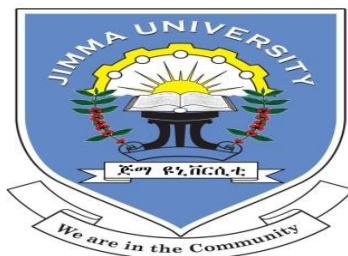


**JIMMA UNIVERSITY**  
**COLLEGE OF NATURAL SCIENCES**  
**DEPARTMENT OF BIOLOGY**



**Ethnobotanical study of homegarden plants in Woliso District, Oromia  
Region, Ethiopia**

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**Research submitted to Biology Department, College of Natural  
Sciences, Jimma University for partial fulfillment of the requirement of  
M.Sc Degree in Biology**

**September, 2017**

**Jimma, Ethiopia**

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## Abstract

*This study was conducted to assess the uses, distribution, diversity and management of homegarden plants in Woliso District. For Ethnobotanical data collection, 40 homegardens were systematically selected from five kebeles. The ethnobotanical data were collected by using observation of homegardens and semi-structured interviews. The collected data were analyzed by using percentage and ranking the frequently observed plant species in the sampled area. Overall, 123 plant species, belong to 106 genera and 56 families were collected. Functionally they used as food, medicine, live fence, spice, timber production, construction, forage for livestock's, stimulant, ecological benefits and protection as well as a shade for human and other animals. Among 123 plant species identified from homegardens of the study area, 58 (47.15%) species were herbs, 37 (30.08%) were shrubs, 24 (19.51%) were trees and 4 (3.25%) were climbers. Additionally from total identified homegarden plant species in the study area, food plant species account for 30.08% where as non-food plant species account for 69.92%. *Ensete ventricosum* and *Catha edulis* were the most popular and abundant plant species widely used for food and stimulant respectively. Medicinal plants ranked second next to food plant species of the homegardens of the study area. The result of the study indicated homegardens are important for improving food security, agricultural support, size of gardens, application of scientific with indigenous knowledge of management of homegarden plants. The result also indicated as the study is important to improve ecological and environmental benefits of homegarden plants in relation to enhance biodiversity of the homegarden in the study area.*

**Key words/phrases:** Homegarden, indigenous knowledge, plant species distribution,

Plant species diversity, use groups

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# **1.Introduction**

## **1.1 Background of the study**

Ethnobotany is a key science for working with local people on the botanical aspects of conservation and development. Ethnobotany remains the leading tool in finding how people traditionally used plants (Martin, 1995; Balick and Cox, 1996). An Ethnobotanical research is very crucial for a country like Ethiopia where local people depend on local plant resources for their livelihoods. Many of the authors (like Martin, 1995; Posey, 1999) reported as modernization is dominating the lifestyle of traditional societies that resulting in cultural and environmental changes. Traditional knowledge is the information that people in a given community have developed, based on experience and adaptation to local culture and environment (Stephan and Justin, 2003) and such knowledge is a potential for reducing hazards and maintaining cultura and biologicaldiversity.

Homegarden is commonly defined as system of land management involving multipurpose trees shrubs in intimate association with annual and perennial agriculture crops and variable livestock within the compounds of individual house that managed by family labour (Christanty, 1990; Kumar and Nair, 2004).

Homegarden is a practice of integrated land use and agricultural production. Homegarden is also defined as the cultivation of diverse mixture of perennial and annual plant species as well as combining with livestock rearing activities. Homegarden is also defined as a field based study of plant diversity in small scope traditional agro ecosystem (Habtamu Hailu, *et al.*, 2012). Zemedede Asfaw (2004) described homegarden in Ethiopia as small-sized land in which vegetables, spices, oil seeds and fruits are cultivated to supplement cereals and pulse crops, and as homegardens characterized by a diverse mixture of crop plants with enset. As explained by Sebsebe Demissew *et al.* (2012), from the countries in tropical Africa, Ethiopia has a good practice of homegarden agro forestry system. They also stated pastoralist shifting cultivation, grain based cultivation and enset based mixed cultivation as the four major agricultural systems practiced in Ethiopia. Zemedede Asfaw

(2003) revealed that Ethiopia is well known for its diversity of indigenous homegarden food plants including vegetables; however the traditional homegarden vegetable crops are marginalized in modern agriculture, while the wild and weedy vegetable species receive no special attention. Thus the area seeks further study to assess the main problems that exist in the system (Reta Regassa, 2015).

Homegardens are communities most adaptable and accessible land resources and important component in reducing vulnerability and ensuring food security (Zemedu Asfaw, 2001). Homegardens are also important in year round production of food, decreased risks of production failure due to high diversity of species and increased resource productivity (Zemedu Asfaw 2001). According to Nora *et al.* (2012) findings, homegarden plants used worldwide for traditional medicinal purpose and also play an important role in the everyday life of people who do not have access to modern medication. Putri *et al.* (2016) stated homegarden as one of the principal component of rural landscapes that provide significant value in traditional agro forestry system in biodiversity conservation by forming garden like forest by using indigenous knowledge to manage surrounding house environment. Homegardens are considered as a sign of prestige and pride by the community as their key economic roles (Sebsebe Demissew *et al.*, 2012).

The purpose of cultivation of homegarden plants is to overcome resource constraints, population pressure, and reduction of land available and physical limitation like remoteness of the area in order to provide the basic needs for inhabitants in a self contained manner (Sebsebe Demissew *et al.*, 2012). Tefera Mekonen *et al.* (2015) stated that homegarden provides ranges of ecological benefits and services and other valuable set of products for poor rural people. In addition to this homegarden plants also used as spice, ornamental and stimulants.

Putri *et al.* (2016) explained the problems in implementation of findings from ethnobotanical study of homegardens to improve land management and identification of types of plant species in homegardens. The presence of knowledge gap in the

management of homegardens is another factor that influences the management of homegardens (Putri *et.al*, 2016). According to Reta Regassa (2016), the distribution of homegarden is threatened by agricultural expansion, deforestation and development activities including urbanization. According to Tefera Mekonen *et al.* (2015) explanation, although Ethiopia is one of the eight world centers of diversity of cultivated plants, homegardens in Ethiopia are currently threatened due to genetic erosion and loss of traditional knowledge on homegarden management. Tefera Mekonen *et al.* (2015) also explained that there is limitation in conducting research and documentation works on homegardens in Ethiopia.

In many tropical homegardens farmers grow diversity of perennial and annual crops like vegetables, fruit trees and spices integrated with medicinal, ornamental, fodder and fuel woodplants (Tesfaye Abebe, 2005). Over the recent years there has been growing interest to strengthen and intensify local food production in order to mitigate the diverse effect of global food shocks and food price volatilities. Consequently there is much attention towards homegardens as a strategy to enhance household food security and nutrition (Galhena, *et al*, 2013). The scope of the present study was limited to assess homegarden plants and their distribution and the management practices of homegardens by the local community as well as to identify the main uses of homegarden plants in the study area and factors affecting species diversity and productivity of homegarden plants.

## **1.2 Statement of the problem**

There is no previous report on ethnobotanical study of homegardens in Woliso District. Thus, the present study was designed to assess and document the indigenous knowledge of the people on the use and management of homegardens in the study district. The study aimed to fill the knowledge gap in species diversity and conservation status of homegardens in the study district. The problem encountered within homegardens in the study area is not addressed by government and stakeholders of the district. Therefore, the situation seek full assessment of distribution, management and the uses of homegarden plants in relation to the application of indigenous knowledge of the homegarden owners. Therefore, in order to maintain the ecosystem balance conservation of plant genetic

diversity and to meet homegarden production requirement of the people, scientific information is required.

Crop research in Ethiopia has largely concentrated on the cereal, oil and industrial crops. The rather localized importance of indigenous vegetables seems to be part of the reason for the lack of research focus. Most of the traditional vegetable crops of Ethiopia are produced by small farms following traditional practice. There are not fully documented and no programmes are currently aimed at their development production and some of these species are already at risk owing to land degradation and habitat destruction.

### **1.3 Objectives of the study**

#### **1.3.1 General objective**

The general objective of the study is to assess homegarden plants and their uses in selected sample kebeles in Woliso District of Southwest Shewa Zone. In line with this general objective the following specific objectives have been designed.

#### **1.3.2 Specific objectives of this study**

The specific objectives of this study were to:

1. assess homegarden plants and their distribution.
2. assess the management practices of homegardens by the local community
3. identify the main uses of homegarden plants in the study area .
4. identify factors affecting species diversity and productivity of homegarden plants.

### **1.4 Delimitation of the study**

The study is delimited to assess the distribution, management and some uses of homegarden plants in Woliso district with specific reference to five kebeles. This is mainly due to shortage of time and other resources

### **1.5. Significance of the study**

.This study will provide baseline information for the community, government bodies and others about the homegarden plants and their uses in the district..Initiate the interest of District and kebele officials to work towards creating awareness appropriate utilization and management of homegarden plants in the district.The study will also be used by other researchers who are interested to conduct further research on the homegardens of the study area

## **2. Review of related literature**

### **2.1 Homegardens**

Homegarden is defined as piece of land surrounding home that is used to cultivate diverse mixture of different plant species with raising livestock (Tefera Mekonen *et al.*, 2015). Homegarden is also defined as a practice of integrated land use and agricultural production system (Sebsebe Demissew and Zemedu Asfaw, 2013). As described by Sebsebe Demissew and Zemedu Asfaw (2013), homegardens have evolved from shifting cultivation in order to overcome the problem in shortage of resources, population pressure and reduction in land available for vast farming. Sebsebe Demissew and Zemedu Asfaw (2013) considered homegarden as agro forestry systems that used as micro-environments to preserve large ecosystem. Homegardens have been described as living gene banks in which a variety of germplasm in the form of indigenous varieties, landraces and rare species cultivated side by side and has been preserved through generations. This heterogenous environment of homegardens provides favourable growing condition for a wide variety of useful plants (Mathewos Agize, *etal.*, 2013).

Different countries call homegarden by different names. These include house gardens or kitchen gardens by their defining criterion that they are adjacent to the house where their garden owners live, like urban homegardens and rural homegardens (Regasa Bekele, 2014). Different authors have reported homegarden in Ethiopia is also named by different vernacular names at different places by different ethnic groups (Zemedu Asfaw, 1997). Homegardens are variously named in English language, as agroforestry homegardens, backyard gardens, farmyard garden, roof top garden and homestead farm gardens (Kumar and Nair 2004). In many rural villages homegardening is well developed, the space in front of house is left with clean grass as a family resting and socializing place and in others the clean grass left with big trees that used as a shade. In

some areas fences confine gardens while in others they merge with crop fields and may be fenced together (Zemedede Asfaw, 2002).

## **2.2 Uses of homegarden plants**

According to Tefera *et al.* (2015), about 25% of homegarden plants are used in Ethiopia as source of food such as fruits, vegetables, legumes and pulses. There are also so many homegarden plant species used as traditional medicinal plants in various regions of the country. From total 1539 homegarden plant species recorded in Ethiopia, about 137 species of them are used for food and 81 species for medicine. About 80% of cultivated food plants and 9% of the medicinal plants known to exist in Ethiopia (Abiot Berhanu and Zemedede Asfaw, 2014). The use of homegarden plants varies within Ethiopia being mostly widely used in south and southwest of the country whereas root and tuber vegetables are widely cultivated and consumed throughout the country (Zemedede Asfaw, 1997). This is because the habit of eating vegetable is limited in Ethiopia (Zemedede Asfaw, 1992). The use of traditional food by indigenous people has been implicated in the prevention of diabetes (Brand *et al.*, 1987) and sufficient amounts of in diet prevent a number of deficiency diseases as they provide essential vitamins and minerals. Besides of the mentioned uses homegardens provide sustainable household food security with appropriate management system as mentioned by Sebsebe Demissew and Zemedede Asfaw (2012).

