ADDIS ABABA UNIVERSITY

SCHOOL OF POST GRADUATE STUDIES

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES

DEPARTMENT OF ZOOLOGICAL SCIENCES

DIVERSITY AND MANAGEMENT OF HOMEGARDEN PLANTS SPECIES IN ABAY CHOMEN DISTRICT, HORO GUDURU, WOLLEGA ZONE, OROMIA REGINAL STATE, WESTERN ETHIOPIA

KENA NAGARO

AUGUST, 2025

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BY:- KENA NAGARO ABDISA

ADVISOR:- HABTE JEBESSA DEBELLA (PhD)

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APPROVAL SHEET
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As thesis research advisers, we attest that we have read and assessed the thesis, Diversity and management of home garden plant species in Abay Chomen district, Horo Guduru, that Kena Nagaro turned in under our direction.

Habte Jebessa Debella (PhD) _____ _____

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As members of the Board of Examiners of the M.Sc. Thesis Open Defense Examination, we have read and evaluated the thesis prepared **Kena Nagaro** the candidate. We recommend that the thesis be accepted as fulfilling the thesis requirements for the degree of Master of Science in the field of Biological Sciences.

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DEDICATION

My parents has always encouraged and supported me, so i dedicate this thesis to them. Words can hardly describe my thanks and appreciation to you. You have been my source of inspiration, support, and guidance. You have taught me to be unique, determined, to believe in myself, and to always perservere. I am truly thankful and honored to have you as my parents.

DECLARATION

I certify that the M.Sc. Thesis I've attached is wholly original. I collected and analyzed data during my research. I complied with all technical and ethical requirements. Every academic source that was used to support the thesis has been properly cited.

This thesis was turned in to fulfill some of the requirements for the Master of Science in Biological Science degree at Addis Ababa University. The thesis can be borrowed in compliance with the rules of the Addis Ababa University Library, where it is kept. I hereby declare that no other academic institution has received this thesis for the purpose of awarding a degree, diploma, or certificate.

Name: **Kena Nagaro**

Signature _____

Date of Submission: _____

Place: Addis Ababa University

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Acronyms and Abbreviation

CSA ……...……. Central Statistical Agency

EMSA …….. Ethiopia National Meteorological Service Agency

FAO …….. Food and Agricultural Organization

FWAO …….. Fincha woreda agrecultural organization

GPS ……...…….... Global Positioning System

HGs ……..… Homegardens

HHs …….. Households

KII ……..…… Key informant interview

Abstract

Between November 2024 and June 2025, this study examined the species diversity and home garden management in the Horo Guduru Wollega Zone of Oromia, Western Ethiopia's Abay Chomen district. Situated between 37°10'-37°21'E and 9°34'-9°45'N. The tarea offered a useful environment for learning about conventional gardening techniques. Sixteen (16) home gardens were chosen at random, and information was acquired through questionnaires, ranking exercises, interviews, and conversations with knowledgeable local elders. 102 households in all took part. We found 100 distinct plant species in 41 families, including 34 trees, 20 shrubs, 7 lianas, and 39 herbs. Common trees include Acacia abyssinica, Ficus sur, and two varieties of eucalyptus. Popular herbs included Brassica oleracea (cabbage), Allium sativum (garlic), and Allium cepa (red onion). Alongside the liana Caesalpinia decapetala, shrubs such as Catha edulis and Rosmarinus officinalis were also extensively cultivated. The Fabaceae family is the most numerous, followed by the Asteraceae and Rosaceae families, according to the numbers of species listed under the representative families. Home garden plants were used to calculate the evenness and diversity index. Intercropping, or combining different species to produce good results in the smallest amount of space, was a common practice among householders. Plant diversity was impacted by problems like weeds, pests, small garden sizes, and water scarcity. The study mentions the need for local agricultural offices to provide more assistance to families so they can cultivate a greater range of plant species for local markets and also their own uses.

Key words: management, home gardens, and households.

CHAPTER 1

1. Introduction

1.1. Background and Justification

In human-managed landscapes, home gardens are typically thought of as habitats for both crop and woody plant species (Francis, 1992). Melese Mengistu and Daniel Fitamo (2016) state that "home gardens are collections of plants with various forms of characteristics, including trees, shrubs, vines, and herbaceous plants, growing in a home compound." Fernandes and Nair (1990), referenced in Mulugeta Kebebew (2018) and Solomon Tamrat (2011), state that home gardens are generally understood to be a plot of land surrounding a homestead that is cultivated with a variety of seasonal and annual plant species, frequently in conjunction with raising livestock, and that is primarily run by household families for actual production. With this mix of beneficial plants and animals, home gardens are recognized as sustainable agroforestry systems and are defined as appropriate land use systems situated in front of or behind the house. Woody and non-woody species are closely clustered in numerous overlapping canopy layers alongside domestic animals (Peyre et al., 2006). In contrast to other agricultural systems, home gardens have been regarded as productive and sustainable agricultural systems that can sustain extremely dense populations (Tesfaye Abebe, 2013). Agro-ecological and socioeconomic benefits of home gardens' high species diversity include the production of food, firewood, fodder, spices, medicinal plants, and ornamentals, as well as the prevention of environmental degradation from climate-related risks typically associated with monoculture production systems (Ewuketu Linger et al., 2014). Because many beneficial plant species have been under strict human management regimes in home gardens for long periods of time, they preserve cultural history (Molebatsi et al., 2010). The daily nutrition and healthy food required by household members can be obtained from home garden production of crop plants. Therefore, home gardens play a significant role in household food security and well-being in a sustainable manner. Home gardens improve household food security directly by enabling families to have a diversity of nutritionally rich food, increased purchasing power from savings on food bills and income from sales of garden products, and contingency food provision during seasonal lean periods (Norris, 2020).

Ethiopia's home gardening history is closely tied to the establishment of agricultural practices between 5000 and 7000 BC (Abiyot Berhanu and Zemede Asfaw, 2014). One could assume

that gardening was likely the first type of farming ever done in Ethiopia given the country's lengthy agricultural history and the presence of ancient crop domestication in home gardens (Abiyot Berhanu and Zemede Asfaw, 2014). Ethiopian home gardens can be found in a variety of locations around the house, including the front yard, side yard, and backyard. They are characterized by a wide range of plant species, sizes, and shapes (Tefera Mekonen et al., 2015). According to Habtamu Hailu (2011), home gardens in Ethiopia demonstrate an environmentally friendly and sustainable agricultural method that enables the collection of a variety of products to meet the needs of urban environments and farming families. Traditional agroforestry home gardens exist in larger regions of southern Ethiopia. The majority of these backyard gardens are situated between 1500 and 2300 meters above sea level, where the climate and moisture levels are ideal for farming. Coffee and enset, two well-known native perennial crops, are combined in a distinctive way in these gardens (Melese Mengistu and Daniel Fitamo, 2016). Traditional home gardens in the Gurage Zone, which are associated with southern Ethiopia, are distinguished by the presence of coffee and enset (Biranu Getie, 2024).

1.2 Statement of the Problem

The purpose of this research is to study the variety and character of crop plant species in traditional home gardens in Western Ethiopia's Horo Guduru Wollega Zone's Abay Chomen district. The types of management practices used by households are also examined in the study. Plant species and management strategies are influenced by environmental and socioeconomic factors. It is anticipated that the results will support household-level plant genetic resource conservation and sustainable agricultural methods. Although home gardens in Western Ethiopia have been studied in the past, there aren't many studies that particularly address the variables affecting crop plant species diversity and composition in the Abay Chomen district. Land fragmentation brought on by growing population pressure has made local communities more dependent on their home gardens for subsistence. The precise environmental and socioeconomic factors that contribute to variations in species diversity and richness among these systems are not well understood, despite the possibility of high crop plant diversity and composition in Abay Chomen home gardens, littles are known about the specific environmental and socioeconomic factors influencing species richness and composition in this district. Existing research on western ethiopia’s home gardens has not focused on this area,leaving creatical gaps in understanding how local practice affect biodiversity and sustainable agriculture. With out such knowledge, opportunities for

improving household food security , conserving plant genetic resources, and guiding policy development may be lost. This study address this gap by systemically analyzing species diversity, composition, and management practices in Abay Chomen home gardens.

1.3 Research questions

1. How can the species diversity and composition of crop plants in home gardens in the Abay Chomen District be analyzed?
2. How can the diversity and management of home gardens in the Abay Chomen district be better understood?
3. What socioeconomic variables influence the variety and composition of plant species in the Abay Chomen district's home gardens?

1.4. Objectives of the study

1. 4.1. General objective

To assess the diversity, composition, and factors influencing the management of traditional home gardens in the Horo Guduru Wollega Zone's Abay Chomen district was the main goal of this study.

1.4.2. Specific objectives

1. To identify and record the diversity and makeup of crop plant species in the study area
2. To determine the socioeconomic and environmental factors that impact the diversity and richness of crop plant species in the study area
3. To understand the variables influencing the management and diversity of home gardens in the study area

1.5. The significance of the study

Improved Management: A deeper comprehension of home garden diversity and management techniques will facilitate the creation of more potent plans for preserving and advancing these priceless agroforestry systems.

Sustainable Livelihoods: The study can help local communities' livelihoods by encouraging the diversification of home garden production.

Local community policy Development: By using the research's insightful findings, policy makers will be able to create and execute efficient regulations that promote the preservation

and sustainable use of home garden resources. By examining the variables that influence the variety and make-up of crop plant species in Abay Chomen home gardens, this study essentially seeks to close a significant knowledge gap and eventually improve crop garden management and the sustainable livelihoods of nearby communities.

CHAPTER 2

2. LITERATURE REVIEW

2.1. Home gardens in tropical regions

Tropical nations are constantly evolving due to a variety of factors, such as social, technological, economic, and demographic pressures on smallholder farming systems. The two main causes of land use changes are population growth, rising product commercialization, and the use of contemporary inputs (Tilman et al., 2002). However, rainforests are nearly closed systems with a high species diversity and minimal input. Numerous agroforestry and intercropping systems are examples of farming systems with intermediate complexity and species diversity (Wiersum, 1997). Concerns regarding the long-term viability and environmental effects of agricultural systems' expansion have grown recently. Intensive production techniques and agricultural sustainability (Tilman et al., 2002).

As a result, tropical home gardens are among the most intricate and varied agroforestry systems on the planet, and they were crucial to the early agricultural development and the domestication of fruit trees and crops (Melese Mengistu and Daniel Fitamo, 2018; Megabit Beyene et al., 2018). A tropical home garden is a collection of plants that grow in or next to a homestead or home compound. These plants can include trees, shrubs, vines, and herbaceous plants (Krishnal and Weerahewa, 2014). Two varieties of home gardens are acknowledged in the tropical region based on how well they improve household welfare (Tesfaye Abebe, 2005). The first are small-scale supplemental food production systems around homes in regions where the owners' livelihood depends on other land use or other activities; these are prevalent throughout much of the tropics (Reta Regassa, 2016). Numerous types of urban, semi-urban, and rural home gardens fall under this category. This includes the majority of home gardens in Latin America and the well-known home gardens of Java that support monoculture rice production.Two varieties of home gardens are acknowledged in the tropical region based on how well they improve household welfare (Tesfaye Abebe, 2005). The first are small-scale supplemental food production systems around homes in regions where the owners' livelihood depends on other land use or other activities; these are prevalent throughout much of the tropics (Reta Regassa, 2016). Numerous types of urban, semi-urban, and rural home gardens fall under this category. This includes the majority of home gardens in Latin America and the well-known home gardens of Java that support monoculture rice production. This also includes urban home gardens that are used to grow vegetables and

decorative plants to augment the owners' non-agricultural income (Mendez and Somarriba, 2001). Extended farm fields surrounding homes, which are the primary source of income for farming households, make up the second category of home gardens. This category included the majority of home gardens in Eastern Africa's highlands (Rugalema et al., 1994). In this case, the farmers either have no extra land or it is very small and only serves as a supplement to their home gardens. Although home gardens can be found all over the tropics, the humid lowlands are where they are most prevalent. Furthermore, they can be found in a number of tropical highland areas.

Ethiopia is one of the tropical countries where home gardens are common in the highlands. In the cereal crop-based farming systems, primary food crops like tef (Eragrostis teff), barley (Hordeum vulgare), wheat (Triticum sativum), and sorghum (Sorghum bicolor) are grown in the outer farm fields, and supplemental vegetables, fruits, and spices are grown in home gardens. These types of home gardens are also common in most Ethiopian cities. The second type of home garden is common in the perennial crop-based farming systems of the south and southwestern highlands. The main source of income for practically every household in this area is the home gardens, which grow staple food crops like maize and enset as well as other cash and food crops. Kassa and colleagues, 2023.

2.2. Categorization of Homegardens

Abebe (2005) states that two categories of home gardens can be distinguished based on how they improve household well-being. He cited the first as the small-scale supplemental food production systems that are typically found around homes in areas where the owners rely on other sources of income (either farming or non-farming). This category, which is thought to be widespread throughout the tropics, encompasses a broad variety of urban, semi-urban, and rural gardens.

