to provide enough evidence of the exact role played by homegarden.

6. Conclusions and Recommendation
6.1 Conclusions
Homegarden agroforestry practices in YCFBR plays a remarkable role in improving food and nutrition security for households residing in transitional (utilization zone) of the biosphere. The results of the study revealed that homegarden agroforestry practices in the present study area have been providing multiple benefits for the locals and playing significant contribution for the communities’ livelihood in the area. The society mainly dependent on diverse plants of different uses in the system.
for food sources of the family. However, more of the plant species were exotic species in their origin and concentration on few species in the garden were observed. Cultivation of cash crop production particularly, *coffee arabica* and *Catha edulis* in homegarden agroforestry practices are attracting more attention of the farming households with the objective of maximizing their cash benefit and concurrently to escape from increased wildlife damage to food crop components in the garden. These situations are happening at the expense of species diversity and bringing a reduction in food provision for poor rural households. Thus, local people livelihood sustenance has been affected. Yet, clear capacity exists to make a homegarden contribution more effective towards of livelihood improvement.

6.2 Recommendations

Based on the findings of this study, the following recommendations are suggested:

a. Attention should be given to make homegarden more effective in local people livelihood improvement.

b. Promotion of homegardens should be included in the programmes of conservation agency and others concerned bodies to enhance the livelihoods of rural poor.

c. Further study is recommended and needed to find available opportunities in supplying plant varieties of ecological and locals' needs.

7. References


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