Homegardens provide perspective for conservation of plant genetic resources, while contributing to improve the livelihoods of homegarden owners (Mersha Gebrehiwot, 2017). A large percentage of Ethiopian population depends upon agriculture for its livelihoods that contributes 42% to 45% of the total domestic products of the country (Zenebe Gebreegziabher *et al.*, 2011). Homegardens have various uses from providing food and other necessary materials for subsistence to serving as a place to live and maintain a traditional lifestyle, cultural values and social relations. Homegardens are also important in strengthening the social bonds among community members in order to serve as a symbol of status and create valuable sites for agrobiodiversity conservation.

Diversity of trees and shrubs in agricultural systems contributes to provision of food, wood and non-wood products as well as protect the environment by enhancing socioeconomic and ecological sustainability of the systems (Tesfaye Abebe *et al.* 2013). Home gardens have a promising approach to enhance house hold food security and well – being and are an integral part of local food systems and the agricultural landscape of developing countries (Galhena *et al.*, 2013). Homegardens have been considered as sustainable and productive agricultural systems that able to supporting very dense population as compared to other agricultural systems (Tesfaye Abebe *et al.*, 2013).

### **2.2.1 Marketed Homegarden Plants**

Marketed homegarden plants are plant species that provide opportunities for selling the surplus products to generate additional income (Sebsebe Demissew and Zemedu Asfaw, 2013). Moreover, the additional income from the garden products used to purchase food that more often benefits the family and contributes to more balanced diets (Sebsebe Demissew and Zemedu Asfaw, 2013). The role of homegarden plants in generating income to families has been focused to grow few cash crops instead of growing other beneficial crops that resulted to the reduction of species diversity in homegardens (Tefera Mekonen *et al.*, 2015).

Farmers benefit from homegardens in several ways. Homegardens act as reserved bank of food and cash for farmers, because income from homegardens was different with the size of homegardens, that means farmers who have large homegarden were getting more income. The proximity to markets had a negative effect on crops species richness. That is farmers close to markets grow slightly lower number of crop plant species, the market access encourage to focus on production of marketable products and to purchase products for consumption. Focusing on the production of few cash crops in homegardens by neglecting other benefits (food security and nutritional requirements) reduce agrobiodiversity and the future fate of homegarden (Tefera Mekonen *et al.*, 2015).



### **2.2.2 Ecological and Environmental benefits of Homegarden Plants**

Environmental and ecological benefits of homegarden plants include trees and shrubs that used as live fence to protect other homegardens from being destructed by soil erosion, wind and flooding (Tefera Mekonen *et al.*, 2015). Additionally, homegardens are responsible to maintain soil fertility in that most homegarden owners use manure instead of using commercial fertilizers (Sebsebe Demissew and Zemedu Asfaw, 2012). *Ensete Ventricosum* is the most frequently occurring species in the homegardens of the area and gardens are mainly managed by male than female (Mekonnen Amberber *et al.*, 2014). The existing ecological diversity and climatic variability coupled with cultural diversity has resulted in various farming systems in Ethiopia among which homegardens make up significant component of system in central southern and southwestern Ethiopia (Abiot Berhanu and Zemedu Asfaw, 2014).

Homegardens serve as the primary unit that initiates and utilizes ecologically friendly approach for food production while conserving biodiversity and natural resources. This is because homegardens usually diverse and contain a rich composition of plant and animal species (Galhen *et al.*, 2013). Homegardens also provide a number of ecosystem services such as habitats services such habitats for animals and other beneficial organisms that use for nutrient recycling, reduction of soil erosion and enhanced pollination. Homegardens used to maintain the agroecological balance of the given ecosystem by providing a place where plants, animals, insects, micro-organisms and soil, air, media mutually interact (Trinh *et al.*, 2002).

### **2.2.3 Other uses of Homegarden Plants**

Homegarden plants have a number of other uses as agricultural implements, house hold furniture, construction materials, musical instruments and others (Balcha Abera, 2013) throughout Africa. According to Putri *et al.* (2016) findings abundance of fruit plant and vegetable provides opportunities for agricultural products to sell for visitors who visit rural area as tourist. Besides this ornamental plants in homegarden improve landscape

visual appearance as a result increase people psychology and mentality (Putri, *et al.* 2016). Homegardens provide a foundation for ecologically sustainable development and improve health condition of the society (Regasa Bekele, 2014).

The functions of homegardens are diverse ranging from providing food and other necessary materials for subsistence to serving as a place to live and maintain a traditional lifestyle, cultural value and social relations. It is also important in strengthening the social bonds among community members and valuable sites for agrobiodiversity conservation (Feleke Woldeyes, *et al.*, 2016). Homegardens are realized as an important self sustaining agroecosystem with the dual function of production and on farm conservation of the agrobiodiversity (Zemedede Asfaw and Zerihun Woldu, 1997). Homegardens are clear examples of diversity rich production system that serve both a development and conservation function (Eyzaguirre and Watson, 2002). The main role of homegardens is for production of diversified food crops and so include high species diversity when compared with monoculture production system in vast farm land (Regasa Bekele, 2014). The high diversity of species in homegardens plays wide socioeconomic and ecological role because it is related with the production of food and other products such as firewood, fodder, spices, medicinal plants and ornamental plants (Christanty, 1985).

### **2.3 Management of homegarden plants**

Although the vegetable resources of Ethiopia are diverse with respect to number of species; only a few of the cultivated taxa are widely used in the country. The use of most of the cultivated and all of the non-cultivated taxa is restricted to some areas and some groups of people. Because of this localization, promotional efforts, including appraisal of nutritional value stated as a part of production ventures (Zemedede Asfaw, 1997). The management of homegardens includes tree planting, watering, weeding and fencing. The homegardeners maintain their homegarden soil fertility by using animal manure and leaf litter (Reta Regasa, 2016).

The management of crops in homegarden may be related to the various uses of the crops micro-environmental adaptation and the habits of homegarden owners. The management

of homegarden also contain some food crops as the most important function of homegarden is food production. Various authors described as special focus has to be given to developing homegardens indigenous and exotic useful plants could be maintained for the benefits of present and future generation (Mathewos Agize, *et.al.*, 2013).

Most of the home garden owners manage to use crop residues ,weeds, ashes and manures as fertilizer for their homegarden plants and the management of home garden also through division of labor among family members.The exchange of seeds of selected varieties and knowledge of homegarden owners was among relatives, friends and neighbours played role in maintaining local cultural knowledge and practice (Tefera Mekonen *et al.*, 2015). And also the ethnobotanical knowledge of farmer is an important resource for the development of sustainable agriculture and the conservation of genetic material.This means that indigenous knowledge is said to be at the hand of farmers and which is important for sustainable use of resources and sustainable development of livelihoods in particular and society in general.(Mathewos Agize, *et al.*2013).Recent studies on homegarden indicate that culturally diverse ethnic groups in Ethiopia have their own unique life style and perception of their surroundings for developing,maintaining, conserving and utilizing biological resources (Mathewos Agize *et al*, 2013).

## **2.4 Distribution of homegarden plants**

The distribution of homegarden plants is based on biogeographical zone and socioeconomic characteristics of homegarden owners (Belachew Wasihun, 2006). The distribution of homegarden plants varies according to traditional agro ecological zones namely Kolla, Woyna Dega and Dega (Sebsebe Demissew and Zemedede Asfaw, 2013.) They also described as the largest portion of this zone is covered by Woyna Dega agro ecology which accounts for 56% of the total area.

Homegardens of the southern Ethiopia high lands are dominated by the native perennial crops, enset and coffee as well as include a large variety of main food crops ,vegetables, and tree crops (Tsfaye Abebe, 2005). Unique homegarden plants in Ethiopia with

significant number of indigenous crop taxa and some that have been domesticated such as *Coffea arabica*, *Ensete ventricosum*, *Coccinia abyssinica*, *Brassica carinata*, *Plectranthus edulis*, *Elevsine coracana* and other lesser known species (Regasa Bekele, 2014)

## **2.5 Plant diversity in homegradens**

Homegarden are rich in species diversity than that of a way from due to protected by fence and spreading of household wastes that served as manure for their growth (Endgedasew Andarge *et al.*, 2014). Topical rain forest contain more than half of the global species diversity and its often subjected to increasing anthropogenic pressure which leads to loss of biodiversity since they are located within the high rain fall zone (Fonge, *etal.*, 2013). As revealed by Tefera Mekonen *et al.* (2015), the species of homegarden plants belong to few families of plant species; like family Fabaceae, Asteraceae, Lamiaceae, Solanaceae, Poaceae and Rosaceae. The problem of species homegarden richness and diversity of homegarden plants is related to access to water, size of and invasion of plants by pests and weeds (Tefera Mekonen *et al.*, 2015). Homegardens diversity interms of genetic diversity, have a total of about 539 species belonging to 352 genera and 109 families that generally account for 9% of Ethiopian flora (Abiot Berhanu and Zemedede Asfaw, 2014). Homegardens are one of the most complex and diverse agroforestry systems world wide and played an important role towards the development of early agriculture and domestication of crops and fruit trees (Melese Mengistu and Daniel Fitamo, 2015).

As revealed by Tefera Mekonen *et al.* (2015), the species of homegarden plants belong to few families of plant species; like family Fabaceae, Asteraceae, Lamiaceae, Solanaceae, Poaceae and Rosaceae. The problem of species richness and diversity of homegarden plants is related to access to water, size of homegarden and invasion of plants by pests and weeds (Tefera Mekonen *et al.*, 2015). The reason for low species diversity of homegarden could also be the result of shifting polycultural practice to cultivating few income generating food crops. The loss of species richness and diversity varies from region to region based on the influence of similar factors such as size of homegarden, water availability management system and the availability of resources required for plant growth and development.

Plant species diversity in homegarden is decreasing from time to time because of changing of traditional subsistence agriculture into market oriented agriculture. The diversity and productivity of these homegardens are characterized the factors that affect the dynamics are identified as the implication of these change for agricultural sustainability. Homegarden agroforestry is believed to be more diverse due to combination of varieties of crops trees and livestock (Euketu Linger Mekonnen *et al.* 2014). The diversity in homegarden is a promising option to improved the nutritional status of poor people both in rural and peri-urban area (Regasa Bekele, 2014)

## **2.6 Factors that influence the distribution of homegarden plants**

Homegarden ownership is influenced by complex relationship between age, gender and education level of the farmer (Belachew Wasihun *et al.*, 2003). The dramatical population growth rate is a challenge in decision makers to conserve natural resources. According to Reta Regassa (2016), the major constraints of homegardens include knowledge gap in plant breeding, lack of material and improved seed varieties, lack of agricultural support system and lack of awareness in implementation of modern ways of plant breeding. The distribution of homegarden plant of unique species also vary with ethnicity, food culture, religion and spirituality (Reta Regasa, 2016). According to Sebsebe Demissew and Zemedu Asfaw (2012), other factors that influence the distribution of home garden plant species are socioeconomic status, soil fertility, rainfall pattern, and distance from home, management system and personal perception. As explained by Sebsebe Demissew and Zemedu Asfaw (2013), some homegarden owners believe to depend on limited number of plants species in homegarden, instead of introducing new crops to their homegarden. The diversity and productivity of homegardens of the country were mainly affected by lack of agricultural support and biological factors such as disease and pests (Mekonnen Amberber, *et.al* 2013). According to Galhena *et al.* (2013) explanation the most important limiting factors in homegarden are access to suitable and sufficient land to establish and lack of ownership and usage right of some form and others access to capital, access to water ,seeds and planting materials, weak extension and advisory services, access to labor and access to

market. A decline in the transfer of indigenous knowledge causes not only loss of the knowledge and skill of plant management, but also the plants themselves will be irreversibly lost, putting animals that used to feed on those plants in danger and ultimate loss too (Galluzzi *et al.*, 2010). Major factors that influenced the distribution, species diversity and the productivity of homegarden plants are limited access to agricultural inputs such as seeds and planting materials, shortage of land available, shortage of water access, due to damage by insect pests and disease, poor environmental conditions, lack of knowledge, information and advisory service, poor soil fertility and lack of nutritional benefits of homegardening (Habtamu Hailu and Zemedu Asfaw, 2011).