The majority of home gardens in Latin America and the home gardens of Java, which complement monoculture rice production, are examples of this kind (Mendez et al., 2001). According to Abebe (2005), this also includes urban gardens that are used to grow ornamentals and vegetables in order to supplement the owners' non-agricultural revenue. Since Burkina Faso's home gardens are primarily used for subsistence (Ouédraogo, 2010; Kristensen and Balslev, 2003), they are anticipated to fall under this heading. Extended farm fields surrounding homes that serve as the primary source of income for farming households are referred to as home gardens in the second category. This group includes the majority of

home gardens in Eastern Africa's highlands (Rugalema et al., 1994). These farmers either don't have any extra land or have smaller plots of land that they use in addition to their home gardens.

2.3. Structure and composition of homegardens

Vegetation layers (stories) that mimic the structure of tropical forests are a defining characteristic of tropical home gardens. The tall tree canopy at the top of the building reduces radiation and the mechanical effects of rainfall, maintains a relatively constant microclimate in the lower layers, and adds organic matter to the soil through leaf fall after dead body parts have decomposed. The production of staple foods and fruits, such as bananas (Musa x paradisiaca), mangoes (Mangifera indica), papayas (Carica papaya), etc., is found in the lower layer. The third layer is characterized by bush-level growth, such as peppers (Capsicum species), maize (Zea mays), etc.

The final layer is made up of in-ground and ground-covering species (such as roots and tubers), whereas climbing species move through the lower stories. Complementary species are frequently mixed even though the species' spatial arrangement appears to lack order and pattern (Fernandes and Nair, 1986). Additionally, the spatial organization of these systems often reflects their functional adaptation in various ways, including the use of plant-symbiotic connections through mixed cropping. The species composition and arrangement of home gardens in various places may be influenced by a range of ecological, socioeconomic, and cultural factors, such as the distance from urban markets, the size and makeup of the household, environmental degradation, and family customs. Megabit Beyene et al. (2018).

2.4. Homegardens in Ethiopia

The domestication of crops and the early agricultural revolution depended heavily on home gardens, one of the most complex and diverse agro-ecosystems on the planet (Abdoellah et al., 2006). Ethiopian home gardens have a unique design, crop mix, and primary species, which include a number of native crop taxa as well as truly endemic ones like Coffea arabica, Enset ventricosum, and many others (Zemede Asfaw, 2002; Arayasilassie Abebe Semu, 2018). Ethiopians begin home gardens in a number of ways that are influenced by biotic, abiotic, cultural, and socioeconomic factors.

According to Tesfaye Abebe's study from 2005, Ethiopian home gardens can be broadly classified into two categories. In order to supplement the cereals and pulses grown in

neighboring fields, the first kind of home garden is a small garden that grows fruits, vegetables, spices, and oil seeds. The country's cereal crop-based farming regions and urban areas both have this type of garden (Reta Regassa, 2016). The other types of home gardens, which are characterized by a diverse range of crop plants with enset (Ensete ventricosum) as the foundation, are found in the country's south and southwest. In these systems, which frequently have a high degree of crop diversification, enset and coffee still control the majority of sites (Melese Mengitu and Daniel Fitamo, 2015). However, there are variations both between sites and among farms within a site. In certain areas and farms, the proportion of the two primary crops, coffee and enset, is declining, despite the growth of monoculture fields of new cash and food crops (Tesfaye Abebe, 2013).

Home gardens are located in a variety of locations. There are many different types of home gardens; in Ethiopia, the most common are in backyards (48%), front yards (26%), side yards (13%), and those surrounding the house (13%). A neat, green meadow in front of houses was viewed as a space for family leisure and socializing. Some areas have gardens surrounded by live and/or dry fences, while others are just penned together with agricultural fields (Zemede Asfaw, 1997). The living house, livestock enclosures, grain warehouses, drying grounds, and garden plant plots are examples of Ethiopian garden areas. Usually fenced, the barrier is supported by shrubby and multipurpose living trees. Typical garden sizes range from approximately 100 m^2 to more than 2000 m^2, though extreme cases have been reported with garden sizes as small as 20 m^2 and as large as 6000 m^2. Larger gardens nearer the upper limit are more prevalent in southwest Ethiopia (Zemede Asfaw, 1997a; 2002).

2.4.1. Homegardens in Western Ethiopia

Home gardens are agro-ecosystems that are located close to a location that is used for either temporary or permanent habitation. Ethiopian household gardens are believed to have begun concurrently with the introduction of agriculture between 5000 and 7000 BC (Abiyot Berhanu, 2014; Solomon Tamirat, 2011). The unique design, crop mix, and important species of Ethiopian home gardens include many native crop taxa as well as some that are truly endemic, like Coffea arabica, Ensete ventricosum, and many more (Solomon Tamirat, 2011; Arayaselassie Abebe Semu, 2018). Large areas of traditional agroforestry home gardens can be found in the south and southwest of Ethiopia (Melese Mengitu and Daniel Fitamo, 2015; Tesfaye Abebe).

According to Tadesse Kippie (2002), most of these gardens are located between 1500 and 2300 meters above sea level, where the climate and moisture content are perfect for farming. These gardens are characterized by the unique combination of two native perennial crops, enset and coffee. Despite being widely distributed in eastern and southern Africa, enset (Ensete ventricosum, family Musaceae), a staple crop for more than 15 million people in mixed subsistence farming systems, is only grown in southern and southwestern Ethiopia. Because its leaves are an essential source of cattle feed and are also used as mulch to reduce soil erosion and runoff, enset has both protective and productive uses, according to Beyene Teklu Mellisse et al. (2018). Since the climate and moisture content are perfect for farming, most of these gardens are located between 1500 and 2300 meters above sea level (Tadesse Kippie, 2002). These gardens are characterized by the unique combination of two native perennial crops, enset and coffee. Despite being widely distributed in eastern and southern Africa, enset (Ensete ventricosum, family Musaceae), a staple crop for more than 15 million people in mixed subsistence farming systems, is only grown in southern and southwestern Ethiopia. Because its leaves are an essential source of cattle feed and are also used as mulch to reduce soil erosion and runoff, enset has both protective and productive uses, according to Beyene Teklu Mellisse et al. (2018). One of the features of enset-coffee home gardens is that they can occasionally display a mosaic of patches or farm units that vary from one another because of the main crop grown there. For instance, a coffee unit is one where coffee is the main crop but is also grown with other crops and trees, or a maize unit with a few crops and trees interplanted. Tesfaye Abebe (2005) states that while coffee, maize, or other crops predominate in other units farther away, enset predominates in the vicinity of the dwelling. Eset and coffee home gardens have long been reliable agricultural systems that support incredibly dense populations of up to 500 people per square kilometer (Kippie, 2002).

The diversity of systems and the ability of enset to produce a relatively large amount of food per unit area and time may have been the main factors contributing to this stability (Admasu Tsegaye and Struik, 2001). Additionally, due to its multi-year production period and flexible harvesting schedule, enset is the ideal crop to help fight food scarcity during droughts (Desalegne Rahmato, 1995).

2.4.2. Crop plant diversity of Home gardens of Western Ethiopia

Rich agrobiodiversity, primarily vegetables and fast-growing fruit trees, is common in home gardens (Sthapit et al., 2004). Within broader farming systems, home gardens are microenvironments with high species and genetic diversity (Eyzaguirre and Watson, 2002).

The region, the amount of space available, and the family's preferences all influence the crops chosen for home gardens. High-yield crops that are highly adaptable to the region should be selected for cultivation. Crop varieties and cultivars tailored to specific micro-niches surrounding homesteads are essential and easily accessible resources for subsistence and impoverished farmers to ensure a stable income (Sthapit et al., 2004).

Farmers intentionally use crop diversification as a means of ensuring subsistence, and it offers a number of benefits. According to Tesfaye Abebe (2013) and Habtamu Hailu (2008), these include yield stabilization, risk reduction, multiple production, staggered family labor use, utilizing a range of soils and agroclimatic conditions, and increased resource productivity over time. Crop diversity and area vary over time and space. The vertical stratification of the integrated enset-coffee multistory units is referred to as spatial variation. Other features of these agroecosystems include temporal variation in plant species richness and composition at time intervals (Tesfaye Abebe, 2005).

The home gardens are widely distributed throughout the country and are home to a range of taxa of cultivated perennial and annual crop species and varieties (Belachew Wassihun et al., 2003). Home gardens in Ethiopia provide a wide diversity of crop plant species in human-managed landscapes with different indigenous knowledge about management practices and other significant roles in food security and ecological importance. The high diversity of crop plants in home gardens is shown by researchers such as Reta Regassa (2016) and Debissa Lemessa and Abayneh Legesse (2018).

2.4.3. Contribution of home gardens to food security and nutrition

Home garden agroforestry systems in the tropics are known for their structural complexity and diversity of crop and other plant species (Megabit Beyene et al., 2018). Over time, home gardens and traditional food systems have been adjusted to fit local ecological and cultural contexts. They provide smallholder farming communities with a year-round range of nutrient-dense crops in many tropical and subtropical climates (Whitney et al., 2017). Home gardens can be a great help when primary crops fail and there is a food shortage. They are a means of promoting agricultural diversification, which can produce a range of resources, such as firewood, healthy foods, commercial products, medicinal plants, herbs, and spices.

Home gardens have a special place in nutrition, food security, and agriculture. Household gardens are also an effective way for low-income groups to make use of scarce resources, such as time, energy, money, and land (Chadha et al., 2017). Women, who usually prepare

meals for the family, have a substantial source of income without directly defying social and cultural norms that limit their activities. Children and the elderly are examples of other family members who can work. These gardens serve as diverse agricultural areas where rural women grow vegetables and spices to meet a range of domestic needs and make a little cash (Gari, 2003).

2.4.4. Factors affecting crop plant species diversity and composition of home gardens

Home gardens have a special place in nutrition, food security, and agriculture. Household gardens are also an effective way for low-income groups to make use of scarce resources, such as time, energy, money, and land (Chadha et al., 2017). Women, who usually prepare meals for the family, have a substantial source of income without directly defying social and cultural norms that limit their activities. Children and the elderly are examples of other family members who can work. These gardens serve as diverse agricultural areas where rural women grow vegetables and spices to meet a range of domestic needs and make a little cash.

Cultural preferences and other environmental factors impact plant diversity and yield in home gardens. According to Tefera Mekonen et al. (2015) and Talemos Seta et al. (2013), a variety of factors influence the situation, such as socioeconomic status, soil fertility, garden size, rainfall pattern, distance from home, management system, lack of access to water, proximity to roads and markets, cultural preferences, personal preferences/perception, and the presence of pests and weeds.

2.4.5. Management of home gardens

Native skills and practices have created the intricate architecture of home gardens and the patterning of plant categories within them (Zemede Asfaw, 1997a; Shrestha et al., 2002). The home gardening culture has evolved a general framework that enables garden owners to cultivate the crops they desire and to oversee and guide a large portion of the garden's development. Germplasm is freely shared among friends, neighbors, family, and acquaintances. Traditional methods of limiting uncontrolled germplasm transfer from household-grown home gardens were also noted (Shrestha et al., 2002).

The majority of gardens are owned by individual families, with the head of the household overseeing general management. In addition to designing the structure, choosing suitable sites for major crop placement, and keeping an eye on the structure and direction of garden

development, the male head of the family is responsible for managing the garden's space and plant components (Fernandes et al., 2002). In addition to labor-intensive banana and enset gardens, the contribution of men is more significant in large gardens and gardens that are dominated by cash crops like chat and coffee (Zemede Asfaw, 2002).

Most gardens are owned by individual families, with the head of the household overseeing general management. Along with designing the structure, choosing suitable sites for major crop placement, and keeping an eye on the structure and direction of garden development, the male head of the family is also responsible for managing the garden's space and plant components (Fernandes et al., 2002). In addition to banana and enset gardens that demand hard labor, the contribution of men is more significant in large gardens and gardens that are dominated by cash crops like chat and coffee (Zemede Asfaw, 2002). In addition to identifying local varieties and managing mostly minor plants like vegetables, spices, tasty varieties, and plants with medicinal value, women are also aware of the uses of plants and how to maintain them (Talemos Seta et al., 2013).

2.5. Geographical distribution of home gardens

According to Hoogerbrugge and Fresco (1993), a home garden is a small-scale, supplemental food production system by and for household members that mimics the natural, multilayered ecosystem. Based on their ability to enhance household well-being, home gardens are divided into two categories. The most common types of home gardens in the tropics are small-scale supplemental food production systems around homes in areas where the owner's income depends on other land uses or other activities. A wide range of urban, semi-urban, and rural gardens fall under this category. The second type includes home gardens around homes that are extended to farm fields that are the main source of income for farming households. The highlands of Eastern Africa are where these are most common (Oduol and Aluma, 1990; Rugalema et al., 1994). Home gardens are also very popular in the tropical and subtropical regions of China. Home gardens are most common in the humid and subhumid regions of Asia, but they are found in many ecological regions, especially the tropical highlands of Asia, Africa, and Mesoamerica (Nair, 1989). Home gardens are a long-standing tradition in many rural African communities, especially in humid and sub-humid areas (FAO, 2001). They comprise a significant agricultural region that typically contains a diverse range of plants, particularly those with high micronutrient qualities.