### **3. Materials and methods**

#### **3.1. Study area description**

Woliso District is found in Southwest Shewa Zone, Oromia Regional State, Central Ethiopia. The district is found at about 114 km from Addis Ababa in the southwest direction. The district has 37 rural and 3 urban kebeles. The number of population in Woliso District was 188691, that is there were 91770 men and 96921 women from this 95% accounted Oromo, 3.6% were Gurage, 0.5% were Amhara and the remaining 0.9% of them were other nations. Religion wise about 78% Christianity (Ortodox and protestant) 1% were others such as Waqefeta according to census report 2007. The study district is bounded by Becho and SedenSodo districts in the East, Wenchi district in the west, Dawo and Dendi districts in north and Goro district and South Nation Nationalities and People Regional States (SNNPRS) in the South and has an elevation of 1850 to 2300 above sea level. Woliso district has two agro ecological zones-Woyna Dega about 70% and Dega 30% of the area of the district. The mean annual rainfall ranges from 1200-1350 mm and the average mean annual temperature is 16<sup>o</sup>c minimum and maximum is about 27<sup>o</sup>c. The soil types of Woliso district are grouped under black, red and brown.

#### **3.2. Study Design**

Selected homegarden owners and development agents were organized into research team and involved in observation and responded to interview questions. The informants were selected from homegarden owners of the study area and Development agents from sampled kebeles. The interviews for development agents were based on homegarden plant distribution, management of homegarden, expertise support in providing training about appropriate utilization and management of available resources as well as how they manage factors that may influence the distribution of homegarden plants.

#### **3.3. Sampling techniques and sample size**

To determine the sample of population under study, systematic sampling technique was used. The systematic sampling was used to select five representative kebeles from 40 kebeles of the District. That means one kebele was selected for every eight kebeles. The



Systematic sampling was also used to select eight homegarden owners from each sampled kebeles and a total of 40 representative homegarden owners were selected from the selected kebeles in the study area. The purposive sampling technique was used for five development agents of the sampled kebeles. Total sample size was 40 homegarden owners and 5 development agents.

Table 1: Lists of five sampled kebeles from Woliso District under the study.

No.	Name of kebeles	Number of informants	Remark
1	Jelisa Cheka ( Jallissaa Ceekaa)	8	
2	Dererie Ebicha (Dararree Eebicha)	8	
3	Didila Mangura (DildilaManguraa)	8	
4	Birbirs Kentero(BirbirsQanteeroo)	8	
5	Kile (Qilee)	8	
		Total = 40	

### 3.4 Method of data collection

#### 3.4.1 Field Observation

Homegarden observations were made with systematically selected homegarden owners from systematically selected kebeles of the district. During walking along with homegarden owners, plant species identified with their use, parts used and how to use. Field note was taken in local name of the homegarden plants including the use of plants and parts used. Field observation was used to see the way in which homegarden owners cultivate different plant species and the way they manage it. This helps to observe plant species cultivated in the homegardens in the selected kebeles. In addition, the number of plant species, the distribution of each plant species, and the application of modern with

the traditional means of cultivation and the type of plants diversity in each homegarden from the study area was recorded.

### **3.4.2 Interview**

The interview was conducted in Afan Oromo since this was the language understood by all informants of the study area. Semi-structured interview questions were used during data collection included the local name of the homegarden plant species and the purpose of those homegarden grown plants, management practices and others as needed. Other additional information that required for further clarity and understanding were used during the field observation as required and interview was used to supplement and validate the data obtained from field observation.

### **3.4.3 Plant data collection**

Sample of plant species encountered in the homegardens locally called ‘oddo’ in Afan Oromo were collected following a standard botanical techniques. Their local names, uses and parts used were recorded, numbered, pressed and dried. The collected voucher specimens were brought to the Jimma University for identification using taxonomic keys given in the flora of Ethiopia and Eritrea with assistance from the technical personnel and higher taxonomic experts of Jimma University Herbarium and further information of the species name with family name were established by comparing specimens found Herbarium of Jimma University

### **3.5 Methods of Data Analysis**

Ethnobotanical data were analyzed and summarized using descriptive stastical method means percentage and the data analyzed for species diversity, uses, distribution and management of homegarden plants of the study district. Responses from semi-structured interview and data obtained from observation were organized and analyzed quantitatively and qualitatively and described by grouping under similar category. Generally the analyzed result of observation and interview was discussed in relation to the focus of the study in order to make relevant recommendation for the research problems.

## 4. Results

### 4.1. Diversity and growth habits of plants in homegardens of Woliso District

Homegardens in Woliso District are composed of trees, shrubs, herbs and climbers in different composition and uses as food, live fence, for construction, shade provision and others. The distribution of these plants in homegardens depending on soil type, water availability, awareness of homegarden owners and the uses of plant in particular. Thus, certain plant species like *Ensete ventricosum*, *Catha edulis* and *Rhamnus prinoide* are the most popular cash crops for income generating in majority of the study area. The proper conservation and utilization of homegardens enable to obtain the majority of medicinal plants required for the treatment of human and other animals ailments (Behailu Etana, 2010).

Almost all homegardens in Woliso have crop plants with slight variation in types and number of species that they bear. This means that homegarden owners of the district cultivate similar crop varieties with a few variation. Some cultivate cereal crops with limited number of fruits and vegetable crops in the homegardens (as identified during field observation and from responses of informants). Cereal crops such as *Zea mays*, *Hordeum vulgare* and *Eragrostis tef* were cultivated in most homegardens of the district. Specially *Ensete ventricosum*, *Catha edulis* and *Rhamnus prinoide* were equally dominant plants in the homegardens of the study area. *Ensete ventricosum* is widely used for food in the district, while *Catha edulis* and *Rhamnus prinoide* were used for generating income for the homegarden owners. At the frontyard of most homegardens, large trees like *Acacia abyssinica*, *Casimiroa edulis*, *Casuarina equisetifolia*, *Cordia africana*, *Croton macrostachyus*, *Cupressus lussitanica* and *Grevillia robusta* were observed. The most dominated tree species of most of the study area were *Eucalyptus camaldulensis* and *Cupressus lussitanica*. The occurrence of homegarden types varied by location of kebeles of the study area. Generally, most of homegardens were dominated by exotic plant species (*Casuarina equisetifolia*, *Cupressus lusitanica*, *Eucalyptus camaldulensis*, *Grevillia robusta*, *Schinus molle*) rather than indigenous tree plant species

such as *Acacia abyssinica*, *Hagenia abyssinica*, *Podocarpus falcatus* and *Cordia africana* and *Ficus sur*. The plant that occurred in the higher frequency in the homegardens of Woliso District are the species belonging to family Poaceae, Fabaceae, Brassiaceae, Solanaceae, Rutaceae, Myrtaceae and Asteraceae that have species number 9, 8, 7, 7, 7, 5 and 5 respectively from highest to lower species number. From 123 plant species that identified during observation and from the informants response of the study district, 58 (49.15%) of the plant species were herbs, 36 (30.5%) shrubs and 22 (18.64%) trees and 2 (1.69%) climbers. This finding shows that most homegarden plants from the study area are herbs and then followed by shrubs. This could be due to the fact that there are more herbs than woody plants and the second reason is woody plants are over used than herbaceous species.

Those plant species of the homegardens of Woliso District have various functions as revealed by informants of the study district. Some main functions are source of food for homegarden owners and for their domestic animals, spice, stimulants, medicines, income generating, shade, live fence, fire wood and other purposes as explained by informants of this study area.

Table 2: List of some species of homegarden plants that widely used for food in the homegardens of Woliso district.

No.	Scientific name	Family name	Local name	Part used
1	<i>Brassica carinata</i>	Brassicaceae	Gomen	Leaf
2	<i>Brassica integrifolia</i>	Brassicaceae	Yegurage gomen	Leaf
3	<i>Brassica oleracea</i>	Brassicaceae	Tikle gomen	Leaf
4	<i>Beta vulgaris</i>	Brassicaceae	Kosta	Leaf
5	<i>Lycopersicon esculentum</i>	Solanaceae	Timatim	Fruit

6	<i>Lactuca sativa</i>	Asteraceae	Selata	Leaf
7	<i>Saccharu officinarum</i>	Poaceae	Shenkora	Stem
8	<i>Solanum tuberosum</i>	Solanaceae	Dinnich	Tuber
9	<i>Beta vulgaris</i>	Chenopodiaceae	Key-sir	<b>Root</b>
10	<i>Colocasia esculenta</i>	Araceae	Godare	Seed
11	<i>Dicus carota</i>	Apiaceae	Karot	Root
12	<i>Dioscorea olata</i>	Dioscoreaceae	Bonya	Root
13	<i>Ipomoea batatas</i>	Convolvuleceae	Maxaxisa	Root
14	<i>Carica papaya</i>	Caricaceae	Papaya	Fruit
15	<i>Casimiroa edulis</i>	Rutaceae	Kasmir	Fruit
16	<i>Citrus aurantium</i>	Rutaceae	Komtate	Fruit
17	<i>Citrus medica</i>	Rutaceae	Tringo	Fruit
18	<i>Citrus aurantifolia</i>	Rutaceae	Lomi	Fruit
19	<i>Citrus sinensis</i>	Rutaceae	Birtukan	Fruit
20	<i>Cucurbito pepo</i>	Cucurbitoceae	Debakula	Fruit
21	<i>Mangfera indica</i>	Anacardiaceae	Mango	Fruit
22	<i>Molus sylvestris</i>	Rosaceae	Apple	Fruit
23	<i>Moras- alba</i>	Moraceae	Gora	Fruit
24	<i>Musax paradisiacal</i>	Musceae	Muzi	False fruit
25	<i>Persea Americana</i>	Lauraceae	Avocado	Fruit

26	<i>Prunus persica</i>	Rusaceae	Koki	Fruit
27	<i>Canavalia Africana</i>	Fabaceae	Adenguare	Seed
28	<i>Carthamus tinctorius</i>	Asteraceae	Suf	Seed
29	<i>Phaseolus vulgaris</i>	Fabaceae	Boloke	Seed
30	<i>Fragaria vessa</i>	Rosaceae	Injori	Fruit
31	<i>Eragrostis clitrolus</i>	Poaceae	Tef	Seed
32	<i>Hordeum vulgare</i>	Poaceae	Gebis	Seed
33	<i>Brassica oleraceae</i>	Brassiaceae	Yewer gomen	Leaf
34	<i>Capsicum annum</i>	Solnaceae	Yeferenge karia	Fruit
35	<i>Psidium guajava</i>	Myrataceae	Zeyitun	Fruit
36	<i>Sorghum bicolor</i>	Poaceae	Tinkish	Stem
37	<i>Ensete ventricosum</i>	Musaceae	Enset	Stem corm

As revealed from the study, there are about 37 (30.1%) plant species used as food by homegarden owners. These plant species belong to 33 genera and 22 families. There were 15 (40.54%) fruits, 9 (24.32%) vegetables, 7 (18.92%) crop plants, 4 (10.81%) root plants and 1 (2.7%) tuber plant species from total identified food plants of Woliso district homegardens. Based on the findings of the study, fruits have large number of species compared to the rest food plant species and tuber only one species. The majority of these homegarden plant species are exotic with few number of indigenous plant species. From listed food plants *Ensete ventricosum* is widely used by majority of the homegarden owners of the study district as daily diet as well as means of income generating by females. Next to the

plant species used for food in the study area are *Eragrostis tef*, *Zea mays* and *Sorghum bicolor*. Fruits and vegetables are used by minority of homegarden owners as additional food. As recognized during field inspection and interview responses of homegarden owners and development agents homegarden owners use fruits and vegetables for sell as means of income generating rather than using for food by majority of homegarden owners. From total of 123 plant species that identified, 37 (33%) plant species were recognized as food plant species, fruits and vegetables accounted large number of plant species as the study revealed.



Figure 1 *Solanum tuberosum* and *Ensete ventricosum* food plant species in the back yard of the Woliso District homegarden.



Figure 2: *Malus sylvestris* with *Musa x paradisiac* in the side yard homegarden of Woliso District.



Table 3: Species of medicinal plants widely used in the Wolis district

Table  
3

No	Species name	Parts used and method of preparation Part used	Treatment of disease
1	<i>Moringa stenopetala</i>	Leaf chopped together	Hypertension
2	<i>Ajuga integrifolia</i>	Leaf chopped and squeezing	Intestinal and stomach disorder
3	<i>Rumex nepalensis</i>	Root part chewed	Intestinal and stomach disorder
4	<i>Calpurnia aurea</i>	Leaves chopped ground into pieces and apply it.	Used for fungal disease on the skin
5	<i>Aloe pubescens</i>	Pulp by removing the outer skin, taken orally	Head skin fungus (called forefori)
6	<i>Ocimum lamiifolium</i>	Leaves chopped, ground and squeezing its fluid	Cold in human headache.
7	<i>Ruta chalepensis</i>	Fresh leaves chewed	Stomachache headache
8	<i>Croton macrostachyus or Carissa spinarum</i>	Leaves with young shoot chopped and chewed	For stomach disorder
9	<i>Euphorbia tirucalli</i>	Chopped leaves secrete	Use for Gonorrhoea and haemorage
10	<i>Melia azedarach</i>	Chopped leaves ground and apply	Malaria

11	<i>Prunus Africana</i>	Bark ground and apply	Cancer and diarrhea
12	<i>Withania somnifera</i>	Leaves with stem parts chopped	By rubbing on wound for healing it
13	<i>Justicia schimperiana</i>	Pulp juice	For paint the face make up for human skin
14	<i>Lepidium sativum</i>	Seed ground and mix with water and tea	Skin wound, Evil eye, diarrhea
15	<i>Allium sativum</i>	Bulbs chewed	Headache
16	<i>Citrus aurantium</i>	Fruit squeezed sucking	Stomachache
17	<i>Citrus aurantifolia</i>	Fruit squeezing by sucking	Stomachache
18	<i>Zingiber officinale</i>	Rhizobium chewing	Stomach disorder
19	<i>Cymbopogon citrates</i>	Leaves using by chewing	For stomach disorder
20	<i>Nicotiana tabacum</i>	Leaves use by chewing through nose or mouth of goat or sheep	Use for respiratory disorders
21	<i>Croton macrostachyus</i>	Leaves and young tip chopped and mix with water	Stomach disorder Use as anti insect like flies in house
22	<i>Dodonaea angustifolia</i>	Leaves with stem chopped together and put on fire	Smoking as insecticide And for glueing
23	<i>Vernonia amygdalina</i>	leaves chopped and ground by mixing with water	Use for intestinal and stomach disorder

24	<i>Punica granatum</i>		Expel tape worm
25	<i>Ensete ventricosum</i>	Crom part chopped and groun eaten with milk or some times roased barely flour and butter	Broken limbs of humans
26	<i>Brassica nigra</i>	Seed is ground and mix with green pepper	Stomach ache and intestinal disorder
27	<i>Carica papaya</i>	Seeds	Internal parasite
28	<i>Verbascum sinaiticum</i>	leaves chopped and ground	haemorage
29	<i>Crateva adansonii</i>	dried rootgroud with water	diarrhea

There are 29 (23.58%) plant species identified from total 123 plant species, as the main medicinal plants that widely used by homegarden owners of the study area. Some of the plant species like *Lepidium sativum*, *Allium sativum*, *Zingiber officinale*, *Ruta chalepensis* and *Moringa stenopetala* are plants used for the treatment of various diseases.. *Ensete ventricosum* is also used for the treatment of many human ailments. The type of *Ensete ventricosum* locally known as *Carqummaa* is used to expel placenta in cow after delivery and also Guare, Astara, Qiminar and Teguanene are used for repairing broken legs and other parts of the body.

Table 4 List of homegardens plants species in Woliso district used for timber production

No	Species name	Family name	Local name	Part used
1	<i>Croton macrostachyus</i>	Euphorbiaceae	Bakkanisa	Stem
2	<i>Juniperus procera</i>	Cupressaceae	Gaatira-abasha	Stem

3	<i>Casaurina eaiusetifolia</i>	Casuerinaceae	Shiwashiwe	Stem
4	<i>Grevillia robusta</i>	Proteaceae	Muka-kawe	Stem
5	<i>Syzygium guineense</i>	Myrtaceae	Gosu	Stem
6	<i>Cupressus lussitanica</i>	Cupressaceae	Gaatira-faranji	Stem
7	<i>Podocarpus falcatus</i>	Podocarpaceae	Birbirsa	Stem
8	<i>Eucalyptus globules</i>	Myrtaceae	Bargamo adii	Stem
9	<i>Cordia Africana</i>	Boraginaceae	Wadessa	Stem
10	<i>Albizia schimperiana</i>	Fabaceae	Mukarba	stem

There are 10 (8.13%) plant species of homegarden plants identified from a total of 123 as plant that use for timber production in study area based on field observation and responses of interview question by informants from homegarden owners and as additional information by development agents from sampled kebeles of the district



Figure 3 *Juniperus procera* one of the homegarden plant of Woliso distirct used to produce timber

Table 5 List of homegarden plant species used as spice in Woliso District

No	Species name	Family name	Local name	Parts used
1	<i>Allium cepa</i>	Amaryllidaceae	Qullubii diimaa	Bulb
2	<i>Allium sativum</i>	Amaryllidaceae	Qullubii adii	Bulb
3	<i>Brassica nigra</i>	Brassicaceae	Sinafich	Seed
4	<i>Coriandrum sativum</i>	Apiaceae	Dimbilal	Seed
5	<i>Lippia adoensis</i>	Verbenaceae	Kosseret	Leaf
6	<i>Ocimum basilicum</i>	Lamiaceae	Besobila	Leaf
7	<i>Rosmarinus officinalis</i>	Lamiaceae	Siga-metibesha	Leaf
8	<i>Ruta chalepensis</i>	Rutaceae	Tena-adam(Am)	Leaf &seed

9	<i>Thymus schimperi</i>	Lamiaceae	Tosign	Leaves
10	<i>Mentha spicata</i>	Laminaceae	Nana	Leaf
11	<i>Rhamnus prinoides</i>	Rhamanceae	Gesho	leaves



Figure 4: *Rhamnus prinoides* one of the plant species used as spice in Woliso District

Of the homegarden plants collected from Woliso District, 11 (8.94%) are used as a source of spices. This was confirmed during field observation. From those plants used as spices by homegarden owners, *Allium cepa* and *Ruta chalepensis* are used daily.

Table 6 List of stimulant plants species grown in homegardens of Woliso District

No	Scientific name	Family name	Local name	Parts used
1	<i>Catha edulis</i>	Celastraceae	Khat (Jima)	Young leaf
2	<i>Nicotiana tabacum</i>	Solanaceae	Timbaho	Leaf
3	<i>Coffea Arabica</i>	Rubiaceae	Bune	Seed



Figure 5 *Coffea arabica* one of the stimulant plant species in homegardens of Woliso District

Homegarden owners of the Woliso district use these *Nicotiana tobacum* and *Coffea arabica* directly for stimulant purpose whereas *Catha edulis* is used for both stimulant purpose and income generating according to informants' responses. But few numbers of homegarden owners of the study area mainly focused to cultivate income generating plants like *Catha edulis* and *Rhamnus prinoides* rather than cultivating fruits, vegetables, root and tuber plants that are directly used for consumption as food. Informants of the study area responded that *Catha edulis* and *Rhamnus prinoides* are provided for sale two times per year. Thus, *Catha edulis* is the most dominant plant species of the study area that is used for sale and stimulant as observed during field inspection.

Table 7 List of some species of homegarden plants used as live fence for other homegardens in Woliso Distric

No	Species name	Family name	Local name
1	<i>Caesalpinia decapetala</i>	Fabaceae	Arangama
2	<i>Justicia shimperiana</i>	Acanthaceae	Sensel
3	<i>Grevillia robusta</i>	Proteaceae	Gravilia
4	<i>Dovyalis caffra</i>	Flacourtiaceae	Koshim
5	<i>Euphorbia tirucalli</i>	Euphorbiaceae	Kinbichi
6	<i>Carissa spinarum</i>	Apocynaceae	Agamsa
7	<i>Casuarina equisetifolia</i>	Casuarinaceae	Shiwashiwe
8	<i>Millettia ferruginea</i>	Fabaceae	Birbira

As the study revealed 8 (6.50%) plant species were identified as live fence from total 123 homegarden plant species of the homegardens of Woliso District. There were also other plant species from homegardens of study area that not listed as live fence, because the researcher believed that plants species listed in table frequently observed in majority of homegardens of the study area. Specially *Caesalpinia decapetala* and *Dovyalis caffra* are used as live fence for majority of homegardens of the study area. In addition to this, some plant species served as shade for other homegarden plants as well as wind break and protect soil erosion.





Figure 6 *Caesapinia decapetala* serves as live fence for homegarden of Woliso District



Figure 7 Homegarden plant species in Woliso district used as live fence and ornamental purpose in front of home locally named Dallawaa mooraa (A/O)

Table 8 List of homegarden plant species in Woliso District used as a shade

No	Species name	Family name	Local name
1	<i>Podocarpus falcatus</i>	Podocarpaceae	Birbirsa
2	<i>Acacia abyssinica</i>	Fabaceae	Lafto
3	<i>Olea europaea</i>	Oleaceae	Ejersa
4	<i>Persea Americana</i>	Lauraceae	Abocado
5	<i>Mangifera indica</i>	Anacardiaceae	Mango
6	<i>Prunus persica</i>	Rosaceae	Koki
7	<i>Cordia Africana</i>	Boraginaceae	Wedessa
8	<i>Ficus elastic</i>	Moraceae	Herbu
9	<i>Croton macrostachyus</i>	Euphorbiaceae	Bekanisa
10	<i>Albizia schimperiana</i>	Fabaceae	Mukarba
11	<i>Casimiroa edulis</i>	Rutaceae	Kezamiro
12	<i>Casuarina cunninghamiana</i>	Casuarinaceae	Shiwashiwe
13	<i>Juniperus procera</i>	Cupressaceae	Gatira Abesha
14	<i>Cupressus lussitanica</i>	Cupressaceae	Gatira Ferenji
15	<i>Vitis winifera</i>	Vitaceae	Weyini
16	<i>Syzygium quineense</i>	Myrtaceae	Gosu

About 13% of the total plant species identified from the homegardens of the study area are use for shade provision for other homegarden plants. They also serve as wind break and flooding as well as maintain soil fertility in the homegardens. Forexample, one of the

informants of this study explained *Syzygium quineense* as one of the homegarden plant specie that has the capacity to attract rain and improve soil fertility.