2.6. Sustainability of Homegardens

Home gardens and other multi-species agroforestry systems are examples of traditional agricultural systems that are often cited as a proven model for sustainable production systems. Achieving production that is adequate to satisfy the demands of both current and future populations while preserving or improving the land resources that support that production is known as sustainable land use (Huxley, 1999). Wiersum (2004) asserts that the term "sustainability" is frequently used solely to describe stable, current circumstances, but it should also take into account the shifting needs of future generations and social dynamics. Accordingly, a sustainable agroecosystem should also be able to react to and modify changes in the socioeconomic and environmental landscape (Gliessman, 1990). Home gardens are frequently regarded as sustainable because they have been successfully maintained for centuries (Fernandes et al., 1984) or because they are associated with the same ecological processes and functions as natural forests (Hochegger, 1998).

2.7. Species diversity, evenness and Similarity

Biodiversity is the total variability of all living organisms and the ecological systems in which they exist. Species diversity is measured by the number of species richness (which shows how many different species there are in a given area or community) and their relative abundances (which show how even or uneven the species are) within the sample or community (Kent, 2012). Analysis of species diversity, evenness, and similarity is used to characterize plant communities. It is determined by species richness, or the number of species present, and species evenness, also known as species equitability or abundance of each species, or the even distribution of individuals among these species (Magurran, 2004). According to Kent and Coker (1992), the species diversity and equitability of a plant community are used to examine relative differences both within and between the communities and to help explain the underlying causes of those differences. Species variety is one of the most crucial markers of sustainable land use practices, and substantial resources are being used to identify and implement strategies that will halt the current decline in biodiversity at the local, regional, and global levels (Getaneh Belachew, 2006).

A plant community's species diversity and equitability are used to analyze relative differences within and between the communities and to help identify the underlying causes of those disparities, according to Kent and Coker (1992). At the local, regional, and global levels, significant resources are being used to find and put into practice strategies that can stop the

current decline in biodiversity. Species variety is one of the most important indicators of sustainable land use practices (Getaneh Belachew, 2006).

2.8. Benefits of Home gardens

Homegrown crops offer a privileged basis for nutritional quality and an extra food source in rural communities. They might also become a source of income. They assist in coping with periods of scarcity and the failure of staple crops. Among the many resources that can be obtained from the variety of crops that home gardens typically or may contain are wholesome foods, marketable goods, firewood, herbs, spices, and medicinal plants.

2.8.1. Home garden contribution to the family health

It has been shown that even moderate and mild energy malnutrition contributes to child mortality, and micronutrient deficiencies are associated with an increased risk of maternal and child mortality (Kiss et al., 2001). Home gardens are one way to fight hunger and micronutrient deficiencies. Poor households may only have access to fruits and vegetables, even though animal products are the best source of micronutrients (Talukder et al., 2000; Bloem et al., 1998; Reddy, 1995). A substantial amount of the fruits and vegetables consumed by home gardening families are produced in their gardens, per multiple surveys. It is relatively easy to determine whether a home gardening program has increased the production and consumption of fruits and vegetables, but it is more challenging to determine how home gardening has impacted nutritional status (HKI/AP, 2003). Nonetheless, a number of studies have discovered a connection between home gardens and better nutrition in the home.

2.8.2. Home gardens Environmental Benefits

The diversity of plant species and the layered canopy of species, which frequently consists of intermediate layers between a herbaceous layer near the ground and a tree layer higher above, are the most noteworthy features of all home gardens (Nair, 1993). The varied home garden can provide a home for wild species such as insects, birds, reptiles, and small mammals (Cristanty, 1990). Nutrient recycling is the main element affecting home gardens' ecological rationality (Gajaseni, 1999). A detailed examination of four traditional home gardens revealed that the household did not harvest anything that could be gathered, ensuring the export of animal nutrients from the system. Additionally, there was more plant litter in the home garden than in a typical tropical forest, which should contribute to the incredibly

efficient recycling of nutrients (Gajaseni, 1999). It is an integrated system in which solar energy is transferred to people and animals through plants, and materials are recycled and cycled. In home gardens, reusing plant cover reduces soil erosion, leaching, and exhaustion (Soemarwoto, 1985). Fernandes and Nair (1986) assert that the coexistence of herbaceous and woody species provides essential nutrients and aids in soil conservation.

2.8.3. Contribution of home gardrns in agrobiodividersity conservation of plant genetic recourses

Agricultural biodiversity refers to the genetic, species, and ecosystem-level diversity and variability of plants, animals, and microbes that make up the whole agroecosystem that farmers actively manage (Cromwell et al., 1999). In tropical home gardens, the spatial arrangement of trees, shrubs, vegetables, crop species, and animals is highly varied (Mergen, 1987). The high species diversity of home gardens serves a number of socioeconomic and ecological purposes, including producing food and a wide range of other products like firewood, fodder, spices, medicinal plants, and ornamentals (Christanty, 1985; Martenand Abdoellah, 1988; Gliessman, 1990), as well as preventing environmental degradation typically associated with monocultural production systems (Fernandes and Nair, 1992).

This is largely due to efficient nutrient cycling and relatively low risks of leaching and soil erosion.

Introducing new crops is usually a feasible and desirable strategy because home gardens provide a great deal of flexibility with little agroecological impact. To improve the agrobiodiversity foundation of home gardens, a variety of crops can be utilized, including leafy vegetables, fruit vegetables, root crops, and legume crops. Home gardens typically include a variety of agrobiodiversity, fruit trees, and vegetable crops. Considerations like seed access and seed multiplication are necessary for home gardens to succeed and keep growing (FAO, 2001).

CHAPTER 3

3. MATERIALS AND METHODS

3.1. Descriptions of study area

The current study was carried out in the Horo Guduru Wollega Zone of the Oromia Regional State in Western Ethiopia, specifically in the Abay Chomen district. The district is physically 364 kilometers from Addis Ababa and 48 kilometers from the Shambu zonal center. The study area is located geographically between latitudes $9^0$34' and $9^0$45'N and longitudes $37^0$10' and $37^0$21'E. Lake Fincha borders this research area on the south, Horo borders it on the southwest, Amuru Jarte borders it on the northwest, Sulula Fincha borders it on the north, and Guduru borders it on the east and south. The area is located between altitudinal ranges of 880 and 2400 meters above sea level.

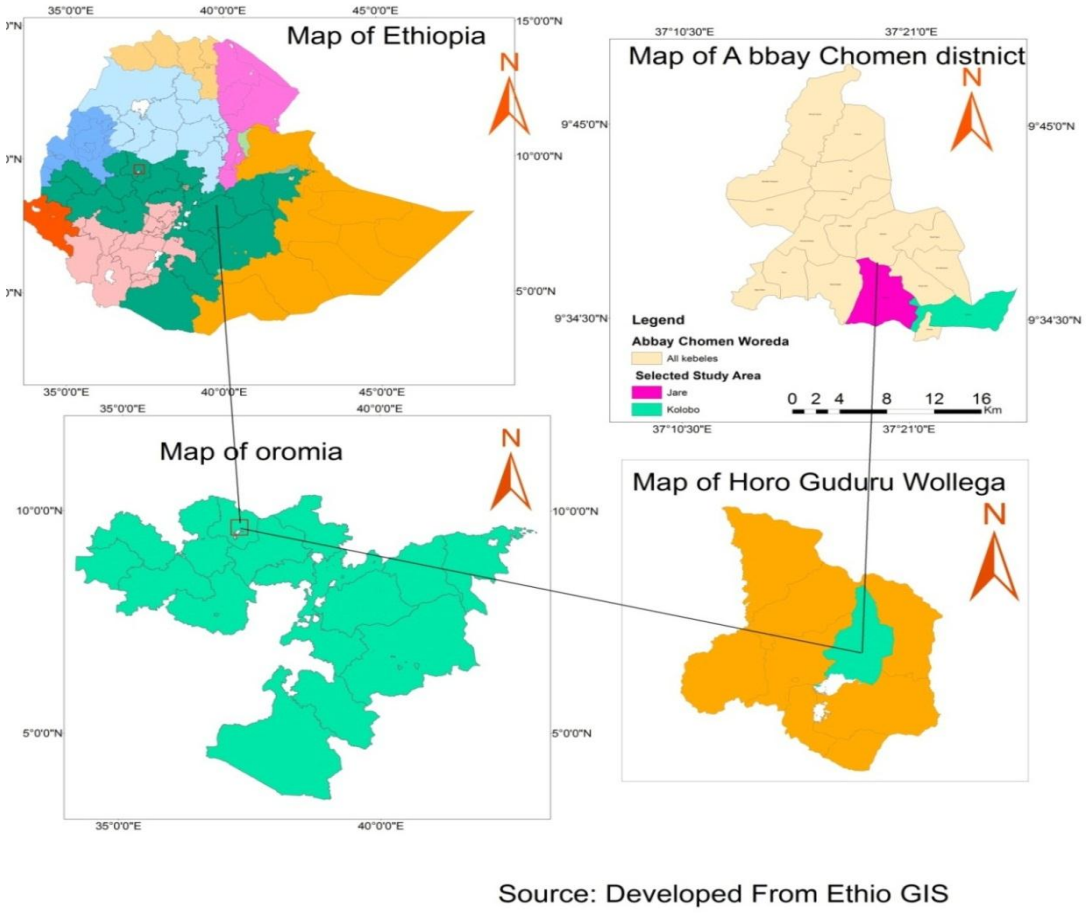

Figure 1. Location of the study area map (source: ETHIO-GIS)

3.1.1. Physical and Biological of the Study Area

Climate

The study used temperature and precipitation data from 2010 to 2017 from the Shambu meteorological station (EMSA, 2016). The unimodal rainfall distribution is characterized by a long rainy season (June to September) with heavy rain and a short dry spell with showers from mid-February to April. There is a long dry spell from October to the end of February (H.W.R.D.O., 2017). With little to no precipitation in January and February and a peak rainfall period from May to October, followed by a decrease in November and December, the study area receives an average of 1566 mm of rainfall annually.

With the lowest recorded temperature of 10.780°C and the highest recorded temperature of 22.320°C, the average annual temperature is approximately 16.60°C. July through December are the coldest months, with mean low temperatures of 9.800°C. February through May are the hottest months, with the highest recorded temperature of about 24.60°C. The three agroclimatic zones of Abay Chomen District are 10.24% tropical (Kolla) 500-1500m, 87.5% subtropical (Woina Dega) 1500-2300m, and 0.5% temperate (Dega) 2300-3300m, according to the traditional classification system (EFAP, 1994).

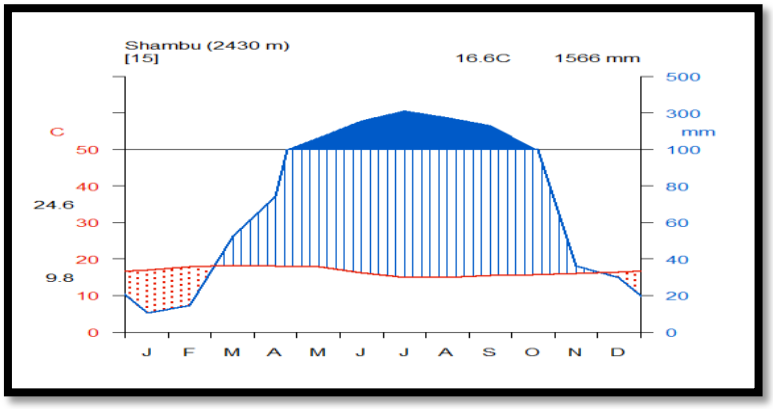

Figure 2. The Climate diagram for Abay Chomen Shambu Town. Source: EMSA, 2024/5) (2004-2024/5).

Vegetation

The vegetation of Abay Chomen Woreda, Ethiopia, consists of a mix of arable, woodland, grassland, and mountainous .

17.82 percent are pasture (grazing), and 75.24 percent are arable or cultivable. Forest: 5%; other use: 2%.(FWAO)

The Abay Chomen District was in the Oromia National Regional State of Ethiopia. The region receives a lot of rainfall during one season of the year. Small-scale farmers have always dominated the agricultural practices in the area. The crops grown in the area include teff, maize, niger seed, and root and tuber crops like potatoes and "anchotes." Shrubs and herbs make up the majority of the medicinal plant species found in Abay Chomen Woreda.

Soil and Topography

The geology and soil of Ethiopia belong to the geological structural units of the Horn of Africa. The most common forest soils in Ethiopia are red or brownish ferrisols, which are formed from volcanic parent material. The soil type in the district is sandy loam. However, the soils in the forest area are visually observed to be darker reddish in color with concentrated humus because of the strong eroding forces along the vegetation cover.

Economic Activities

The main economic activity in the administrative district of Abay Chomen is agriculture. In the past, the main sources of income were crop cultivation and animal husbandry. The most widely grown crops in the region were cash crops like mango, orange, and avocado, as well as maize, teff, sesame (salit), and nug (Niger seed). Livestock includes things like cows, sheep, goats, chickens, and so forth. Vegetables planted in different kebeles include sweet potatoes, tomatoes, green peppers, and potatoes (FWAO, 2025).

3.1.2. Population and Land Use

According to the CSA's 2017 population and housing census, the total population of the Abay Chomen district was 41,019, consisting of 17,877 women and 23,142 men. Animal rearing and agricultural production are the main sources of income for the majority of people in the study area.

The functional categories that people in the research area use to use and classify their land are grazing, browsing, farming, and forest land. The Abay Chomen Woreda Agricultural Office's 2017 annual report states that 19,887 hectares, or 4,712 hectares, are under cultivation.

Eleven hectares are used for grazing, 1,320 hectares are covered by forest, and 512 hectares are used for other purposes.

3.2. Research methods

3.2.1. Selection of study area

The study sites were selected in October 2025 during a general reconnaissance inspection. Among the weredas in the Horo Guduru Wollega Zone, Abay Chomen Wereda was selected at random for the current study. 102 homes were chosen at random from a total of 392 households to determine the home garden's location in relation to the dwelling house surrounding the homestead and to gauge the number of home gardens. Of the twenty-one (21) kebeles in Abay Chomen Wereda, two (2) were randomly selected for closer inspection (Jare and Colobo).

3.3. Data collection

Ethnobotanical data was collected primarily through semi-structured interviews, preference ranking, direct matrix ranking, paired comparison, and market surveys with the selected knowledgeable elders between November and February 2024. The interviews and conversations were conducted in Oromo. Interviews took place in a setting that made interviewees feel comfortable and free to voice their opinions.

Free listing

Free listing is a first step in ethnobotanical data collection. Fourteen (14) randomly selected informants were asked to categorically list the plant species in their garden using their colloquial names in order to characterize the variations in gardening knowledge and practices among home garden owners. Martin (1995).

Semi-structured interviews

The interviews and questions arise during the time of conversation to collect data regarding the management and conservation practices of home garden plant species, to what extent conservation practices are undertaken by the people in home gardens, and for what purpose do people in the study area use home gardens (household food supply, shade aesthetics and ornamentation, fuel wood production for use and for sale, etc.)?

Preference ranking

A preference ranking technique was employed with informants to rate a few selected home garden species according to their value or desirability. Martin (1995) describes preference ranking as a method for classifying five to seven items based on a predetermined criterion. Each rank is given an integer value between 1 and 4, where the most important item is given the highest value and the least important item is given the lowest. The 14 informants were given six marketable plant species that they could grow in their home gardens and asked to arrange them however they saw fit. A preference ranking technique was employed with informants to rate a few selected home garden species according to their value or desirability. Martin (1995) describes preference ranking as a method for classifying five to seven items based on a predetermined criterion. Each rank is given an integer value between 1 and 4, where the most important item is given the highest value and the least important item is given the lowest. The 14 informants were given six marketable plant species that they could grow in their home gardens and asked to arrange them however they saw fit. It is believed that the plant with the highest value is the most desirable, and the one with the lowest value is the least desirable. The numbers for each respondent are added to get an overall ranking of the items by the selected group of respondents.

Direct matrix ranking

According to Martin (1995), direct matrix ranking is an analytical method that asks participants to simultaneously rank their favorite plants in their home garden according to several criteria (medicinal, spices, and medicinal). Each order was given a numerical scale, where the "best" item was represented by the highest number and the "worst" item by the lowest. Based on data gathered from selected informants, six multipurpose tree species were selected, and each attribute was assigned a score (5 = best, 4 = very good, 3 = good, 2 = less used, 1 = least used, and 0 = not used). In the end, fourteen respondents' responses were added to create a matrix that represented the community.

Market survey

A market survey has been carried out to document the types and quantities of food and other plant products that have market values in one local market in the study area by interacting with producers, sellers, and consumers. This is in addition to gathering vegetation data in home gardens.

Field survey

Given the importance of identifying trends in attitudes, opinions, behaviors, or characteristics of a large group (population), a field survey was employed as one method of data collection. Therefore, using the proper surveying techniques, the information required for each forest factor was evaluated.

Questionnaire

It is among the primary techniques used to gather data. It is employed to elicit crucial information from the informants. In order to produce some qualitative and quantitative data analysis, this was set up as both open-ended and closed-ended questions.

Key Informant Interview

The purpose of this study was to gather information about Abay Chomen woreda from professionals, residents with firsthand knowledge of the forest, and well-connected and knowledgeable community experts (leaders). Initially, Martin (1995) purposively selected and interviewed 15–20 respondents whose experiences with the forest were gathered from other groups.

Field Observation

To evaluate the variety and upkeep of home gardens in Abay Chomen woreda, it is crucial to supplement the data gathered using other techniques. The researcher created and employed checklists to gather the desired data while observing the study area (Martin, 1995).

3.4. Sources of Data

Both primary and secondary sources were used as data sources. Field survey quantification, focus group discussions, in-depth interviews with chosen informants, and field observation were the main sources of data. The documents of the zonal agricultural and rural development offices and the woreda, on the other hand, provided the secondary data.

3.5. Sampling Size and Sampling Technique

The total number of 392 households in the two nearby kebeles to the home garden was used to calculate the number of responders. Using Cochran's formula, 102 respondents were chosen as the sample size from the two Kebeles. The survey sampling formula for determining sample size (Cochran, 1977).

$$n_0 = \frac{Z^2(p)(q)}{e^2} \quad \text{---------- (1)}$$

$$n = \frac{no}{1+\frac{no\_1}{N}} \quad \text{---------- (2)}$$

where z is the 95% confidence level, or 1.96, and no is the sample size for the proportion of the population.

The percentage of the population that will be included in the sample, p, is 0.1.

q is equal to 1 minus p, or 0.9.

The desired or actual sample size is e, which is the acceptable margin of error, which is 5% or 0.05.

The sample size is n.

The total number of households in the two kebeles is denoted by N.

After calculating for no, the value of no was entered into the second formula to determine the precise sample size.

$$n_0 = \frac{Z^2(p)(q)}{e^2} = \frac{1.96^2(0.1)(0.9)}{o.05^2} = \frac{0.345744}{o.05^2} = 138.2976$$

$$n = \frac{n_0}{1+\frac{no\_1}{N}} = \frac{138.2976}{1+\frac{138.2976-1}{392}} = \frac{138.2976}{1+\frac{137.2976}{392}} = 102$$

Consequently, 102 households made up the study's sample size. The people who would be included in the sample size were chosen in a methodical manner. The two Kebeles' households were sorted alphabetically for this purpose. Then, each Kth member of the entire population was selected to be included in the sample (K is the ratio that is obtained by dividing the population size by the desired sample size). where n is the sample size of the representative groups, K is the sampling frame, and N is the total number of households in the area (Burns, 1994). The sampling interval K = (N/n) =392/102=4 was used to systematically choose the sample size. Therefore, a representative from every fourth household was chosen to collect data, and the sample interval was 4. Those with extensive knowledge of the study area led or assisted with the fieldwork, chose the respondents' language, and received training to help those who had trouble filling out the questionnaires.

3.6. Data Analysis

Species diversity was investigated using the Shannon-Wiener Diversity Index. The index takes into account the species richness and proportion of each species in each of the quadrats sampled from the research site. Pie charts and graph drawings were created using Microsoft Office Excel 2010 following the computation of species richness, variety, evenness, frequency, and density. Species richness was calculated as the total number of species present in the sample plots.

Frequency

Frequency describes a species' distribution across the standards. A species is identified by calculating the proportion of plots or quadrants in a sample region that are home to that species (Martin, 1995).

$$F = \frac{\text{quadrants in which a species occurs}}{\text{Total number of quadrats in the sample}} \times 100$$

Relative frequency

Relative frequency is the number of occurrences of a species expressed as a percentage of all species' occurrences (Martin, 1995). The number of occurrences of a species expressed as a percentage of all species' occurrences is known as its relative frequency (Martin, 1995).

$$\text{Relative frequency} = \frac{\text{Frequency of a species in the sample}}{\text{Total frequency of all species in the sample}} \times 100$$

Density

Density is the average number of individuals of a species on a unit area basis. It is closely related to abundance but more useful in estimating the importance of a species (Martin, 1995).

$$\text{Density} = \frac{\text{Number of individuals in the sample}}{\text{Total area of the sample } (m^2)}$$

Relative density

Relative density is the number of individuals of a species as a percentage of the total number of individuals of all species in that area (Martin, 1995). The number of occurrences of a

species expressed as a percentage of all species' occurrences is known as its relative frequency (Martin, 1995).

Relative density = Number of individuals of a species in the sample x 100
Total number of individuals of all species in the sample

3.7. The similarity of home gardens in the study area

Sorenson's Index of Similarity will be used to compare the species composition of quadrats or samples.

The formula for the Sorensen Index is **2a/ (2a + b + c) = Ss**, where **Ss** is the Sorensen's similarity coefficient, **a** is the number of species that quadrats and samples share, **b** is the number of species in quadrats and samples, **1** is the number of species in quadrats and samples, and c is the number of species in quadrats and samples. **2** = The coefficient values fall between **0** (total dissimilarity) and **1** (total similarity), per Kent and Coker (1992). Using this method, the plant species found in residential gardens at two particular research area locations will be identified.

3.8. Shannon and Wiener Diversity Index

The Shannon-Weiner Index, which has a maximum value when all species are present in equal abundance and a zero value when there is only one species in the community, is the most widely used diversity indicator in plant communities (Shannon and Wiener, 1949).

$$H' = \sum_{i=0}^{s} \text{pi x lnpi}$$

H is the Shannon diversity index and **pi** is the proportion of the total population that is made up of species **I**.

ln is the natural logarithm to base e (**log e**), **Σ** is the sum of species **1** to species **S**, and **S** is the number of species encountered.

CHAPTER 4

4. RESULTS AND DISCUSIONS

4.1. **The socioeconomic characteristics of the respondents**

Table 1 indicates that the majority of farmers (36.79%) are men (82.35%) between the ages of 18 and 25. The results also indicate that the great majority of young people in the area work in farming systems. Given that unemployment is the main reason why many young people migrate to Nigeria, it is not implausible (Oyisola, 2011). People in this age group are usually motivated and creative, and they are also the ones who are economically active (Yunusa, 1999). Furthermore, it is implied that the low farming participation rate among adults (32.08%) jeopardizes food availability in the future. The low level of female participation in agricultural production implies that women are more engaged in other agricultural activities, such as farm product processing and sales. The farmers' modal education qualification is secondary education. 32.08% and 24.52% are illiterate. The level of education attained is sufficient to promote information sharing and exchange and ease the uptake of technology. According to Table 1, 41.7% of the respondents had only completed primary school, which facilitates the dissemination and promotion of technology meant to boost crop productivity and is consistent with the research findings of Lawal and Ayoola (2008).

The results imply that the farmers were likely to seek out information centered on productivity because the majority of them were literate. 32.35% of respondents said they had 0–5 years of farming experience, whereas 46.08% said they had 6–9 years. About 5.8% have been farmers for over a decade.

The findings show that most farmers are not new to farming and have been in the industry for a long time. Experience as a factor in risk management: Ridler and Hishamunda, (2001) assert that inexperienced farmers are more susceptible than experienced farmers. With farms ranging from 1 to 5 hectares to just over 6 to 10 hectares, the table also reveals that the vast majority of respondents are small-scale farmers. Small-scale farmers operate farms that range in size from 0.1 to 5.99 hectares, according to Olayide et al. (1980). While contact with extension workers was mostly weekly (14.6%), the majority (22) reported no communication at all from extension agents (44.7%). Extension contact is the main reason why crop farmers in Abay Chomen Special Woreda stop embracing new technologies, and it has been demonstrated to boost technology adoption (Oladele, 2005). Since most farmers (46.608%)

use mixed farming systems, extension agents should provide farmers with a range of farming system skills. The only agricultural systems in which some farmers are engaged are poultry (13.6%), grains (10.78%), cash crops (19.61%), beekeeping (3.92%), and animal rearing (6.2%). Extension agents must also closely monitor them to ensure that they produce at a standard level. Of the population, only 4.95% earn more than 20,000 birr, whereas the majority (50.50%) earn less than 10,000 birr and 45.55% earn between 10,000 and 20,000 birr (Table 1). Consequently, most farmers will hardly be able to meet their financial obligations.

Table 1: Socio - Economic Characteristics of Respondents

Variables		**Frequencies**	**Percentages (%)**
Sex	Male	84	82.35
	Female	18	17.65
Age	18- 25	39	36.79
	26-35	25	23.58
	36-45	34	32.08
	Above 45	8	7.55
Education	Illiterate	34	32.08
	Primary school	43	42.16
	Secondary school	25	24.52
Farming experience(Years)	0-5	33	32.35
	6-9	47	46.08
	Above 10	22	21.57
Type of farming most practice	Poultry	13	12.75
	Cereals	11	10.78
	Cash Crop	20	19.61
	Bee Keeping	4	3.92
	Live Stock	7	6.86
	Mixed Farming	47	46.08
Income level(Ethiopian birr)	Less than10,000	51	50.50
	10,000 -20,000	45	44.55
	Above 20,000	5	4.95

4.2. Local knowledge and home garden management in Abay Chomen Woreda

The basic home garden design developed by the locals is highly flexible and varied, enabling the production of the primary necessities for their daily lives. They have had success selecting crops that are co-adapted and provide a number of benefits. The area of land that encircles a farmer's home and gives him access to the fruits, vegetables, fodder, medicinal plants, and some culturally significant plants he needs on a daily basis is known as a home garden. The preservation of agrobiodiversity, a component of biodiversity conservation, depends on the relationship between local residents and plant resources. Marten, (1995).