Figure 8 *Pesea americana* and *Syzygium quineense* as a shade trees of homegardens in Woliso District

Table 9 The main income generating and marketed homegarden plants of Woliso District

No	Species Name	Family name	Local name	Rank
1	<i>Saccharum officinarum</i>	Poaceae	Shankoragadaa	11
2	<i>Catha edulis</i>	Celastraceae	Chat (Jima)	38
3	<i>Rhamnus prinoides</i>	Rhamanceae	Gesho	36
4	<i>Mangifera indica</i>	Anacardiaceae	Mango	10
5	<i>Persea Americana</i>	Lauraceae	Abocado	9
6	<i>Brassica oleracea</i>	Brassicaceae	Raafuu	7
7	<i>Ricinus communis</i>	Euphorbiaceae	Qobo	6



Figure 9 *Catha edulis* in backyard of homegarden of Woliso District as main income generating plant specie in the study area

From a total of 123 homegarden plant species identified, seven (5.69%) were identified based on the response of the informants of the study area. *Catha edulis* is ranked first and *Ricinus communis* ranked last as income generating homegarden plant species of the Woliso District.

Table 10 The main homegarden plants in Woliso District that used as fodder for livestock

No	Species name	parts used	Preparation
1	<i>Sesbania sesban</i>	young branches and leaves	chopping and mix with crop residue.
2	<i>Medicago sativa</i>	top parts	direct grazing, cut and hay making
3	<i>Cynodon dactylon</i>	top parts	direct grazing ,cut and hay making

4	<i>Pennisetum purpureum</i>	top parts	chopping and mix with crop residue
5	<i>Albizia schioperiana</i>	leaves parts	chopping and directly feeding livestock
6	<i>Ensete ventricosum</i>	leaves and corm	leaves chopping and its corm grounded (during dry season)

Among home garden plants identified from homegardens of Woliso District six (4.88%) of the plant species identified as fodder plants used as forage by livestock in Woliso district.

Table 11 Important home garden plant species of Woliso district with multiple uses

No	Species name	Family name	Local name	Uses
1	<i>Ensete ventricosum</i>	Musaceae	Enset	Food & medicine...
2	<i>Catha edulis</i>	Celastraceae	khat	Stimulant & income...
3	<i>Persea Americana</i>	Lauraceae	Avocado	Food & shade....
4	<i>Syzygium guineense</i>	Myrtaceae	Gosu	Timber for shade...
5	<i>Cynodon dactylon</i>	Poaceae	Sardo	Fodder, soil fertility..
6	<i>Mangifera indica</i>	Anacardiaceae	Mango	Food, shade & timber
7	<i>Eucalyptus globules</i>	Myrtaceae	Bargamo adii	Timber and medicine

8	<i>Cordia Africana</i>	Boraginaceae	Wedessa	Furniture and shade
9	<i>Croton macrostachyus</i>	Euphorbiaceae	Bekanisa	Medicine fuel and for furniture
10	<i>Allium sativum</i>	Amaryllidacea	Qullubii adii	Spice and medicine
11	<i>Casuarina equisetifolia</i>	Casuariaceae	shiwashewe	Timber shade and ornamental

From 123 plant species identified from study area, 11 (8.94%) plant species have more than two uses (multipurpose plant). Foreexample, when we take enset, it is used as major food plant, fodder for domestic animals particularly during dry season, for medical purpose for both humans and animals and for environmental regulation and others.

The number of plant species listed under different functional category may be exceeded or greater than total number of plant species identified from the study district. This is because one plant may be repeated for different category of functional groups since most of homegarden plant species have more than one uses.

#### **4.2 Ecological benefits of homegardens in Woliso District**

The presence of diverse plant species that have various functions in majority of homegardens of the study area, created interdependence among different plant species. For example the majority of homegarden owners understand the benefit of cultivation of different species of homegarden plants. This could help to maintain soil fertility and to withstand the influence of drought or climate change on the cultivated or non-cultivated plant species. For instance, *Ensete ventricosum* and *Catha edulis* are believed to have the ability to resist drought as described by majority of informants. They also explained that in order to overcome problem of scarcity of farm land and limitation of water source, it is

better to cultivate different varieties of plant species in homegardens that use for various functions.

### **4.3 Diversity of homegarden plant species of Woliso District**

According to information obtained from informants of the study area and during homegarden observation, the District has a large variety of homegarden plant species. These homegarden plant species play a great role in environmental, social and economic benefits of homegarden owners as well as society as a whole. Although there was problem in awareness in how to apply sustainable and proper utilization of those homegarden plants, majority of homegarden owners tried to apply indigenous knowledge to cultivate homegarden plants with modern means of cultivation.

According to responses of the informants of the study area, the impact of climate change on the productivity of homegarden plants has been improved by replanting of indigenous plant species (like *Podocarpus falcatus*, *Acacia abyssinica*, *Hagenia abyssinica*, *Juniperus procera* ) rather than planting exotic plant species in several places. About 74% of the respondents explained that seedlings for planting are obtained from different sources (from forest, market, government and friends). About 16% of the respondents responded that they obtained from market and 10.53% responded that they obtained from their friends.

### **4.4 Distribution of homegarden plants in Woliso District**

The study revealed that the distribution of homegarden plants in Woliso district varies according to the size of homegarden which means their distribution is either directly or indirectly influenced by the size of homegarden. For instance, if the size of homegarden is large, the number and varieties of homegarden plants is also large. This was also confirmed during field work and from the data obtained during the study. The type and distribution of homegarden plants of the study area were also influenced by the presence of different ethnic groups in the district. Foreexample, the distribution of homegarden plants of Gurage community and Oromo community of study area show variation. of the majority of the study area, this was also reported in Loma and Gena Bosa District of The study also indicated that the homegardens were mainly dominated by exotic and a few

number of indigenous species of plants. This means the majority of homegarden plants are identified as exotic varieties.

#### **4.5 Homegardens management practice in Woliso District**

According to information obtained from respondents of the study area, management practice of homegardens varied from homegarden of one kebele to homegarden of another kebele. Based on researcher's observation, the management practice of homegardens which means fencing, hoeing, weeding, planting pattern as well as utilization of those homegarden in day to day activities is different when compared to them. In case of method of pest and weed control, 13 (34.21%) informants responded as use chemical method, 6 (15.79%) of them use cultural method and 19 (50% ) as they alternatively use chemical and cultural method of pest and weed control. In case of role of homegarden management, 5 (13.16% ) informants as female role, 10 (26.32%) responded as male role and 23 (60.53%) of them responded as both equally involved in management of homegarden. Additionally, as observed by researcher during homegarden observation majority of homegarden owners use organic fertilizer like manure for their homegarden plants specially for *Ensete ventricosum*, *Catha edulis*, *Rhamnus prinoides*, *Coffea arabica*, *Musa x paradisiaca* and *Brassica carinata*. All members of family involved in management practice of the study area. But elder men have a significant role in management of homegarden rather than females and children in study district.

Source of planting materials in Woliso District such as *Solanum tuberosum*, *Allium sativum* and *Zea mays* obtained from neighbouring district like Wenchi and Dawo districts as explained by informants of the study area. Sometimes these planting materials obtained from SNNPRS. The informants from Jelisa Cheka kebele described as planting materials like *Allium sativum*, *Solanum tuberosum* and *Zea mays* provided to them by their kebele development agent with collaboration of kebele officials as well as expertise from Woliso agricultural office. They also described that the planting materials mainly obtained by sharing among friends, family and relatives. These exchange of planting materials among homegarden owners of the study area has its own contribution in sharing knowledge of cultivation and management as well as sharing cultural diversity with homegarden owners other districts and regions as explained by homegarden owners of



the area. Some respondents of the study area revealed that this exchange of planting materials is the way of adopting the application of knowledge of homegarden management system with indigenous knowledge by homegardens of the study district.



Figure 10: A young boy hoeing in homegarden of his family (Photo by Zenebech Duki)

#### **4.6 Factors that affects the management and the productivity of plants in Woliso District**

Regarding the source of water for homegardens of Woliso Districtas, about 76% of the informants respond that the rain water is the source; 18% of the respondents responded that both irrigation water and rain water are the source of water and only 5% mentioned irrigation water as the source. Generally, all informants of the study area believe that there is a shortage of water to cultivate different varieties of homegarden plants. The responses of informants concerning their knowledge of management and cultivation of homegarden plants of the study area, 12 (31.58%) responded as they learned from their elders, 8 (21%) responded as they learned from their parents, 7(18.42%) responded as learned from training provided by their kebele development agents and 11 (28.95%) as they learned through practice. The development agents of study area and informants of

the five sampled kebeles explained as the distribution of rain fluctuating from time to time. This means, some times excessive rain that cause flooding and damage homegarden plants, in other time it become scarce. These informants also mentioned the irregularity in rain fall and lack of support from the government officials directly affected the species diversity of homegarden plants of their homegarden. According to informants responses, the most mentioned threats to homegarden plants of the study area are poor management and use of big indigenous tree plants for fire wood, charcoal production, timber production and construction. The informants of the study area explained that the condition becoming worse due to increasing population pressure that severely threaten plant species in homegarden.



## 5 Discussion

### 5.1 Types, diversity and distribution of homegarden of Woliso District

Woliso District homegardens have a mixed type of garden with diversified plant species such as *Ensete ventricosum*, *Rhamnus prinoides*, *Coffea arabica*, *Catha edulis*, *Zea mays*, *Solanum tuberosum* and other non cultivated homegarden plant species like *Podocarpus falcatus*, *Acacia abyssinica*, *Cordia africana* and *Croton macrostachyus*. These are the major homegarden plants that frequently observed in the homegardens of the study area. The similarity of Homgardens of Woliso with homegarden in Hawasa city is the presence of plant species like *Ensete ventricosum* and *Catha edulis* in abundant (Reta Regasa, 2016). The study indicated that modernization and change in life style of homegarden owners due to modern education, cultural abuse and global influence are increasing the rate of loss of indigenous knowledge. This agrees with Tigist Wondimu *et al.*, (2007). Diversity and density of homegarden tree plants varied among sites and households mainly due to socioeconomic and physical conditions (farm size, area of woodlots proximity to major roads and altitudes) (Tesfaye Abebe *et al.*, 2013).

Homegardens of the Woliso district that locally named as oddoo have many uses like source of food, medicinal plants timber and construction materials, live fence for other homegarden plant species, shade provision, spice, ornamental, income generating, use as fodder for live stocks, fire wood as well as provision of environmental protection from flooding and soil erosion. In this regard, the homegarden of Woliso District is similar with the homegardens in Sebeta town (Habitamu Hailu and Zemedede Asfaw 2011) Holeta town (Mekonnen Amberber *et al.*, 2014) and homegardens of Wolayita Zone (Sebsebe Demissew and Zemedede Asfaw, 2013). From different functional groups of homegarden plant species food plants have larger number of species which accounts for 37 (30.1%) species (refer table-2). Although there are high diversity of food plant species grown in homegardens of the Woliso District, homegarden owners focus on cultivation of limited number of food plant species as realized from observation of homegardens of the study area.

The diversity of plant species surrounding home was arranged in regular manner, in that smaller enset plants arranged step wise from home towards to the backyard of the homegardens of the majority of the study area, this was also reported in Loma and Gena Bosa District of Dawro Zone (Mathewos Agize, *et al.* 2013). The arrangement of homegardens in Woliso District more or less is similar to the arrangement of homegardens in Sebeta town (Habtamu Hailu and Zemedede Asfaw, 2011). This is because, in both cases most of the homegardens have similar types of herbs and shrubs with few exceptional species in number and in their growth habits as well as abundance from homegarden to homegarden. In case growth habits and number of species identified Woliso District homegarden is different from Dilla Zuria District according to the findings by (Melese Mengistu and Daniel Fitamo, 2015). The type of species habit and distribution of those plant species from one homegarden to another home garden in Sebeta town is not the same (Habitamu Hailu and Zemedede Asfaw, 2011).

## **5.2 Functional groups of homegarden plants growing in Woliso District**

Homegardening has proven to be an effective approach to improve household food security, in that the production of vegetables and fruits in the homegarden contributes significantly to increase consumption of these types of food in many countries in Asia (Melese Mengistu and Daniel Fitamo, 2015). Similar to this information, majority of homegarden plants recorded from the study area were used for food when compared to other recorded functional groups.

Among species of homegarden plants recorded as a food plants in the study area, *Ensete ventricosum* is widely used by majority of homegarden owners of the study district. According to responses of the interview question and observation, *Ensete ventricosum* is ranked first and *Eragrostis tef* is ranked second next to Enset based on number of homegarden owners consumption. The study also revealed that Enset has many functions such as medicine for human and livestock and fodder in animals. Additionally, *Ensete ventricosum* is used for provision of fibers that named locally as qaacaa and hoofii. The use of this fiber in some similar ways reported in Loma and Gena Bosa District of Dawro Zone (Mathewos Agize *et al.*, 2013). These fibers used for the formation of ropes for house construction as raw materials and a mat by homegarden owners of the study area.

As mentioned by majority of informants enset has many other uses such as maintainance of moisture and the fertility of soil. Thus, because of mentioned and other uses of enset homegarden owners of the study area considered enset as gold as the name implies (forexample one informant named Negash Gurmu) and also mentioned *Catha edulis* is the second important homegarden plant next to enset. This is because of its several uses for homegarden owners of the study area. In most of homegarden of the study area homegarden plants with diversify species found at the backyard of the home rather than at the front and sides of the home of homegarden owners basing on observation of different homegardens in Woliso District homegardens.

The majority of herbaceous plant species are used as medicinal plants than shrubs and tree plant species. This is similar to the findings of Regasa Bekele (2014) from Bishoftu town and Sebsebe Demissew and Zemedede Asfaw (2013) from Wolayta Zone. In most homegardens of the study area, few large trees such as *Podocarpus falcatus*, *Jacaranda mimosifolia*, *Grevillia robusta*, *Acacia abyssinica*, *Croton macrostachyus*, *Persea americana* were located in front yard of the homegardens of the study area. According to the informants of the study area, the trees available are used for the purpose of mini conferences for the community to discuss about their social issues. Most of the time, species of plants that are used for this purpose are *Podocarpus falcatus*, *Croton macrostachyus* and *Cordia africana*.

Three homegarden plants were listed as stimulant by homegarden owners of the area. The number of stimulant homegarden plant species in Woliso District were similar to that of Holeta town, Sebeta town, Hawasa town and Bishoftu town. The total number of homegarden plant species in Woliso District was different from the number of homegarden plant in Hawasa town in that the number species in Woliso District was 123, while in it was 258 in Hawasa town (Reta Regasa, 2016). Among these stimulant homegarden plant species, *Catha edulis* and *Coffea arabica* are widely used by local community of the study district, but *Nicotiana tabacum* is used by few people. Besides using as a stimulant, people of the study area also use *Catha edulis* as main income generating homegarden plant. *Coffea arabica* could not be cultivated and used for sell like *Catha edulis*, but used for domestic use. Among total 123 plant species identified

from homegardens of Woliso District, eight plant species (6.50%) were identified as used as a live fence by majority of homegarden owners of the study district. Especially, *Caesalpinia decapetala* is plant species in the homegardens of Woliso District that widely used by majority of homegarden owners to protect the remaining homegarden plant species from damage by animals. This is similar to the findings of Habitamu Hailu and Zemedet Asfaw (2011) from Sebeta town homegardens. The remaining homegarden plant species of the study district serve as medicine, ornamental, protect the entire homegarden plants from being eroded by flood and wind as well as restore the fertility of the soil which means improving soil fertility. Additionally, those plant species provide shade for the entire plants as well as for local society and animals.

There are 10 (8.13 %) homegarden plant species used for timber production identified from total 123 homegarden plant species from Woliso District (Table-4). The number of these species is very scarce when compared to homegarden plants that belong to herbs and shrubs. This is because the demand of consumption of those plants exceed to the amount produced or cultivated by homegarden owners of the study district as stated by informants of the study area. Especially, there are limited number of indigenous homegarden plant species in the study area such as *Podocarpus falcatus*, *Juniperus procera* and others in homegardens of Woliso District as explained by majority of informants of the study area

## **6. Conclusion**

The results of this study indicated that homegardens in Woliso District had high species diversity and rich floristic 'Thus the present study also indicates that Woliso District homegardens have of a high diversity of useful plant species such as *Ensete ventricosum* and *Catha edulis*. These species are more abundant, accessible and culturally rooted in the study area. Homegardens in Woliso District provide significant contribution for the homegarden owners and the society as source of supplementary food, medicinal functions and income. Despite of gradual socio-cultural transformation, the inhabitants have remarkable knowledge of cultivation and uses of these plants. Regarding the difficulties

in knowledge transformation and ignorance of new generation towards traditional knowledge, there seems great danger of extinction in species like *Podocarpus falcatus*, *Cordia africana* and *Syzygium guineense* (that believed as it use for water retention) replaced by exotic species such as *Eucalyptus globulus*, and *Cupressus lusitanica* and others for income generating. The result of the present study provide evidence that homegarden plants continue to play an important role in maintaining food security, environmental and biodiversity conservation. Knowledge of management and uses of homegarden owners and other communities are still a major part of their livelihood and culture. The traditional knowledge of using and preserving homegarden plants is a problem in the transfer of local indigenous knowledge about management of homegarden from the elders to the young generation.

The study also shows that plant species in the homegardens as gradually replaced by certain income generating plants rather than cultivating varieties of plants. That is in a amajority of homegardens of Woliso District the varieties of indigenous plant species replaced by exotic ones (forexample by Eucalyptus trees as one of the income generating plant). Majority of the intervied informants of the study area reflected that as certain non-cultivated homegarden plants lack attention local community facing problem like rainfall pattern, rising temperature that leads to drought. Thus, the study shows that insufficient agricultural support for homegarden owners, shortage of water, awareness problem in application of scientific knowledge of cultivation and management of homegardens, problems in utilization of homegarden plants and diseases and pests are major problems of homegarden owners in Woliso District in maintaining the sustainability and productivity of homegarden plants that seeks immediate solution.

## **7 Recommendations**

Based on the research result the following recommendations are forwarded:

The kebele administrative staff Woliso District agricultural office and development agents of each kebele should work in collaboration to conserve and enhance cultivation of varieties of plant speices particularly endangered plant species like *Hagenia abyssinica*.



Woliso District agricultural office should provide continuous awareness creating training in sustainable and proper utilization of homegarden plants, in cultivation of selective breeding using their indigenous knowledge and scientific method of cultivation as well as about the threats resulted during plant harvesting time for local people by development agents.

Woliso District agricultural office should conduct continuous follow up and supervision the implementation of the scientific method of cultivation with that of their indigenous knowledge as well as should provide any required support for homegarden owners.

In order to solve physical and socioeconomic problems that encountered within homegardens, development agents of each kebele with collaboration of kebele administration and other stakeholders should provide discussion for homegarden owners of the kebele.

Woliso District youth association with other governmental and non-governmental bodies interested to improve the productivity and sustainability of homegarden plants should provide awareness creating programme for young generation in particular to enhance their interest of working and managing homegardens by using scientific and indigenous knowledge that inherited from elder homegarden owners.

Because the area has highly diversified homegarden plants with multiple functions, like ecological benefits and cultural value and some endangered plant species, the area highly seeks further investigation by researchers who interested to conduct further investigation on the area.

The indigenous knowledge of the cultivation and management of homegarden of homegarden owners must be encouraged by agricultural expertise of Woliso district.

Since some of the highly valued homegarden plants are being overexploited to their use construction, timber production for furniture, for medicinal purpose and for fire wood, conservation strategy should be formulated and implemented for a long term management of those plants in the area

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## Appendices

### Appendix 1: Lists of homegarden plants found in Woliso District

No	Scientific name	Family name	Local name	Plant habit	Voucher No
1	<i>Allium sativum</i>	Alliaceae	Kulubi adii	Herb	ZW051
2	<i>Allium cepa</i> <i>aggregatum</i>	Alliaceae	Kulubi dima	Herb	ZW062
3	<i>Brassica carinata</i>	Brassicaceae	Rafu(gomen)	Herb	ZW053
4	<i>Brassica integrifolia</i>	Brassicaceae	Yegurage gomen	Herb	ZW013
5	<i>Brassica oleracea</i>	Brassicaceae	Tikil gomen	Herb	ZW064
6	<i>Beta vulgaris</i>	Brassicaceae	Kosta	Herb	ZW052
7	<i>Lycopersicon esculentum</i>	Solanaceae	Timatim	Herb	ZW054
8	<i>Lactuca sativa</i>	Asteraceae	Selata	Herb	ZW065
9	<i>Saccharum officinarum</i>	Poaceae	Shankorageda	Shrub	ZW056
10	<i>Solanum tuberosum</i>	Solanaceae	Dinichi (mose)	Herb	ZW038
11	<i>Moringa steropetala</i>	Moringinaceae	Shifera	Tree	ZW037
12	<i>Beta vulgaris</i>	Chenopodaceae	Keysir	Herb	ZW066
13	<i>Colocosia esculenta</i>	Araceae	Godare	Herb	ZW055
14	<i>Dicus carota</i>	Apiaceae	Karot	Herb	ZW067

15	<i>Dioscorea olata</i>	Dioscoreaceae	Bonia	Herb	ZW030
16	<i>Ipomoea batatas</i>	Convolvulaceae	Matatis	Herb	ZW058
17	<i>Carica papaya</i>	Caricaceae	Papaya	Herb	ZW005
18	<i>Casimroa edulis</i>	Rutaceae	Kasmir	Shrub	ZW063
19	<i>Citrus aurantium</i>	Rutaceae	Komtate	Shrub	ZW057
20	<i>Citrus midica</i>	Rutaceae	Tringo	Shrub	ZW049
21	<i>Citrus aurantifolia</i>	Rutaceae	Lomi	Shrub	ZW009
22	<i>Citrus sinensis</i>	Rutaceae	Birtukan	Shrub	ZW020
23	<i>Cucurbito pepo</i>	Cucurbitaceae	Debakula	Herb	ZW044
24	<i>Dovyalis caffor</i>	Flacourtoceae	Koshima	Shrub	ZW061
25	<i>Mangifera indica</i>	Anacardiaceae	Mango	Tree	ZW068
26	<i>Molus sylveestris</i>	Rosaceae	Apple	Shrub	ZW018
27	<i>Moras alba</i>	Moraceae	Gora	Climber	ZW059
28	<i>Musax paradisical</i>	Musaceae	Muzi	Herb	ZW071
29	<i>Persea Americana</i>	Lauraceae	Abocado	Herb	ZW069
30	<i>Prunus persica</i>	Rusaceae	Koki	Tree	ZW080
31	<i>Psidium guajava</i>	Myrtaceae	Zeyitun	Tree	ZW074
32	<i>Syzygium guineense</i>	Myrtaceae	Gosu (Dokuma)	Tree	ZW004
33	<i>Canavalia Africana</i>	Fabaceae	Adanguare	Herb	ZW031
34	<i>Carthamus tinctorius</i>	Asteraceae	Suf	Herb	ZW084