According to some home gardeners in the research area, most of them cultivate vegetables during the rainy season and during times when water is scarce by fetching water and watering their plants at least twice a week. Some home gardeners believe that the continuous production of plants for domestic use is what sustains the ecological system and makes the garden sustainable. Farmers were trained by the developing agency in the study area to turn leftover plants and leaves from their home gardens into compost, which improved crop yields and maintained soil moisture. In an effort to reduce soil movement from upper slopes, a depositional phase has been established. Home gardeners planted bushes such as (*Rosmarinus officinalis*) near the homestead in areas that were vulnerable to erosion because of their market value in the study area. Home gardens were situated near homes or a little farther away, within four to six minutes' walking distance, in order to alleviate the land shortage and provide more cultivable space for home gardening. There were open areas and home gardens that were enclosed or partially enclosed. Live fences with trees and bushes to shield home garden plants from predators (domestic animals) were the most frequently seen management techniques. In some locations, fenced-in private gardens coexist with fields of crops. According to Mekonen Amberber et al. (2014), women were more involved than men in the management of home gardens. Another way to manage family gardens is to assign women a greater amount of responsibility because they are more involved in planting, watering, and weeding, while men are only involved in fencing (Mekonen Amberber et al., 2014). Besides recognizing indigenous varieties and caring for primarily small plants such as vegetables, spices, edible varieties, and medicinal plants, women also know how to preserve plants and their applications (Talemos Seta et al., 2013).

4.3. Plant species composition in home gardens of Abay Chomen Woreda

4.3.1. Plant Species Richness and Evenness

100 plant species (table 3) from 41 families were identified from the 100 home gardens that were inspected for this study (Appendix 5). The representative families and the number of species in each family are listed in Table 3. 13 species were found in the Fabaceae family, followed by 8 species in the Asteraceae and 6 species in the Solanaceae. All plant species found in home gardens were used to calculate the variety index and evenness (Table 2). This study also identified the most varied plant species. *Mangifera indica*, *Catha edulis*, and *Coffea arabica* were the most prevalent of these.

In the home gardens examined for this study, a total of 100 plant species were found. The most prevalent plant species in the home gardens of the research area were *Coffea arabica*, *Mangifera indica, and Catha edulis*. They can be grown separately or in combination. Home gardens in tropical regions have a greater diversity of plant species due to the more favorable rainfall and temperature conditions compared to temperate regions (Tesfaye Abebe, 2005). Because the study sites were situated in tropical areas with favorable environmental conditions, they consequently had a high crop species composition. These gardens usually have uneven plant abundance because some species *Catha edulis*, *Mangifera indica*, and *Coffea arabica* in particular are more common than others. The dominance of these plants is explained by their wide-ranging ecological and social roles within the systems. Both upper-story and lower-story crops can be grown alongside them. This intricate plant combination makes a substantial environmental contribution by reducing erosion, regulating temperature and water flow, and providing organic matter. The main plants in these gardens made it possible to see different stories. The existence of such distinct zones in Nicaraguan home gardens has been documented by Mendez and associates, (2001).

Since some species; Catha edulis, Mangifera indica, and Coffea arabica in particular are more prevalent than others, the plant richness in these gardens is typically uneven. The diverse ecological and social roles that these plants play within the systems account for their dominance. They can be planted alongside one another and with crops that are higher and lower up the tree. This complex combination of plants provides organic matter, controls water flow and temperature, and reduces erosion, all of which are very beneficial to the ecosystem. Due to the primary plants in these gardens, it was feasible to observe various stories. Mendez et al. (2001) have demonstrated that home gardens in Nicaragua comprise

multiple distinct zones. Mathewos Agize et al. (2013) documented 77 crop plants in the home gardens of Loma and Gena Bosa Districts of Dawro Zone, Southern Ethiopia, while Tesfaye Abebe (2013) reported 78 species from the Enset-coffee agroforestry home gardens in Southern Ethiopia.

This finding disagrees with the general scenario that Fabaceae is taxonomically diverse and, most importantly, that it contributed more to the ethnobotanical database of our country, Ethiopia (Solomon Tamrat, 2011, and Debissa Lemessa and Abayneh Legesse, 2018), and it agrees with the Habtamu Hailu (2008) result. The Rutaceae family had a larger share of the number of species of crop plants available in home gardens. Crop species in the Rutaceae family are more common than those in the Fabaceae, which may be due to the fact that data collection occurred after the Fabaceae annual crops were harvested. The variation in crop species richness across different locations can be caused by a variety of factors, including environmental factors, farmers' management practices, land use and management intensities, socioeconomic disparities, and the amount of space available in home gardens (Getahun Haile et al., 2017; Debissa Lemessa and Abayneh Legesse, 2018). Sthapit et al. (2004) state that the variety and unique composition of plants in home gardens of crops vary based on the environmental conditions in which they are grown as well as the farmers' and their families' opinions of those crop plants. The crop is as important as enset and has the highest cultural value. According to research by Tadesse Kippie (2002), Belachew Wassihun et al. (2003), Tesfaye Abebe (2005), and Talemos Seta (2007), enset is a basic staple food that is kept as the mainstay species of home garden components in many southern nations and nationalities, and coffee and/or chat are major cash crops in southern Ethiopian farming systems. In general, regional differences in species richness may be caused by variables like soil type, altitude, species preference, and income inequality. Ewuketu Linger et al. (2014).

4.3.2. Plant species diversity

Plant species richness differed from one location to another. The findings of this study are inconsistent with the report by Debissa Lemessa and Abayneh Legesse (2018) on the variety of crop plant species in the Abay Chomen District of Western Ethiopia. The diversity in this study is lower than that of Tesfaye Abebe (2005), who studied home gardens in the Sidama zone of southern Ethiopia, and Whitney et al. (2017), who recorded $H = 1.41$ and $H' = 1.61$ at the district level, respectively. The results of the new study also revealed a maximum value of $H = 2.19$, which is higher than the results of the previous findings, and a minimum value

of H = 1.35 at the study sites, or kebele level, which is lower than the results of the previous findings. Jare (H = 1.67) and Kolobo (H = 2.19) had the highest diversity index values.

Table 2: Total and average number of crop species, mean values of the Shannon (H') and Evenness index for the two study sites.

Study Sites	Number of plant species			Shannon's index	Evenness index
	Total	Mean	SD	H'	E = H'/H' max
Jare	40	11.27	1.64	2.19	0.593
Kolobo	33	10.54	1.90	1.67	0.477

Among the 100 species (100 spp.), there were 39 herb species, 34 tree species, 20 shrub species, and 7 liana species (Figure 3). *Ficus sur* (harbuu), *Acacia abyssinica* (laaftoo), *Croton macrostachyus* (bakkanniisa), *Eucalyptus camaldulensis* (bargamoo diimaa), and *Eucalyptus globulus* (bargamoo adii) were the most prevalent tree species. This is due to the fact that people in Fincha town are planting trees of different kinds that are sold at the market and nurseries. In the home gardens, *Rhamnus prinoides* (geeshoo), *Catha edulis* (caatii), and *Rosmarinus officinalis* (Siga-metibesha) were the most prevalent shrub species. *Brassica oleracea* (Goommana), *Allium cepa* (Qullubbii diimaa), and *Allium sativum* (Qullubbii adii) were the most frequently found herb species in home gardens. In home gardens, *Caesalpinia decapetala* (Arangamaa) was the most common liana. 100 species from 41 groups were found in the 16 home gardens that were examined.

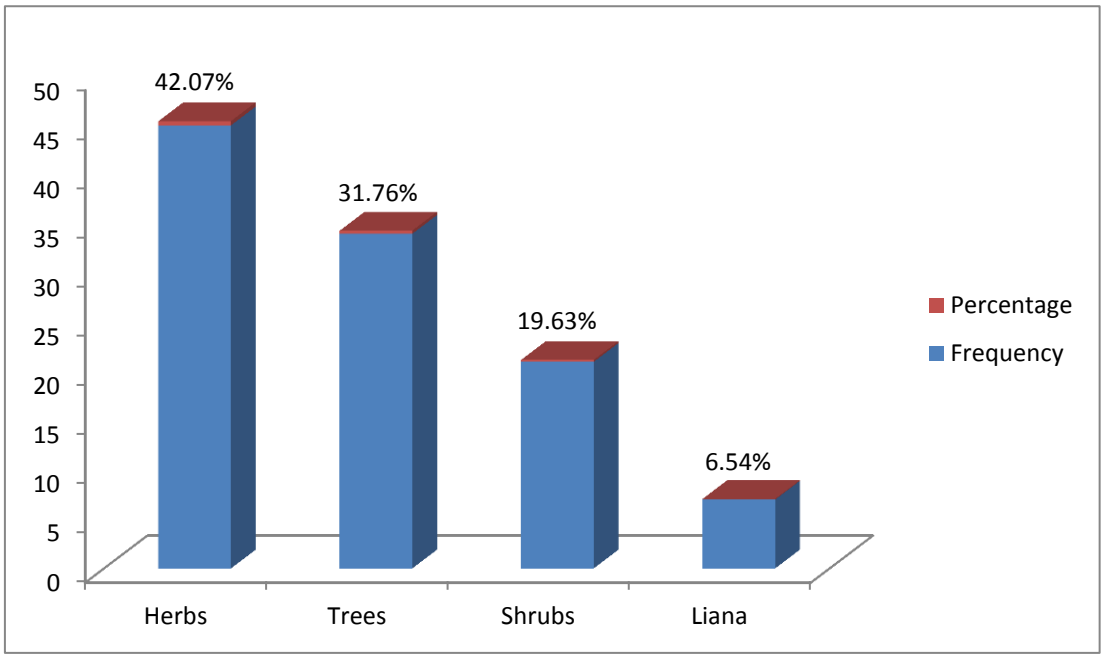

Figure 3. Diversity of species in the home gardens of Abay Chomen woreda

One hundred species (100 spp.) under 41 families were recorded from the set of 16 home gardens surveyed (Appendix 5). The representative families and number of species under each family are given in Table 3.

Table 3: Families with number of species recorded in the study area

Family Name	Species No.	Family Name	Species No.
Fabaceae	13	Cactaceae	1
Asteraceae	8	Acanthaceae	1
Solanaceae	6	Lauraceae	1
Rosaceae	6	Scrophulariaceae	1
Rutaceae	5	Musaceae	1
Poaceae	4	Nyctaginaceae	1
Myrtaceae	4	Phytolaccaceae	1
Brassicaceae	4	Pinaceae	1
Anacardiaceae	4	Broaginaceae	1
Amaranthaceae	4	Annonaceae	1
Euphorbiaceae	3	Apocynaceae	1
Malvaceae	2	Caricaceae	1
Moraceae	2	Celastraceae	1
Agavaceae	2	Chenopodiaceae	1
Alliaceae	2	Polygonaceae	1
Apiaceae	2	Proteaceae	1
Cucurbitaceae	2	Rhamnaceae	1
Verbenaceae	2	Rubiaceae	1
Oleaceae	2	Salicaceae	1
Simaroubaceae	2	Santalaceae	1
Cupressaceae	1		

4.3.3. Richness in functional groups of plants

The known plant species and their functions are listed in Appendix 2. The wide variety of crop species found in home gardens has been shown by researchers such as Reta Regassa (2016), Debissa Lemessa, Abayneh Legesse (2018), and Bayisa Dugasa (2021). Of my study, it was found that of the 100 species (100 spp.), 6.20% were medicinal plants, 9.90%

were constraction plants, and 32.10% produced food (fruits, vegetables, legumes, and pulses) (Figure 4).

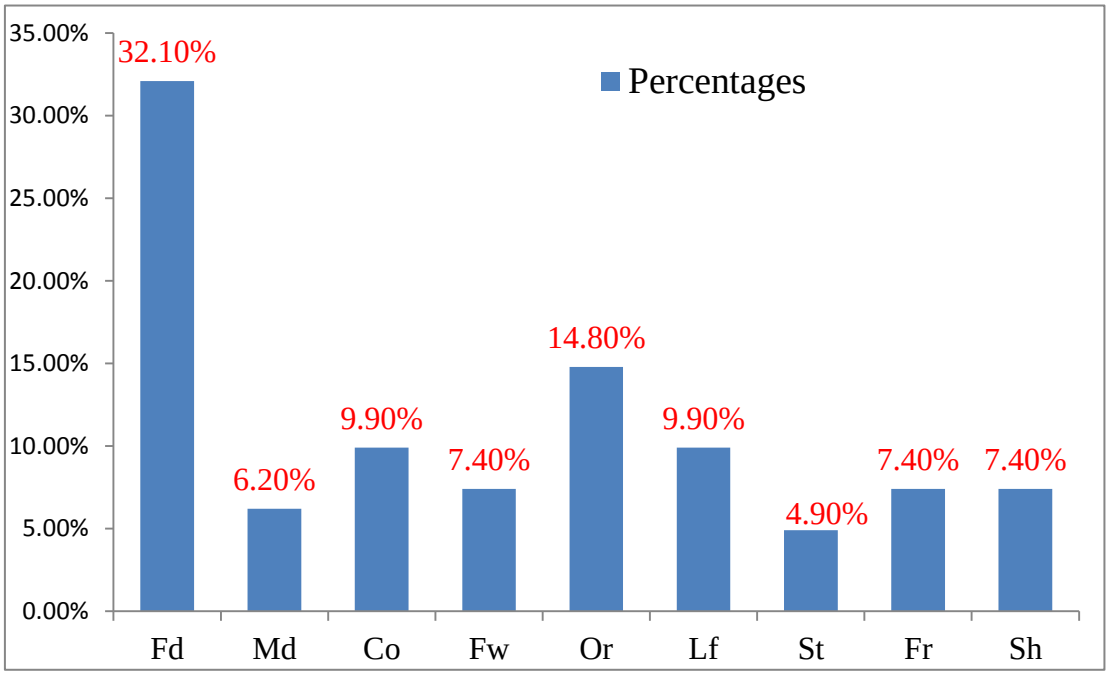

Figure 4: Use and category of plant species with their percentage occurrence

4.3.4. **Using home gardens as a source of nutrition**

Plants that produce food are cultivated and made available all year round in the research area. However, a wider range of nutrient-supplying home garden products are available during the main rainy season, which lasts from June to September. According to informants who participated in the interview, even home gardening families who are skilled at cultivating a wide range of plants are ignorant of the nutritional value of fruits and vegetables. Raising awareness and educating people about the nutritional benefits of food-producing plants in home gardens is therefore crucial. The cultivated food-producing species (leafy vegetable crops, root and tuber vegetable crops, and fruit crops) are given in Appendix 2. There are also plant species commonly used as both medicine and food by local people (*Allium sativum*, *Carica papaya*, *Cucurbita pepo*). The mode of preparation for the remedy of health problem five nutraceutical plants reported by key informants is given in Table 4.

Table 4: Medicinal and food plant species recorded from the study area

Botanical name	Part used	Health problems	Preparation methods
Allium sativum	Bulb	Headache, abdominal cramp and flu	The bulb is eaten and *Zingiber officinale.*
Carica papaya	Seed	Intestinal parasites	Eaten Fresh seeds
Cucurbita pepo	Seed	Tapeworm infection	Eaten and swallowed.
Ensete ventricosum	Corm	Broken legs and arms	The tuber is boiled and is eaten to get better from injury.
Punica granatum	Leaf	Tapeworm infection	The ingredient extracted by boiling from the leaves was reported to be used as a tape worm remedy.

4.3.5. **Medicinal plant species that are found in home gardens in the research area**

Residents in the study region use medicinal plants grown in their backyards to help them meet their daily medical needs. From the current study, 12% of the species of medicinal plants were identified. When it came to habitat diversity, the most common species were herbs and shrubs. The most popular traditional medicinal herbs and parts are listed in Table 5.

Table 5: Species of medicinal plants widely used in the home garden of Abay Chomen woreda

Botanical name used	Local name	Part
Allium sativum	Qullubbi-adii	Bulb
Artemisia absinthium	Ariti	Leaf
Calpurnea aurea	Ceka	Seed, Root
Cymbopogon citratus	Tejsar	Root
Ensete ventricosum	Kocho-diimaa	Corm
Mentha spicata	Nana	Leaf
Ruta chalepensis	Tiena'adamii	Leaf
Withania somnifera	Gizawa	Leaf

4.3.5. Marketed home garden species

Farmers benefit from homegardens in several ways. Home garden act as reserve banks of food and cash for farmers. Even though the study on the economic status of the local people is not considered in this study, income from home gardens was different with the size of the home gardens. Farmers who have large home garden size were getting more income because of having large home garden size they produce more crops. The farmers in the study area give priority to cash crops for their financial needs. The proximity of farms to markets had a negative effect on crop species richness. Farmers near marketplaces grow a slightly smaller variety of crops because market accessibility encourages them to focus on creating marketable goods and purchasing consumables. Farmers can cultivate cash crops like *Rosmarinus officinalis* (Siga-metibesha), *Rhamnus prinoides* (geeshoo), and *Catha edulis* (caatii) for local markets (Fincha and Migiru) thanks to the road access in almost all study sites. These home garden products come in both fresh and dried forms. It was discovered that farmers who had a medium-sized home garden worked their gardens very hard. By focusing on a few lucrative crops for the market and purchasing the remainder for their own use, they might be able to boost their revenue from their home garden. Focusing on growing a few income crops while neglecting other benefits (like food security and nutritional needs) leads to decreased agrobiodiversity and the future of home gardens. The plant species are in great demand locally and are commonly found in home gardens in the study area. The common plant species found in home gardens in the study area are listed in Table 6. These species are highly sought after locally and are used to rank the data analysis preferences.

Table 6: Simple Preference ranking of frequently encountered plant species having market utility (1-7) 7- most valuable, 1- least valuable

	Respondents (R)															
Botanical Name	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	Total score	Rank
Artemisia absinthium	3	2	1	1	1	2	2	3	2	1	1	1	2	2	24	7
Catha edulis	7	6	7	7	7	7	7	7	7	5	6	7	6	7	94	1
Cymbopogon citratus	2	1	3	2	2	1	1	2	3	3	2	3	1	1	27	6
Myrtus communis	1	3	2	3	3	3	3	3	1	4	3	4	3	3	39	5
Rhamnus prinoides	5	4	5	5	5	5	6	5	4	6	5	6	5	5	71	3
Ruta chalepensis	4	5	4	4	4	4	5	4	5	5	5	4	4	4	61	4
Rosmarinus officinalis	6	7	6	6	6	6	4	6	6	6	7	5	7	6	86	2

4.3.6. **Similarities between home gardens of study area**

Sorenson's Index was calculated for the species present in the sixteen home gardens. A similarity in overall plant composition across homegardens (Figure 5) indicates that the similarities among groups of home gardens are not consistent. It is highest between Jare and kolobo. This was a result of different factors like anthropogenic (exploitation or disturbances), physical factors like soil, slope, etc., and related to the altitudinal variation on which most of the classifications were based.

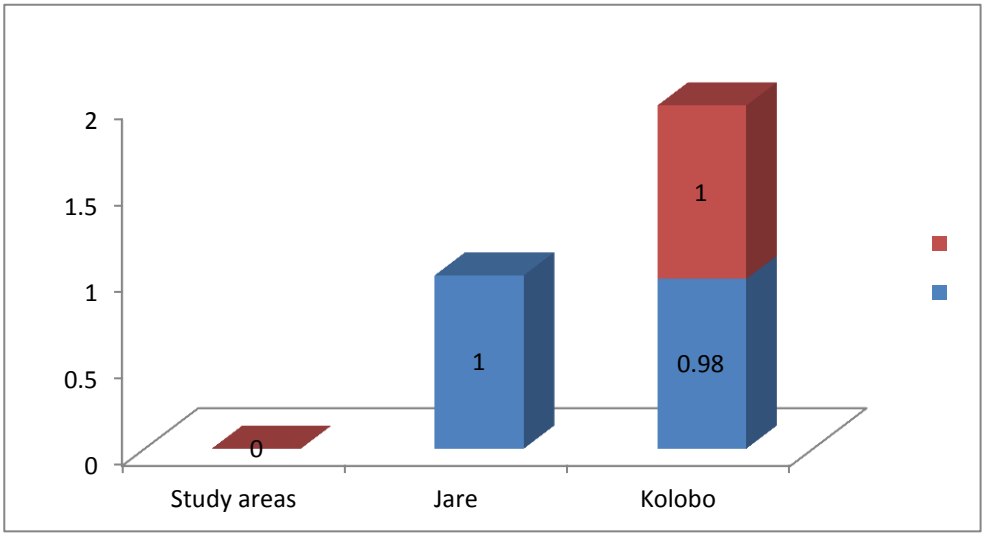

Figure 5. The sorenson's index of species similarity between two selected locations

4.3.7. Multiple-use tree species encountered at the research site

Residents of the study region cultivate a wide variety of plant species in their home gardens for a number of reasons. Direct matrix ranking was computed for six tree species found in sampling home gardens based on the selected use criteria of each plant as reported during ethnobotanical data collection. Crafting, fence construction, house construction, and home furnishings are just a few of the uses for these trees. Table 7, which is the total of each plant's scores, displays the findings from fourteen key informants.

Table 7: The results of 14 key informants' direct matrix ranking for 6 home gardens tree species with multiple uses

Botanical name	***Cordia africana***	***Croton macrostachyus***	***Acacia abyssinica***	***Acacia albida***	***Juniperus procera***	***Eucalyptus globulus***
Construction	39	20	31	35	63	73
Soil fertility	37	29	51	59	27	-
Furniture	64	41	47	37	41	27
Charcoal	33	25	59	55	24	58
Shade	47	35	49	31	37	23
Live fence	30	21	31	23	65	58
Medicine	34	61	23	17	36	62
Total score	284	211	291	257	293	301
Rank	4	6	3	5	2	1

4.3.8. Abundance, density and relative density, occurrence of woody tree species

To determine plant abundance, each location's individual plants must be counted by species. It can be used to display spatial distribution and ranges over time (Kent and Coker, 1992; Van der Maarel, 2005). Table 8 below shows that *Ficus sur* (Harbuu) has the lowest average number of individuals per unit area (0.02), while *Eucalyptus globulus* (Bargamoo adii) has the highest average number (0.20). It is closely related to abundance but more useful in assessing the significance of a species. The most prevalent tree species with the highest relative density among those found is *Eucalyptus globulus* (Bargamoo adii), which is followed by *Eucalyptus camaldulensis* (Bargamoo diimaa) and *Juniperus procera* (Gaattiraa). (Martin, 1995).

(Table 8). The availability of seedlings at the market and nursery locations in Abay Chomen town is the cause of this.

Table 8: Abundance, density, and relative density occurrence of woody tree species

Botanical name	Local name	Abundance	Density	R.density
Eucalyptus globulus	Bargamoo adii	20	0.20	21.74
Eucalyptus camaldulensis	Bargamoo diimaa	14	0.14	15.22
Croton macrostachyus	Bakkanniisa	11	0.11	11.96
Olea europaea	Ejersa	6	0.06	6.52
Cordia africana	Waddeessa	4	0.04	4.35
Juniperus procera	Gaattiraa	12	0.12	13.04
Persea americanaa	Abukaadoo	5	0.05	5.43
Mangifera indica	Maangoo	9	0.09	9.78
Carica papaya	Pappayyaa	3	0.03	3.26
Ficus sur	Harbuu	2	0.02	2.17
Acacia abyssinica	Laaftoo	6	0.06	6.52

4.3.9. Frequency and relative frequency of plant species

The home garden survey in Abay Chomen indicated that it comprises gardens with different sizes and shapes that include the animal houses, grain stores, and pieces of land intended for growing garden species. To determine the home garden's position in relation to the living house and its size, the surrounding the homestead was counted. Surveyed land surrounding the living Jare houses showed that 55 (52.38%), which has the highest percentage of plant species, followed by Kolobo, 50 (47.62%), and their gardens were found in their home, especially at the backyard of the living houses. The size of the home gardens sampled 10mx10m ($100m^2$) in 16 home gardens, two with different cultivated plant species (Apendix Figure 2). Among the smallholder farmers in the study area, notable differences in size, diversity, and composition were noted. The species composition varied more as the holding size increased. The same case was also reported by Tesfaye Abebe (2005) in her investigation of diversity in southern Ethiopia's home garden agroforestry system. The variety of plant species in a home garden grows with its size (Tesfaye Abebe, 2005).

Trees, shrubs, herbs, climbing plants, and food crops in various strata make up the home gardens in the study area. They include herbaceous plants up to one meter above the ground strata, fruit crops one to ten meters above the ground (Citrus sinensis), and trees roughly ten to fifteen meters above the ground (Cordia africana) in the upper strata. Table 9 lists the plant

species that are utilized as revenue generators in the study area and have the highest frequency and relative frequency of occurrence.

Table 9: The frequency of Home garden in each selected kebele

Kebeles	Number of households	Frequencies	Percentage
Jare	26	55	52.38%
Kolobo	26	50	47.62%
Total	52	105	100%

16 home gardens from 10 quadrants were counted in order to determine the species variety in the study area. Catha edulis (80.9%) was the most prevalent species in residential gardens in the study areas, while Arundo donax (45.2%) was the least common.

Table 10: Lists of plant species with the highest frequencies and relative frequencies in the study areas

Botanical name		Frequency (%)	Relative frequency
Scientific name	Local name		
Arundo donax	Shamboqqoo	45.2	1.63
Catha edulis	Caatii	80.9	2.94
Citrus aurantifolia	Loomii	47.6	1.73
Citrus sinensis	Burtukaana	52.3	1.89
Coffea Arabica	Buna	52.3	2.68
Malus *sylvestris*	Apple	71.4	2.59
Mangifera indica	Maangoo	78.5	2.85

4.4. Factors affecting species diversity in the Study location

Home garden species composition and organization may vary across different sites due to a variety of ecological, socioeconomic, and cultural factors, such as family tradition, household size and composition, environmental degradation, and distance from urban markets (Megabit Beyene et al., 2018).