35	<i>Phaseolus vulgaris</i>	Fabaceae	Boloke	Herb	ZW073
36	<i>Ricinus communis</i>	Euphorbiaceae	Kobo (gulo)	Shrub	ZW024
37	<i>Capsicum annuum</i>	Solanaceae	Mitmita	Herb	ZW081
38	<i>Casicum frutescens</i>	Solanaceae	Berberie	Herb	ZW072
39	<i>Lipia adoensis</i>	Verbanaceae	Koseret ( Am)	Shrub	ZW027
40	<i>Lipia adoensis</i>	Verbanaceae	Kesie (Am)	Shrub	ZW008
41	<i>Menta spicata</i>	Lamiaceae	Nana (Am)	Herb	ZW082
42	<i>Ocimum basilicum</i>	Lamiaceae	Besobila (Am)	Herb	ZW070
43	<i>Rhamnus prinoids</i>	Rhamnaceae	Gesho	Shrub	ZW012
44	<i>Zingiber officinala</i>	Zingiberaceae	Zingibil	Herb	ZW083
45	<i>Catha edulis</i>	Celasteraceae	Jima (chat)	Shrub	ZW075
46	<i>Nicotiono tobacum</i>	Solanaceae	Tambo (timbaho)	Herb	ZW089
47	<i>Coffea Arabica</i>	Rubiaceae	Bune (buna)	Shrub	ZW007
48	<i>Ocimum lamifolium</i>	Lamiaceae	Anchebi (demakese)	Shrub	ZW011
49	<i>Olea europia</i>	Oleaceae	Ejersa (weira)	Tree	ZW025
50	<i>Ruta chalepensis</i>	Rutaceae	Chirakot (Tenadem)	Shrub	ZW014
51	<i>Rosnarinus officinalis</i>	Lamiaceae	Siga-metibesha	Shrub	ZW076
52	<i>Cynodon dactylon</i>	Poaceae	Merge (sardo)	Herb	ZW088

53	<i>pennistum puprucum</i>	Poaceae	Elephant grass	Herb	ZW077
54	<i>Azadiachta indica</i>	Maliaceae	Neem	Herb	ZW086
55	<i>Artemisia abyssinica</i>	Asteraceae	Aritii (Am)	Herb	ZW078
56	<i>Corissa adulis</i>	Apocyraceae	Agamsa (agam)	Shrub	ZW021
57	<i>Croton macrostachyus</i>	Euphorbiaceae	Bekenisa (Bisana)	Tree	ZW023
58	<i>Dodonaea angustifolia</i>	Sapindaceae	Ittacha (kitkita)	Shrub	ZW032
59	<i>Euphorbia tirucalli</i>	Euphorbiaceae	Chada (kinchib)	Shrub	ZW087
60	<i>Juniperus procera</i>	Cupersaceae	Gatira abesha (A/O)	Tree	ZW079
61	<i>Melia azendaracha</i>	Meliaceae	Nimi	Shrub	ZW036
62	<i>Prunus Africana</i>	Rosaceae	Gerbi (bark) (A/O)	Tree	ZW085
63	<i>Withania somnifera</i>	Solanaceae	Gizawa (root)	Herb	ZW123
64	<i>Aningera odolfi</i>	Spotaceae	Keraro (A/O)	Tree	ZW090
65	<i>Arundo donax</i>	poaceae	Shenboko(Am)	Shrub	ZW103
66	<i>Casaurino equisetifolia</i>	Casuarinoceae	Shiwashiwe (Am)	Tree	ZW017
67	<i>Gravilia robusta</i>	Proteaceae	Giravilia	Tree	ZW034
68	<i>Acacia abyssinica</i>	Fabaceae	Wachu (A/O)	Tree	ZW091

69	<i>Acacia albida</i>	Fabaceae	Lafto (Am)	Tree	ZW122
70	<i>Cymbopogon citrolus</i>	Poaceae	Tej-sar (Am)	Herb	ZW102
71	<i>Eragrostis citrolus</i>	Poaceae	Tef	Herb	ZW094
72	<i>Hordeum vulgare</i>	poaceae	Gerbu (gebs)	herb	ZW121
73	<i>Justicia shimperiana</i>	Acantheceae	Dhumuga (sensen)	Shrub	ZW100
74	<i>Lepidium sativum</i>	Brassicaceae	Shinfe (Fetto)	Herb	ZW092
75	<i>Asplenium aethiopicum</i>	Aspleniaceae	Fern (Eng)	Shrub	ZW120
76	<i>Ajuga integrifolia</i>	Lamiaceae	Hermegusa (A/O)	Herb	ZW043
77	<i>Brassica oleraceae</i>	Brassicaceae	Fotena ((yewergomen)	Herb Herb	ZW093
78	<i>Capsicum annum</i>	Solanaceae	qaaraa ferenji (A/O)	Herb	ZW101
79	<i>Rosa hybrid</i>	Rosaceae	Tsigereda (Am)	Herb	ZW095
80	<i>Psidium guajava</i>	Myrataceae	Zitun (Am)	Shrub	ZW119
81	<i>Sorghum bicolor</i>	Poaceae	Tinkish (Am)	Herb	ZW104
82	<i>Cyperus citrutus</i>	Cyperaceae	Kuni (A/O)	Herb	ZW096
83	<i>Salix subserrata</i>	Salicaceae	Aleltu (A/O)	Shrub	ZW118
84	<i>Otostegia integrifolia</i>	Lamiaceae	Tinjit (Am)	Shrub	ZW105
85	<i>Romex repalensis</i>	Polygonaceae	Dhangago (imbochi)	Shrub	ZW097

86	<i>Calpurnia aurea</i>	Fabaceae	Cheka (A/O)	Shrub	ZW006
87	<i>Aloe pubcaens</i>	Alaceae	Eret Am)	Herb	ZW106
88	<i>Corandrum sativum</i>	Apiaceae	Dimbilal (Am)	Herb	ZW117
89	<i>Vemonia amygdalina</i>	Asteraceae	Girawa (ebicha)	Shrub	ZW015
90	<i>Fragaria vessa</i>	Rosaceae	Injori (Am)	Herb	ZW098
91	<i>Foeniculum vulgare</i>	Apiaceae	Ensilal (Am)	Herb	ZW107
92	<i>Lagenarias siceraria</i>	Cucurbitaceae	Buke (Kil)	Climber	ZW099
93	<i>Sesbania sesban</i>	Fabaceae	Sesbania	Shrub	ZW116
94	<i>Trigonella foenumgraecum</i>	Fabaceae	Abish (shinko)	Herb	ZW108
95	<i>Vitis vinifera</i>	Vitaceae	Weyine( Am)	Climber	ZW115
96	<i>Brassica nigra</i>	Brassicaceae	Snafichi (Am)	Herb	ZW109
97	<i>Punica granatum</i>	Lythraceae	Roman (Am)	Shrub	ZW114
98	<i>Echinops kebericho</i>	Asteraceae	Kebericho (Am)	Herb	ZW110
99	<i>Caesalpinia decapetala</i>	fabaceae	Arangama	Climber	ZW016
100	<i>Acokanthera schimperi</i>		Yemerz-enchet (Am)	Tree	ZW113
101	<i>Calpurnia aurea</i>	Moraceae	Digita (A/O)	Herb	ZW111
102	<i>Ficussur forsk</i>	Moraceae	Herbu (shoal)	Tree	ZW112
103	<i>Eucalyptus</i>	Myrtaceae	Bargamo diima	Tree	ZW041

	<i>camaldulensis</i>				
104	<i>Eucalyptus globulus</i>	Myrtaceae	Bargamo adii	Tree	ZW040
105	<i>Millettia ferruginea</i>	Fabaceae	Birbira (AO)	Herb	ZW047
106	<i>Sesamum orientale</i>	Fabaceae	Selit(Am)	Herb	ZW060
107	<i>Thymus schimper</i>	Lamiaceae	Tosign (Am)	Herb	ZW084
108	<i>Opuntia ficus indica</i>	Cactaceae	Adami(A/O)	Shrub	ZW050
109	<i>Medicago sativa</i>	Fabaceae	Alfalfa	Herb	ZW039
110	<i>Schinus molle</i>	Anacardiaceae	Turmanturi	Tree	ZW035
111	<i>Jacaranda mimosifolia</i>	Bignoniaceae	Muka kewie (A/O)	Tree	ZW 046
112	<i>Malva vetriciliata</i>	Malvaceae	Liitii (A/O)	Herb	ZW029
113	<i>Brucea antidysentrica</i>	Simarubaceae	Komegno(A/O)	Shrub	ZW026
114	<i>Annona cherimola</i>	Annonaceae	Gishta	Tree	ZW028
115	<i>Rhus glutinosa</i>	Anacardiaceae	Xaaxessaa(A/O)	Shrub	ZW022
116	<i>Amaranthaceae hybridus</i>	Amaranthaceae	Orome (A/O)	Herb	ZW002
117	<i>Euclea racemosa</i>	Ebenaceae	Miessaa(A/O)	Shrub	ZW019
118	<i>Albizia schioperiana</i>	Fabaceae	Mukarba (A/O)	Tree	ZW042
119	<i>Juniperus procera</i>	Cupressaceae	Gaatira ferengii	Tree	ZW045
120	<i>Vibiscum sinaiticum</i>	Scrophulariaceae	Gure Herie	Herb	ZW001
121	<i>Cordia Africana</i>	Boraginaceae	Waddeessa	Tree	ZW010

122	<i>Podocarpus falcatus</i>	Podocarpaceae	Birbirsa	Tree	ZW033
123	<i>Crateva adansonii</i>		Qollaadii	Shrub	ZW048

## Appendix-2

Semi-structured interview items for ethnobotanical data collection from home gardens in Woliso District provided for homegarden owners.

### Personal information

1- Date.....Kebele.....specific.....

2- Name respondent.....sex.....age.....

3- Maternal status.....occupation-----job.....religion.....

4- For how long have lived in the area? (a) since birth (b) for the last 20 years

(c) for the last 10 years (d) for less than 10 years

5- Have you attended class? Yo yes / No..... If yes what is the last grade you have attended?

### GAAFFIILEE QOMAA BIQILTOOTA ODDOO ILAALCHISEE

Akkan qu'annoo kana aanaa Woliso irratti gaggeessu kan na kakaase tokkoffaa kanaan dura qu'annoon waan hingaggeefamneef lamaffaa qorataan biro o dhimuma kana irratti gadi fageenyaan qorannoo gaggeessuuf fedha qabu ka'uumsa akka ta'uuf akkasumas rakkooleen omisha fi omishuma biqiltoota akka hinguddane gufuu ta'an addan baasuun qaama dhimmi ilaalatuun furmaatin akka barbaadamu kaka'uumsa uumuuf.

Kanaafuu milkaa'ina qu'annichaaf tumsi fi gargaarsi keessan murteessaa waan ta'eef odeefannoo qu'annoo kana irratti dhiyaatuuf deebii dhugaa jiru waliin deemu akka naaf laatan kabajaan isiin gaafadha, gargaarsa naaf taasiftaniif galatni koo baayee olaanaadha.