Respondents stated that the primary factors affecting the variety and expansion of successful home gardens in the study area are the size of the garden, weeds, pests, and lack of water. Water availability or scarcity is the biggest barrier to home garden crop cultivation in the study area. The informants state that most home gardens in the study area are rain-fed and that the diversity of home gardens drastically decreases during the dry season due to a lack of

water. To keep up with the demand for water, watering the home garden and transporting it have become challenging and time-consuming tasks.

Garden products are regularly grown and harvested throughout the year in some homes' home gardens that have access to water sources. Home gardens in the selected kebeles ranged in size from 300 m² in many farmer associations and study area families to over 1000 m² in many other households. Some informants claim that the effects of pests on certain species limit the diversity of species found in home gardens. In the study area closest to the main road, Jare and Kolobo, gardeners, identified weeds as a contributing factor to the low diversity in some household gardens. Numerous factors, such as the size of the study area, weeds, pests, and a lack of water supply, affect the diversity of plant species, according to home garden owners. The variety and yield of plants in home gardens vary depending on the climate and cultural preferences. Numerous factors, including socioeconomic status, soil fertility, garden size, rainfall pattern, distance from home, management system, lack of access to water, proximity to roads and markets, cultural preferences, personal preferences and perceptions, and the presence of pests and weeds, all have an impact, according to Tefera Mekonen et al. (2015) and Talemos Seta et al. (2013).

Environmental variables and the ability of plant species to adapt are probably the causes of the observed variation. Numerous factors, such as knowledge and seed exchanges between family members and neighbors, elevation (temperature, rainfall, and soil qualities), a shortage of workers, microenvironmental conditions, and the presence of plant diseases, can cause crop variety to vary between research sites (Whitney et al., 2017). Additionally, respondents in the study area reported that plant diseases impacted plant species, particularly Citrus sinensis and Ensete ventricosum. When herbaceous and annual crops are harvested, plant diversity may decrease seasonally after increasing during the growing season. Other elements, such as management suitability, also had an impact (Tesfaye Abebe, 2005).

4.5. Major Constraint against the farm production of home garden

Figure10 shows that lack of water was rated the most serious constraint, 60 (58.8%), in farming and using home garden in the study area. About 13 (12.7%) of the farmers in the location are both economically resource –poor, who do not have adequate financial resources to acquire home gardens for their farm production, and have inadequate information. About 16 (15.7%) lack access to use home gardens.

Earlier findings in this study showed that the most of the farmers are small scale earners (Table1) who may not be able to afford the purchase of expensive home gardens inputs, and the development of sustainable production requires increased use of purchased inputs such as seeds, fertilizers, pesticides and equipment; however, acquiring these factors of production also demands the availability of adequate financial resources.

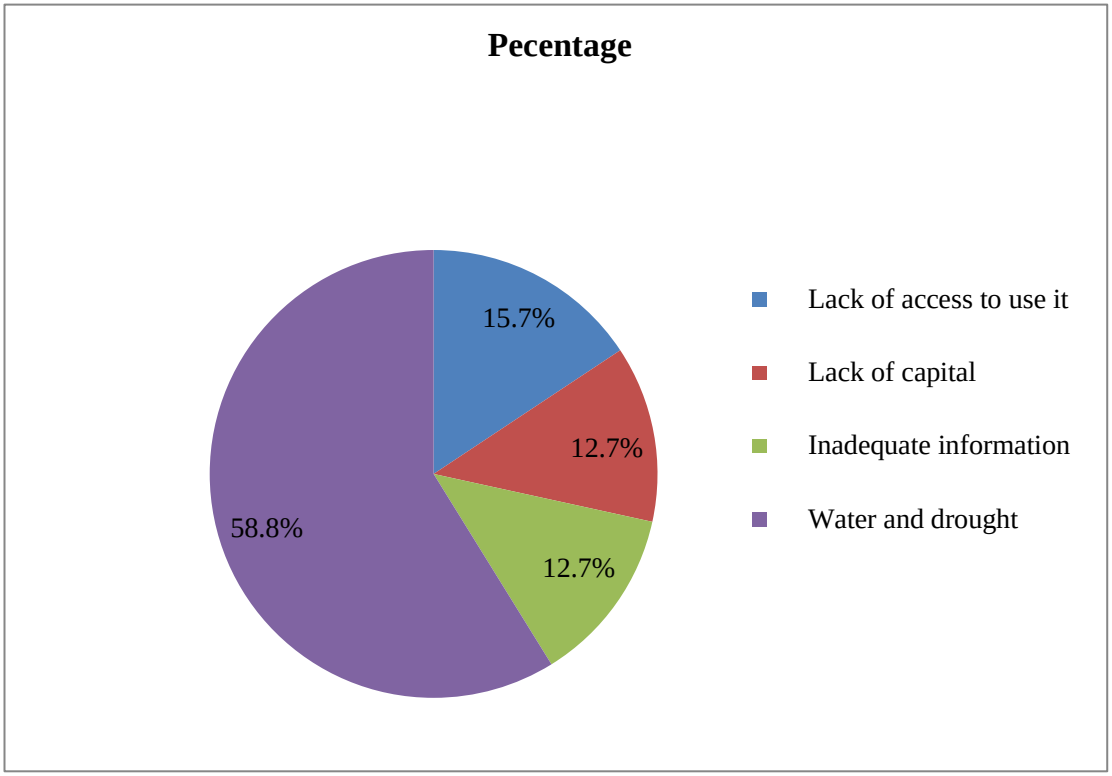

Figure 6. Major Constraint against the farm and use of homegardens in the study sites

CHAPTER 5

5. CONCLUSION AND RECOMMENDATION

5.1. Conclusions

Home gardens in the study area consist of various plant species, including food-producing, utility, and medicinal plants. They offer both financial and environmental advantages as a sustainable agricultural production system. The Fabaceae family is the most representative family.The plant species found in home gardens were used to calculate the diversity index and evenness. *Catha edulis, Mangifera indica*, and *Coffea arabica* were among the most diverse plant species found in home gardens, analyzed using evenness and Shannon's diversity index.Water availability or scarcity is the biggest barrier to home garden crop cultivation in the study area. The variety and yield of plants in home gardens are influenced by both environmental factors and cultural preferences.

5.2. Recommendations

The following are recommendations forwarded based on research results.

- The local population should be educated on sustainable plant resource management, encouraged to engage in off-farm activities like plant husbandry, and mentored by extension service workers to ensure resilience in case of crop failures.
- Home garden awareness should focus on households without involvement or knowledge of its nutritional benefits.
- Nutrition education should be integrated into community development activities, with health workers encouraging families to plant and consume more vegetables.
- The local agricultural office should educate people on diverse plant species, identify suitable crops for home garden productivity, and involve gardeners in a holistic approach for sustainability and agrobiodiversity conservation.
- Extension service workers should educate farmers about the long-term benefits of mixed cropping in home gardens, and discourage households from selling produce until their food needs are met, or encourage increased production for cash income.

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APPENDICES

Appendix I: Plant species recorded in homegardens, including their local name and habit

No	Scientific Name	Family	Local Name	Habit	Coll. No
1	*Arachne racemosa (Roem. & Schult.) Ohwi*	Poaceae	Coqoorsa (O)	Herb	TM920
2	*Acacia abyssinica* Hochst. ex Benth.	Fabaceae	Laaftoo (O)	Tree	TM9
3	*Acacia albida* Del.	Fabaceae	Laaftoo (O)	Tree	TM1
4	*Acacia saligina* (Labill) Wendi	Fabaceae	X	Tree	TM18
5	*Achyranthes aspera* L.	Amarathaceae	X	Herb	TM4
6	*Allium cepa* L.	Alliaceae	Qullubii-diimaa (O)	Herb	TM105
7	*Allium sativum* L.	Alliaceae	Quulubii-adii (O)	Herb	TM76
8	*Anethum graveolenls* L.	Apiaceae	X	Herb	TM1
9	*Artemisia absinthium* L.	Asteraceae	Arrity (A)	Herb	TM24
10	*Arundo donax* L.	Poaceae	Shambako (O)	Herb	TM87
11	*Beta vulgaris* L.	Chenopodiaceae	Qosta (A)	Herb	TM20
12	*Brassica oleracea* L.	Brassicaceae	Goommana (O)	Herb	TM93
13	*Brassica oleracea* L. var. capitata	Brassicaceae	Tql-gomen (A)	Herb	TM101
14	*Brucea antidysentrica* J. F Mill.	Simarobaceae	Qomeenyo (O)	Shrub	TM38
15	*Buddleja davidii* Fresen.	Simarobaceae	Amfar (O)	Shrub	TM82
16	*Caesalpinia decapetala* (Roth) Alston	Fabaceae	Arangamaa (O)	Liana	TM3
17	*Calpurnea aurea* (Ait.) Benth.	Fabaceae	Ceekaa (O)	Shrub	TM68
18	*Capsicum annuum* L.	Solanaceae	Barbare (O)	Herb	TM34
19	*Carica papaya* L.	Caricaceae	Papaya (O)	Tree	TM7
20	*Carissa spinarum* L.	Apocynaceae	Hagamsa (O)	Liana	TM70
21	*Casimiroa edulis* La Llave	Rutaceae	Shasho (A)	Tree	TM43
22	*Catha edulis* (Vahl) Forssk. ex Endl.	Celastraceae	Caatii (O)	Shrub	TM6
23	*Citrus aurantifolia* (Christm.) Swingle	Rutaceae	Lomii (O)	Shrub	TM37
24	*Citrus sinensis* (L.) Osb.	Rutaceae	Burtukaana (O)	Shrub	TM83
25	*Coffea arabica* L.	Rutaceae	Buna (O, A,)	Shrub	TM11
26	*Conyza pyrrhopoppa* sch. Bip ex A. Rich.	Asteraceae	X	Herb	TM107
27	*Cordia africana* Lam.	Broaginceae	Waddeessa (O)	Tree	TM60
28	*Croton macrostachyus* Del.	Euphorbiaceae	Bakkanisa (O)	Tree	TM46
29	*Cucurbita pepo* L.	Cucurbitaceae	Dabaaqula (O)	Herb	TM87
30	*Cyperus rotundus* L.	Cyperaceae	X	Herb	TM13
31	*Datura inoxia* Mill.	Solanaceae	Asangiraa (O)	Herb	TM102
32	*Daucus carota* L.	Apiaceae	kaarota (O)	Herb	TM57
33	*Dovyalis caffra* (Hook. f. & Harv.) Hook. f.	Flacourtiaceae	Koshomii (O)	Shrub	TM87
34	*Ensete ventricosum* (Welw.) Cheesman.	Musaceae	Qoccoo (O)	Herb	TM41
35	*Eucalyptus camaldulensis* Dehnh.	Myrtaceae	Bargamo-diimaa (O)	Tree	TM5

36	*Eucalyptus globulus* Labill.	Myrtaceae	Bargamo-adii (O)	Tree	TM24
37	*Euphorbia amplyphylla* Pax.	Euphorbiaceae	X	Herb	TM36
38	*Ficus sur* Forssk.	Moraceae	Harbuu (O)	Tree	TM83
39	*Galium aparinoides* Forssk.	Rubiaceae	Maxxannee (O)	Herb	TM103
40	*Grevillea robusta* R. Br.	Proteaceae	X	Tree	TM50
41	*Hagenia abyssinica* (Bruce) J. F. Gmel.	Rosaceae	Heexoo (O)	Tree	TM29
42	*Iresine herbstii* Hook. f.	Amarathaceae	X	Herb	TM61
43	*Juniperus procera* Hochst. ex Endl.	Cupresaceae	Gatira Habasha (O)	Tree	TM16
44	*Justicia schimperiana* Hochst.	Acanthaceae	Dhummugaa (O)	Shrub	TM91
45	*Lactuca sativa* L.	Asteraceae	Selata (A)	Herb	TM44
46	*Lippia adoensis* Hochst.	Verbenaceae	Kusaaye (O)	Shrub	TM59
47	*Lycopersicon esculentum* Mill.	Solanaceae	Timatimi (O)	Herb	TM26
48	*Malus sylvestris* Miller	Rosaceae	Apple	Tree	TM96
49	*Mangifera indica* L.	Anacardiaceae	Mango (O, A)	Tree	TM98
50	*Mentha longifolia* (L.) Hudson	Lamiaceae	X	Herb	TM64
51	*Mentha puegium* L.	Lamiaceae	Nana (A)	Herb	TM45
52	*Millettia ferruginea* (Hochst.) Bak.	Fabaceae	Sotoollo (O)	Tree	TM46
53	*Nicotiana tabacum* L.	Solanaceae	Timboo (O)	Herb	TM28
54	*Ocimum basilicum* L.	Lamiaceae	Besobilla (A)	Herb	TM86
55	*Ocimum lamiifolium* Hochst. ex Benth.	Lamiaceae	Koricha–Michii (O)	Shrub	TM55
56	*Ocimum urticifolium* Roth	Lamiaceae	Koricha-alkani (O)	Shrub	TM74
57	*Olea europaea* L. subsp. cuspidata	Oleaceae	Ejersa (O)	Tree	TM66
58	*Osyris quandripartita* Decn.	Santalaceae	Watoo (O)	Tree	TM22
59	*Persea americana* Mill.	Lauraceae	Abukado (O, A)	Tree	TM106
60	*Phaseolus vulgaris* L.	Fabaceae	Boloqqie (A)	Liana	TM2
61	*Phytolacca dodecandra* L.	Phytolaccaceae	Endod (A)	Shrub	TM49
62	*Psidium guajava* L.	Myrtaceae	Zeytunaa (O)	Tree	TM33
63	*Rhamnus prinoides* L‟ Herit.	Rhamnaceae	Geeeshoo (O, A)	Shrub	TM69
64	*Rhus glutinosa* A. Rich	Anacarddiaceae	Xaxeessaa (O)	Tree	TM53
65	*Ricinus communis* L.	Euphorbiaceae	Qobboo (O)	Herb	TM85
66	*Rosa hybrida* Hort.	Rosaceae	Tsigereda (A)	Shrub	TM78
67	*Rosmarinus officinalis* L.	Lamiaceae	Siga-metibesha (A)	Shrub	TM42
68	*Saccharum officinarum* L.	Poaceae	Shenkor-ageda (A)	Herb	TM88
69	*Schinus molle* L.	Anacardiacae	Alaaltu (O)	Tree	TM67
70	*Senna septemtrionalis* (Viv.) Irwin & Barnby	Fabaceae	Akayi-warabessa (O)	Tree	TM54
71	*Silybium marianum* (L.) Gaertn.	Asteraceae	Sokooruu (O)	Herb	TM20
72	*Solanum tuberosum* L.	Solanaceae	Dinichaa (O)	Herb	TM35
73	*Sonchs oleracea* L.	Asteraceae	Sokooruu (O)	Herb	TM103
74	*Verbascum sinaitucum* Benth.	Scrophulariaceae	Gurra harree (O)	Shrub	TM99