Guyyaa .....Ganda ..... gooxii.....

Maqaa ..... Saala..... Age.....

Haala maatii .....Hojii.....Amantaa.....

### **Uses of Homegarden**

6- Do you have homegarden? Yes/No, if yes what is the last grade you have?

7 -Please list all food crops growing in your home gardens.

.Biqiloota oddoo kee keessaa kanneen nyaataaf oolan tarreesi

8 -Please list all spice plants growing in your homegardens

.Biqiloota oddoo kee keessaa kanneen akka mi'eessituutti fayyadan yoo jiraatan tarreesi.

9 -Please list all stimulant plants growing in home gardens.

Biqiloota oddoo keessaa kanneen akka si'eessituutti fayyadan yoo jiraatan ibsi.

10 Please list plants growing in your home garden mainly for income generating.

Biqiloota oddoo kan akka madda galiitti tajaajilan jiru? Yoo jiru jette tarreesi.

11 -What are the products of income generating plants you take to market?

Bu'aan biqiloota oddoo gabaatti gurgurtaaf dhiyyaachuun yoo jiraatan yaa ibsaman?

12 -Please list all forage plants grow in your home gardens.

Biqiloota oddoo kee keessaa kan nyaata looniif oolan jiruu? Yoo jiraatan yaa ibsaman

13 -Please list all medicinal plants grow in your home garden, parts used and aliments cured, preparation and application methods.

Biqiloota oddoo keessaa kan akka qorssaatti fayyadan ni jiru? yoo jiru jette tarreesi haala itti fayyadmanii fi maaliif akka fayyadanis akkaiitti qophaa.'u ibsi..

14 -Please list all multipurpose tree plants from your homegarden.

Biqiloota oddoo kan faayidaa lamaa fi sanaa ol qaban yoo jiraatan yaa ibsaman.

15 -Please list other plants growing in your home garden and their purpose

Biqilooni oddoo dalagaa yookiin fayyida biroo qaban yoo jiraatan ibsi.

17 -From where did you obtain planting materials for your home garden

(a)From forest places (b) from market (c) from government nursery

(d) From friend and other relatives (e) from all (f) list if any others

Haala omisha biqiloota oddoo ilaalchisee fi madda wantoota kanaaf barbaachisanii

(A)Bosona keessaa (B)Gabaa irraa (C) Bulchiisa yookiin waajjira qonnaa

(D)Hiriyaa koo irraa (E) Hunduma (F)Madda biroo

18 -How do you propagate plants in your home garden

By seed (b) by stem cutting (c) by seed transplanting (d) list please if any others

Biqiloota oddoo akkamiin oomishaman (mala oomishaa) (A) Sanyiidhaan (B)Jirma

isaatiin (C)Sanyii danfisuun (D)Karaan biro yoo jiraate yaa ibsamu

19 -What is the main source of water for your home garden?

(a) Rain fall (b) irrigation (c) both

Maddi bishaan biqiloota oddootiif barbaachisu eessa? (A)Rooba (B)Jallisii (C)Lachuu

20. Where do you learn the way you manage and use your home garden plants?

(a)From elder persons from village (b) from my parents

© From government development agents (d) by learning by doing



Mala biqiloota itti oomishaman eessaa baratan? (A)Hagafootarraa (B)Warra koo irraa ©Hojjetoota misoomaa mootummaa irraa (D) Hjiin yookiin shaakaliin

21 .How do you manage the fertility of soil in your home garden?

Gabbina biyyoo akkamiin eegda yookiinkunuunsita eenyuurraa baratan?

22 What methods do you use for pest management like weeds, disease and insects in your home gardens? (a) by using chemical pesticides (b) by using cultural methods (c) both methods

Malli wantoota farra biqilootaa ta'an kan akka ilbisotaa ,raamolee fi aramaa ittitoo'ataman maali? (A)Qoricha keemikalawaa itti biifuun (B)Mala aadaatiin fayyadamuun (C) Mala aadaa fi keemikalawaa fayyadamuun

23. Who is mostly responsible for taking care of home gardens?

(a) woman and girls (b) Males (c) equally all of family members

Qaamni oomishaa fi omishtumma biqiloota oddoo guddisuu keessatti gahee olaanaa qabaatu eenyu?

(A)Dubartoota fi shamaran (B)Dhiira (C)Lachuu walqixa hirmaatu

24 -Do you know the importance of adding fruits and vegetables in your every day diet Yes/ No

Bu'aan fuduraa kuduraa akka nyaata dabalataa ni beekta Eeyyin/lakki

Deebiin kee eeyyan yoo ta'e akkamitti fayyadamta? A/ Guyyaa hunda nyaata biro waliin (B) Darbee darbee (C)Gonkumaa hin fayyadamu

25 -How often you add fruits and vegetables into your diet? (a)in every day meal

b) very rare c)No adding at all

26 -If your answer is not adding or very rare, what do you think the reason?

Deebiin kee darbee darbee yoo sababiin isaa maal jettee yaada?

27. What do you think the possible solution to overcome the influence of factors that affect the productivity of home garden plants?

Furmaatni wantootaa omisha biqiloota oddoo irratti geesisan ittiin too'ataman maal jetta tarreesi.

28. Is there any change in reduction in diversity and production of plants in your home garden? Why?

Jijjiiramni akaaku biqiloota oddoo kee keessaa fi omishitummaa isaanii hirisan jiraa? maaliif

29. Among plants grow in your home garden, which of the cultivated plants resist drought?

Biqiloota oddoo kee keessaa kan goggiinsa dandamatan kam fa'a?

30. List down useful plants used as a fence/boundary mark and others.

Biqiloota oddoo kee keessaa kanneen akka dallaawaatti yookiin akka daangaatti tajaajilan yoo jiraatan tarreesi.

31. Which of the cultivated home garden plants have positive influence in home gardens productivity?

Biqiloota oddoo kanneen omishaman kan omishtummaa biqiloota oddoo birootiif bu'aa qabu jettee yaadu yoo jiraatan tarreesi.

32. Please list the rest suggestion about plant resources in local community.

Maddoota biroo biqiloota oddootiin hawaasa naannootiif gumaachan yoo jiraate tarreesi

33. In which season of the year do the products of home garden be accessed to the market?

Waggaa keessaa ji'ootni omishin biqiloota itti baay'inaan argamu joota kami?

### **Appendix-3 Interview questions for development agents**

1. How many home garden owners are there in your kebele?
2. Do home garden owners cultivate their home garden plants by using improved cultivation/scientific or modern system of cultivation? Yes/no
3. If no, what is the reason you think? please mention how they cultivate their home garden.
4. Do home garden owners in your kebele cultivate different varieties of home garden plants? Yes/no
5. If no, what do you think the reason is? a/ resistance b/knowledge or awareness problem c/please mention if other reason
6. Do home garden owners have knowledge or awareness about use of cultivation of multiple varieties of plant species in their home garden? Yes/no
7. Do home garden owners in your kebele know the benefits of cultivation of improved plant varieties?
8. Have you provided any training for home garden owners of your kebeles? yes/no
9. If yes how many times? a/once every year b/two times every year c/many times
10. If your answer is no, mention your reason
11. Your training was mainly focused on a/ management of home garden plants b/ about cultivation of varieties of home garden plants c/application of modern system of cultivation d/ about cultivation of selective plant species e/ about ways of maintaining the fertility of soil f/ about cultivation and use of fruits and vegetables in their daily diet g/please list if any remain
12. How do home garden owners apply/use their knowledge that they obtained from training? a/All in all b/rarely or occasionally c/they resist towards it d/please mention if there is other

13-How do home garden owners manage the fertility of soil in their homegarden?

a/ by using commercial fertilizer b/ by preparing and using compost c /by animal waste

14 .Please list if any other remain in the above question number 13

15.Is there any factor in your kebele that affect the productivity of homegaredn plants?

16-If present please list them

17-What do you think as the solution for the problems that affect the productivity of homegarden plants in your kebele?

18-Who is responsible to solve these problems? a/ homegarden owners  
b/developmental agents c/wereda agricultural office managements d/zone agricultural managements e/co-operation of all the stakeholders

19-please list the role of each stakeholders in improvement of the productivity of homegarden plants

20-please what is your comments about improvement of the overall management of homegardens.

**Appendix 4:-List of informants of homegarden owners of five sampled kebeles of Woliso District**

No	Name of informants	Sex	Age	Kebele	marital status	Occupation
1	Teku Mechesa	male	39	Dildila Mengura	Married	farmer
2	Tariku Hasan	male	30	Dildila Mengura	Married	farmer
3	Jida Gana	male	49	Dildila Mengura	Married	farmer
4	Diriba Defar	Male	52	Dildila Mengura	Married	farmer
5	Sufa Geremu	Male	41	Dildila Mengura	Married	farmer

6	Mulugeta Gerefa	Male	58	Dildila Mengura	Married	Farmer
7	Debisa Boru	Male	65	Dildila Mengura	Married	Farmer
8	Girma Negash	Male	40	Dildila Mengura	Married	Farmer
9	Nuguse Bonsa	Male	40	Jelisa Cheka	Married	Farmer
10	Worku Negash	Male	38	Jelisa Cheka	Married	Farmer
11	Beletu Negash	female	32	Jelisa Cheka	Married	Farmer
12	Gerefa Geremu	Male	30	Jelisa Cheka	Married	Farmer
13	Adane Taddesse	Male	40	Jelisa Cheka	Married	Farmer
14	Amdisa Daba	Male	50	Jelisa Cheka	Married	Farmer
15	Tesfaye Taddesse	Male	47	Jelisa Cheka	Married	Farmer
16	Urga Degefa	Male	38	Jelisa Cheka	Married	Farmer
17	Ayansa Denboba	Male	40	Derare Ebicha	Married	Farmer
18	Fantu Gerefa	female	45	Derare Ebicha	Married	Farmer
19	Mitiku Degefa	Male	50	Derare Ebicha	Married	Farmer
20	Negash Gurmu	Male	50	Derare Ebicha	Married	Farmer
21	Kebede Tafa	Male	50	Derare Ebicha	Married	Farmer
22	Geremech Bekele	female	26	Derare Ebicha	Married	Farmer
23	Temam Abdo	Male	42	Derare Ebicha	Married	Farmer
24	Adane Tefera	Male	30	Derare Ebicha	Married	Farmer
25	Tefera Diriba	Male	58	Birbirsa Kentero	Married	Farmer

26	Wegene Elala	Male	41	Birbirsa Kentero	Married	Farmer
27	Seifu Mamud	Male	40	Birbirsa Kentero	Married	Farmer
28	Taddesse Diriba	Male	52	Birbirsa Kentero	Married	Farmer
29	Abebe Elala	Male	45	Birbirsa Kentero	Married	Farmer
30	Takele Nuro	Male	40	Birbirsa Kentero	Married	Farmer
31	Bulo Bekele	Male	50	Birbirsa Kentero	Married	Farmer
32	Alemayehu Tefera	Male	43	Birbirsa Kentero	Married	Farmer
33	Sisay Ketema	Male	50	Kile	Married	Farmer
34	Getu Tamire	Male	29	Kile	Married	Farmer
35	Habte Gebremariam	Male	51	Kile	Married	Farmer
36	Teshome Terara	Male	51	Kile	Married	Farmer
37	Amare Gadisa	Male	43	Kile	Married	Farmer
38	Tesfaye Tamirat	Male	27	Kile	Married	Farmer
39	Wolde Fereja	Male	52	Kile	Married	Farmer
40	Wagari Tulu	Male	48	Kile	married	Farmer