75	*Vernonia amygdalina* Del.	Asteraceae	Eebicha (O)	Shrub	TM101
76	*Vicia faba* L.	Fabaceae	Baqeella (O)	Herb	TM58
77	*Withania somnifera* (L.) Dunal	Solanaceae	Gizawa (A)	Herb	TM65
78	*Zea mays* L.	Poaceae	Boqqolloo (O)	Herb	TM89

Appendix II: Lists and significance of recorded plant species in the study area

Scientific name	**Use of plant**
Annona cherimola Mill.	Fruit crop
Carica papaya L.	Fruit and medicinal
Casimiroa edulis La Llave	Fruit crop
Casimiroa edulis La Llave	Fruit crop
Citrus aurantifolia (Christm.) Swingle	Fruit crop
Citrus sinensis (L.) Osb.	Fruit crop
Malus sylvestris Mill.	Fruit crop
Mangifera indica L.	Fruit crop
Morus indica L.	Fruit crop
Persea americana Mill.	Fruit crop
Prunus x domestica L.	Fruit crop
Psidium guajava L.	Fruit crop
Punica granatum L.	Fruit and medicinal crop
Allium cepa L.	Vegetable crop
Allium sativum L.	Vegetable crop and medicinal plant
Beta vulgaris L.	Vegetable crop
Brassica carinata A. Br.	Vegetable crop
Brassica oleracea L.	Vegetable crop
Brassica oleracea L. var. capitata	Vegetable crop
Capsicum annuum L.	Vegetable crop
Cucurbita pepo L.	Vegetable crop and also medicinal plant
Daucus carota L.	Vegetable crop
Lactuca sativa L.	Vegetable crop
Lycopersicon esculentum Mill.	Vegetable crop
Saccharum officinarum L.	sugar crop
Solanum tuberosum L.	Tuber crop
Zea mays L.	Cereal
Phaseolus lunatus L.	Pulse
Phaseolus vulgaris L.	Pulse
Vicia faba L.	Pulse
Ocimum basilicum L.	Spice

Lippia adoënsis Hochst. ex Walp. var. koseret Sebsebe	Spice and fragrant
Mentha spicata L.	Spice
Ruta chalepensis L.	Spice and medicinal plant
Catha edulis (Vahl) Forssk. ex Endl.	Stimulant
Coffea arabica L.	Stimulant
Nicotiana tabacum L.	Stimulant
Cymbopogon citratus (Dc.) Stapf	Fragrant and medicinal plant
Mentha longifolia (L.) Hudson	Fragrant
Myrtus communis L.	Fragrant plant
Olea europaea L. subsp. cuspidata (Wall. ex G. Don) Cif.	Fragrant plant
Rosmarinus officinalis L.	Fragrant plant
Acacia abyssinica Hochst. ex Benth.	fuel wood, shade trees and implement
Acacia mearnsii De Willd.	fuel wood
Rhus glutinosa A. Rich	fuel wood
Senna septentrionalis (Viv.) Irwin & Barnby	fuel wood
Acacia albida Del.	Shade and implement
Albiza schimperriana Oliv.	Shade and fuel wood
Acacia salignia (Labill) Wendi	Shade
Croton macrostachyus Del.	Shade ,implements and fuel wood
Erythrina brucei Schweinf	Shade tree
Ficus elastic Roxb.	Shade tree
Ficus sur Forsk.	Shade tree
Millettia ferruginea (Hochst.) Bak.	Shade tree
Schinus molle L.	Shade tree and implement
Spathodea campanulata P. Beauv. subsp. nilotica (Seem.) Bidgood	Shade tree
Caesalpinia decapetala (Roth) Alston	Live fence
Buddleja davidii Fresen.	Live fence
Carissa spinarum L.	Live fence
Cupressus lusitanica Mill.	Live fence
Dovyalis caffra (Hook. f. & Harv.)HOOK. f.	Live fence
Grevi llea robusta R. Br.	Live fence, shade
Justicia schimperiana Hochst. ex Nees T.Anders	Live fence
Opuntia cylindrica (Lam.) DC.	Live fence
Rosa abyssinica Lindley	Live fence
Sesbania seban (L.) Merr	Live fence
Arundo donax L.	Implements and live fence

Cordia africana Lam.	Implement, shade, medicine tree
Eucalyptus camaldulensis Dehnh.	Construction, fuel wood and live fence
Eucalyptus globulus Labill.	Construction and medicine
Juniperus procera Hochst. ex Endl.	Construction and Implement
Osyris quandripatrtita Decn	Construction
Arachne racemos (Roem. & Schult.) Ohwi	Utility plant
Agave americana L.	Utility plant
Agave sisalana Perrin. Engl.	Utility plant
Cyperus rotundus L.	Utility plant
Phytolacca dodecandra	Utility plant
Rhamnus prinoides L‟ Herit.	Utility plant
Ricinus communis L.	Utility plant
Sida schimperiana Hochest ex. A. Rich.	Utility plant
Vernonia amygdalina Del.	Utility and medicinal plant
Achyranthes aspara L.	Medicinal Plant
Allium sativum L.	Medicinal, food plant
Artemisia absinthium L.	Medicinal
Brucea antidysenterica J.F. Mill.	Medicinal
Calpurnea aurea (Ait.) Benth.	Medicinal
Datura inoxia Mill.	Medicinal
Ensete ventricosum (Welw.) Cheesman.	Medicinal, implement and fodder
Hagenia abyssinica (Bruce) J. F. Gmel.	Medicinal
Jasminum abyssinicum Hochest ex DC.	Medicinal
Malva verticillata L.	Medicinal
Ocimum lamiifolium Hochst. ex Benth.	Medicinal
Ocimum urticifolium Roth	Medicinal
Otostegia integrifolia Benth.	Medicinal
Rumex nepalensis Spreng.	Medicinal
Withania somnifera (L.) Dunal	Medicinal
Bougainvillea glabra Choisy	Ornamental
Conyza pyrrhopoppa Sch. Bip ex A.Rich	Ornamental
Hibiscus sp.	Ornamental
Iresine herbstii Hook.	Ornamental
Lantana camara L.	Ornamental
Rosa hybrida Hort.	Ornamental
Achyranthes aspera L.	Weed
Amaranths hybridus L.	Weed and vegetable crop
Anethum graveolenls L.	Weed
Galium aparinoides Forssk.	Weed

Parthenium hysterophorous L.	Weed
Silybum marianum (L.) Gaertn.	Weed
Sonchus oleraceus L.	Weed
Trifolium tembense Fresen.	Weed
Verbascum sinaiticum Benth.	Weed

Appendix III: Questionnaire for household survey

Dear respondents, I am a post graduate student of the Addis Ababa University summer program at Abay Chomen satellite in biology. As part of my thesis work, I would like to find out the main diversity and management of home gardens in the Abay Chomen District. For this purposes the following questionnaire will be formulated for the household survey to achieve this goal. You are kindly requested to answer the questionnaire orally.

I. General information about the socioeconomic profile of respondents.

Dear respondents: my name is Kena Nagaro Abdisa. I am Master student at Addis Ababa University. I am conducting research for the fulfillment of the requirement for my second degree. This questionnaire is part of it. The main objective of this questionnaire is to collect relevant data on the study of Diversity and Management of Homegardens in Abay chomen Woreda. The response you provide will have a constructive importance for the successful accomplishment of the study. So, you are kindly requested to give your genuine response. Moreover, be sure that your responses will not be used for other purposes rather than academic purposes. Please note the following points before you start filling the questionnaires:

1. You do not need to write your name on the questionnaire.
2. Read the instructions before attempting to answer the questions.
3. Kindly write your opinion briefly for the short answers on the space provided.

Thank you in advance!

I. Personal Information

N.B.: For closed-ended questions, please put '√' mark in the box provided, whereas for open-ended questions write your answer on the space provided.

1. Kebele: _____
2. Sex: □ Male □ Female
3. Age in year: □ 18-35 □ 36-50 □ 51-65 □ > 65
4. Marital Status: □ Married □ Single □ Divorced □ Widowed
5. Educational level: □ Illiterate □ Read and write □ Primary School
   □ Secondary School □ above secondary level
6. Experience of farmers: 0-5years □ 6-9years □ Above 10 □
7. Type of farming most practice: □ Poultry □ cereals □ cash crops □ Livestock □ Mixed farming

8. What is your annual Income (Ethiopian birr) per a year?

   Less than10, 000 □ 10,000 -20,000 □ above 20, 0000 □

9. In which type of farming are you engaged now? □ Poultry □ Cereals and vegetables
   □ only cash crops □ Beekeeping □ Livestock □ Mixed farming

10. For what purpose you use these homegardens?

Food supply □ Shade □ Aesthetics and ornamentation □ Fruit Production □ Commercial production □ Fuel wood production □ Nutritional □

11. Do you have enough farm land? □ yes □ NO.

12. What is the size of your farm land? □ 1 – 5 hectare □ 6 -10 hectares □ above 10 hectare

13. Which major problems hinder you from farming home gardens?

□ Lack of capital □ Lack of information □ lack of access to use it □ Lack of water □ Disease and pest outbreak

Appendix IV: Semi-structured interview administered to selected owners of homegardens

I. Interview questions for homegarden informants

1. What you call homegarden in your locality?

2. Tell the name of plants or crops in your homegarden.

3. What are the dominant plants or crops in your homegarden? List accordingly.

4. Are there plants in your homegarden that grow throughout the year?

5. Which plants or crops in your garden are more important? Rank accordingly.

6. List names of plants in your homegarden used Vegetables, multi-purpose tree species, live fence and shade tree species, crops, spices, aromatic plants, ornamentals and edible fruit.

Local Name	Habits/life forms	Uses of the plants /part of plants

7. What are the aims and advantages of growing plants in your homegardens?

8. Do you use the homegarden crops/ plants product for household consumption or for the market purpose?

9. Which plants/ crops products more common in the market?

10. Which plant /crop products of homegarden available in the market? Which month?

11. How much do you earn from the homegarden product you sold in the market per year?

12. What are the conservation practices you implement to manage your homegardens?

13. Is there any professional expertise, who is responsible and advice you how to manage your homegardens?

14 .What extent conservation practices are undertaken by the people in homegardens?

15. How frequent are homegardens in the study area?

17. Who is responsible for the proper management of homegardens?

18. Who spends more time in the homegarden?

29. Do you grow crops/trees specifically to meet nutritional requirements?

20. What part of the plants do you use? How or for what?

21. Do you select the variety of the particular species you want to use in your garden?

Appendix V: Lists of homegaren owners involved in the study

	Name	**Sex**	**Age**	**Kebele**
1	Antene Jijo	M	83	Jare
2	Badasa Tolasa	M	76	Jare
3	Boja Tarafa	M	42	Jare
4	Cuchi Gonfa	M	46	Kolobo
5	Daraje Asafa	M	45	Kolobo
6	Dinkisa Amanu	M	64	Kolobo
7	Diriba Bulto	M	59	Jare
8	Fikadu Daba	M	51	Jare
9	Garamu Edosa	M	68	Jare
10	Gonfa Gefe	M	89	Kolobo
11	Hangare Bayisa	M	73	Kolobo
12	Mangistu Hinbalu	M	78	Kolobo
13	Takala Deresa	M	65	Jare
14	Tamasgen Tasgara	M	55	Jare
15	Tolasa Buta	M	80	Jare
16	Wakoya Garuma	M	65	Kolobo

Appendex Figure 1: Marketable fruits and vegetables of homgardens

Appendex Figure 2: home garden gardeners in the study site

Appendex Figure 3: Back yards home gardens for family consumption

Appendex Figure 4: Different types of plants around home gardens